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ASSORTED NON-SKANKY 2

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progress that enables a capital to produce more w of material inputs. If pared to the use of only — labor, for example depends not only on ess but also on the factors of production uses, the more output growth of output per depends on technical of the capital stock. relationships described ainder of this section value-added with the d labor to show how on since the mid-1960s of labor productivity. ns of this study then ncome tax burdens on lation rates since the ed capital accumula- e growth of potential

onfarm Business

the average annual for all nonfarm busi- n 1965 to 1978, how- grew only 1.5 percent ercentage point.[4] This

otnote, 1965 only divides the growth from those of slower ining rate of capital accum... inear trend for technical ... 4.55 indicate that productivity ... one consummate step, it eroded slowly ... i0s and 1970s.

) the estimates shown in the Appendix (equa- ce of technical progress has fallen throughout iod for nonfarm, nonresidential business. The tion of capital offset the modest decline in the nical change in the 1960s, but in the 1970s accumulation coupled with a more rapid growth of technical change has severely rowth of labor productivity.

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Nonlinear liquidity-growth dynamics with corridor-stability

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1. Introduction[1]

As the above citation indicates there is a long tradition taking the view that liquidity when facilitated through credit, may magnify cyclical expansions and contractions. Liquidity, of course, played a central role in Keynes' General Theory and in IS/LM variants of it. Recent advances in this vein have shown how various types of dynamic behavior arise from intrinsic monetary/real interactions. Various lines of work have embellished this basic theme and have emphasized several important implications of the financial role. First is that indeed liquidity can operate procyclically, amplifying business expansions or contractions. Second, the financial/real interaction is

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asymmetric: the effect of financial variables are stronger in contractions than expansions. Third, endogenous propagation mechanisms in monetary economies may depend on the size of the shock.

The present contribution presents an analysis of these issues using a variant of Foley's (1986, 1987) growth cycle model. We obtain an explicit characterization of the different types of dynamics possible. In particular, we show that the model's portrayal of financial/real forces exhibits 'corridor-stability' in the sense of Leijonhuvud (1973). Small shocks to a system in a steady state have no lasting effects but large enough ones can lead to persistent cycles or unstable nonperiodic fluctuations.

After briefly discussing related literature in section 2, we lay out the main model in section 3. Like Foley we primarily focus on the behavior of the firm. Liquidity and productive assets of firms will be the two state variables of the system. A preliminary analysis of the dynamics is given in section 4; this is supported by simulation studies. Section 5 provides the mathematical analysis of the economic model by using perturbation analysis for nonlinear dynamics. Some concluding remarks are added in section 6.

2. Related literature

In the tradition of Keynesian theory, the monetary/real interaction has become central in IS/LM versions.[2] Usually, the asset market is represented by the money market.[3] There are interesting early nonlinear versions of an IS/LM macrodynamic [cf. Rose (1969), Torre (1977), Shinasi (1981)] which connect to recent work.

A novel contribution along this line is represented in the papers by Day and Shafer (1985) and Day and Lin (1989). As in the IS/LM version liquidity is provided from outside through exogenous money supply.[4] Money demand arises from transaction and liquidity motives. An infinitely fast adjustment process, through the adjustment of the interest rate, brings about a temporary equilibrium in the money market allowing the elimination of the interest rate as a variable. A boom then with a strain on liquidity chokes off the boom and the ease of liquidity in recessions allows for recoveries. An unstable accelerator effect destabilizes the system in the vicinity of the equilibrium. The monetary/real interaction generates intriguing periodic or nonperiodic fluctuations.

[2]There is already a tradition before Keynes that highlights the role of liquidity generated through credit for the business cycle; see for example, the theories of credit in Mill, Bagehot, and Marshall in the 19th century, von Hayek and Hawtrey since the 1920s, and Fisher in the 1930s. For an excellent survey on the earlier theorists, cf. Boyd and Blatt (1988).

[3]In the literature after Keynes the transaction and speculative demand for liquidity has become particularly central, cf. Modigliani (1944), Tobin (1958), Minsky (1975).

[4]A different variant is presented in Day (1989) where the money supply is not fixed but rather becomes a policy variable.

In Foley's various growth models (1986, 1987) – to be detailed below – money is presumed to grow at a fixed rate. In addition, commercial credit is introduced where firms are free to borrow and to lend. Banks provide loans and offer deposits so that the overall source of liquidity is commercial credit and deposits. Foley's model shows that an unstable accelerator, coupled with strong borrowing incentives by firms, produces instability in the vicinity of the equilibrium and that liquidity contains instability in the enterprise sector. The financial/real interaction – though in principle a three dimensional dynamic – results in periodic solutions studied through the Hopf-bifurcation theorem.

In models based on imperfect capital markets it is finance that plays a destabilizing role in macroeconomic activity, possibly amplifying business fluctuations. The reasons for this are first, an imperfect capital market – asymmetric information between lenders and borrowers and costly state verifications – drives a wedge between the internal and external cost of funds [Townsend (1979), Gale and Hellwig (1985), Bernanke and Gertler (1989)]. Second, default risk measured for example by balance sheet variables of firms gives rise to an increase in the cost of external finance which moves countercyclically accentuating the inverse relation between capital cost and investment [Bernanke and Gertler (1989, 1991), Greenwald and Stiglitz (1988), and Fazzari et al. (1988)].

In addition, the view that financial variables set in motion a stronger propagation mechanism of business activities is often paralleled by the hypothesis that the financial/real interaction also creates an asymmetry in the business cycle.[5] In particular, it is maintained that contractions are more strongly affected by financial variables than expansions.[6]

On the other hand, it is maintained that liquidity can serve as a buffer stock for flows smoothing production or consumption if the disturbances are not too large. Leijonhuvud (1973), for example, has argued that, in monetary economies, one should observe corridor-stability regarding macroaggregates. He shows that in an economy with buffer stocks small shocks to flows do not give rise to deviation amplifying fluctuations but large shocks may lead to a different regime of propagation mechanisms.

Finally, it is worth noting that there is strong empirical evidence supporting the view that liquidity covaries cyclically with investment and output. A number of studies find procyclical credit flows, see, for example, Friedman

[5]Already in earlier nonlinear models it is demonstrated, for example, in Goodwin (1951) that contractions are asymmetric compared to expansions. There, an asymmetry arises due to a flexible accelerator; financial variables, however, are neglected in modeling cycles.

[6]This, for example, follows from the work of Bernanke (1981, 1983), and Mishkin (1978), who provide evidence for it for the Great Depression.

[7]The direction of causation remains controversial. It is still unresolved of whether money and credit lead output or output leads money and credit. For a recent evaluation of this matter, cf. Bernanke (1990).

(1983), and Blinder (1989). Blinder (1989), by decomposing credit market debt, shows that private credit market debt, in particular trade credit, moves strongly procyclically. The proposition that default risk and the (marginal) cost of external funds – as well as credit constraints – move countercyclically and are negatively correlated with investment and output is empirically demonstrated in Bernanke (1983), Gertler et al. (1991), and Franke and Semmler (1991).[8]

Given the theoretically and empirically well established role of financial variables in the business cycle we subsequently propose a growth cycle model which analytically studies the above issues.

3. The model

We commence with Folye's (1986, 1987) growth cycle version. The real side of the model is construed as follows. Firms through their capital outlay simultaneously determine their sales. Capital outlay, C, comprises the outlay for intermediate goods, wages (which are spent instantaneously) and an increase of capital stock, $\dot{K}$, which denotes an increase in the value of plant and equipment. Thus, investment is defined as part of the capital outlay. Prices are fixed. Wage income is instantly spent for consumption goods. Profit is solely saved by firms.

The financial side of the model can best be characterized by referring to the balance sheets of the economy [cf. Foley (1986)].

Balance Sheets

Assets		Liabilities
	Central Bank	
F_G		R
	Banks	
R		M
F_B		
	Firms	
M		D
F		
K		NW

where NW is the net worth of the sectors, F_G the central bank's holdings of loans, which is equal to the central banks reserve, R, and F_B is the banking sector's holding of loans to firms. Loans are also made among firms through commercial credit, which represent assets, F, for the lending firms. In order

[8]In those studies the cost of external funds is measured as spread between the 6 months commercial paper rate and the interest rate on treasury bonds.

to avoid problems of aggregate excess demand it is posited that money is directly transferred to firms. Thus we have $F_G + F_B + F = D$ or $M + F = D$.

The financial/real interaction can be portrayed by the ensuing three dimensional differential equation system [cf. Foley (1987)]. With profit $\Pi = qS$, q, the markup, S, Sales, the three ratios $m = M/K$, $f = F/K$, $r = \Pi/K$ entail the following growth rates from which a nonlinear differential equation system in m, f, r is derived:

$$\hat{m} = g - \hat{K}, \tag{1}$$

$$\hat{f} = (\dot{D}(m) - gM)/F - \hat{K}, \tag{2}$$

$$\hat{r} = a(r, m+f) - \hat{K}, \tag{3}$$

where g is the growth rate of money supply, $\hat{K}$ the growth rate of capital stock, $\dot{D}(m)$ is derived from $\dot{F} = \dot{D} - g\dot{M}$, and $a(r, m+f) = \dot{C}/C = \dot{\Pi}/\Pi$ the growth rate of capital outlay (equal to the growth rate of profit flows). By assuming that liquidity and interest rate are inversely related the interest rate is eliminated as a variable in the model.

We propose the following modifications of the Foley model (1)–(3) which admit an explicit characterization of the possible dynamics. First, in the above eq. (1) we also allow for endogenously generated liquidity. We replace the constant g by the following function

$$g_l = g_l(g_m, r, \lambda),$$

where now g_m is a constant and $\lambda = L/C$. Accordingly in the above balance sheets of banks L is to be substituted for M. We emphasize the credit view of bank activities [cf. Bernanke (1990)]. Banks are free to issue debt (create deposits) in order to admit credit expansion in the enterprise sector.[9] The specification of the function $g_l(\cdot)$ is undertaken below.

Second, m from which $\hat{m}$ in eq. (1) is derived is the inverse of the velocity of money with respect to capital stock. We will, however, normalize through C – instead through K – since liquidity is typically not only used for investment in fixed Kapital, K, but also for working capital. Thus, λ expresses the inverse of the velocity of liquidity now not with respect to capital stock but with respect to capital outlay.[10]

Third, the behavioral function determining capital outlay $\dot{C}/C = a(r, m+f)$ is replaced by $\dot{C}/C = a(r, \lambda)$. It does not appear reasonable that f is an

[9]In addition the argument can be made, that beside bank loans and commercial papers, trade credit [Blinder (1989, ch. 5)] and unused credit lines [Huberman (1984)] are also important sources of liquidity for firms.

[10]In a later version, Foley has also adopted the above definition of the velocity [cf. Foley (1991)].

additional argument in the capital outlay function since for the enterprise sector as a whole the asset F is generated through the creation of debt D. We, therefore, include solely liquidity λ as an argument in the capital outlay function [for a similar view, cf. also Foley (1986)]. Correspondingly, for the growth rate of capital stock, $\hat{K}$, we also presume $\hat{K}=b(r,\lambda)$.

With those modifications the eq. (2) will not play a role any longer in the dynamics. We thus obtain a dynamic system in two variables only which reads as

$$\hat{\lambda}=g_l(g_m,r,\lambda)-\hat{C}(r,\lambda), \tag{5}$$

$$\hat{r}=\hat{C}(r,\lambda)-\hat{K}(r,\lambda). \tag{6}$$

This is the general form of our proposed dynamics.[11] With respect of $g_l(g_m,r,\lambda)$ of system (5), (6) two versions are explored. The first version we call Dynamic I. Here we define

$$g_l=g(g_m,r,\lambda) \text{ with } g_r,g_\lambda>0 \text{ everywhere.}$$

In this version we thus presume that the banks' willingness to hold the enterprise sector's debt depend positively on the rate of return and liquidity of firms. This expresses the fact that finance operates procyclically possibly magnifying expansions and contractions (as proposed by the above theories).

Subsequently, a second version is explored which we call Dynamic II. Here we define

$$g_l=g(g_m,r,\lambda)-h(r,\lambda),$$

where $g(g_m,r,\lambda)$ remains the same function as in Dynamic I but a function $h(r,\lambda)$ is added. This function is defined below. The term, $h(r,\lambda)$ represents a switch function activated only if r and λ fall below certain threshold values. This reflects the idea that finance adds an asymmetry to the financial/real interaction. We thus will add the term $h(r,\lambda)$ in a downswing. This expresses the view that liquidity will dissipate with the decline of cash flows and the deterioration of balance sheets of firms. Frequently, there are two arguments put forward that lead to dissipating liquidity. First, declining rates of return and deteriorating balance sheets give rise to an increase in the perceived riskiness of loans (default risk of borrowers) entailing a diminished willingness by lenders to buy the debt of firms. Second, with cash flows and liquidity dissipating agents will attempt to intertemporally transfer liquidity

[11]Note that in (6) we can also allow for constant proportion consumed out of profit flows. Let $c_\Pi qS$ be the consumed proportion of profits and $\Pi/K=qS/K$. We can substitute $S=C+c_\Pi qS$ and write $S(1-c_\Pi q)=C$, which gives, since c_Π and q are constants, $\hat{S}=\hat{C}$ and also $\hat{\Pi}=(\hat{\mu S})=\hat{S}$ therefore $\hat{\Pi}=\hat{S}=\hat{C}$. Observe also that eq. (6) represents a dynamic for the utilization of capacity for a growing economic system.

(preserving financial assets when bad times are expected which threaten the agents with possible insolvency and bankruptcy risk).[12]

4. The dynamics of the model

The following briefly discusses the above two types of dynamics. First Dynamic I will be elaborated were liquidity is provided in response to r and λ. The more complicated Dynamic II, resulting from the above function $h(\cdot)$, is studied thereafter.

4.1. Dynamic I

We specify our above defined function $g_l=g(g_m,r,\lambda)$ for the growth rates of liquidity as well as the functions $a(r,\lambda)$, $\hat{K}(r,\lambda)$ as linear functions. Also in the functions $a(\cdot)$ and $\hat{K}(\cdot)$ a constant will be included. The linear specification of our functions will give rise to nonlinear differential equations though of the simplest type.[13] We specify (5), (6) as

$$\hat{\lambda}=g_m+\theta_1 r+\theta_2\lambda-(\beta_2+\mu_1 r+\delta_1\lambda), \tag{7}$$

$$\hat{r}=\beta_2+\mu_1 r+\delta_1\lambda-(\beta_1+\gamma_1 r+\varepsilon\lambda). \tag{8}$$

In eq. (7) the first term on the right-hand side denotes our first version of $g_l(\cdot)$ and the term in brackets represents $a(\cdot)$ with β_2 the growth rate of the autonomous part of capital outlay and $\mu_1 r$, $\delta_1\lambda$ the response of $a(\cdot)$ to the rate of return and the liquidity-capital outlay ratio respectively.

Eq. (7) can be simplified by using $\alpha=g_m-\beta_2$, $\beta=\theta_1-\mu_1$ and $\varepsilon_1=\theta_2-\delta_1$. It seems to be empirically realistic to assume that β_2, θ_2 and θ_1 are small compared to g_m, δ_1 and μ_1, so that one expects negative signs for β and ε_1 and a positive sign for α. Then (7) can be rewritten as:

$$\hat{\lambda}=\alpha-\beta r-\varepsilon_1\lambda. \tag{7'}$$

On the other hand, as shown, the growth rate of profit flows is determined by the growth rate of sales which is equivalent to the growth rate of capital outlays. Using the arguments for $a(\cdot)$ and $b(\cdot)$, we can write (8) as

$$\hat{r}=\beta_2+\mu_1 r+\delta_1\lambda-(\beta_1+\gamma_1 r+\varepsilon\lambda). \tag{8'}$$

Again dropping unnecessary terms we denote $\gamma=\beta_2-\beta_1$, $\varepsilon_2=\mu_1-\gamma_1$ and

[12]For details of those two arguments supporting the use of such a function $h(r,\lambda)$ in a macrodynamic model, cf. Bernanke (1981), and Bernanke and Gertler (1991). Empirical support of this view for the Great Depression is provided by Mishkin (1978) and Bernanke (1983).

[13]More general response functions could be employed but we want to explore the simplest case.

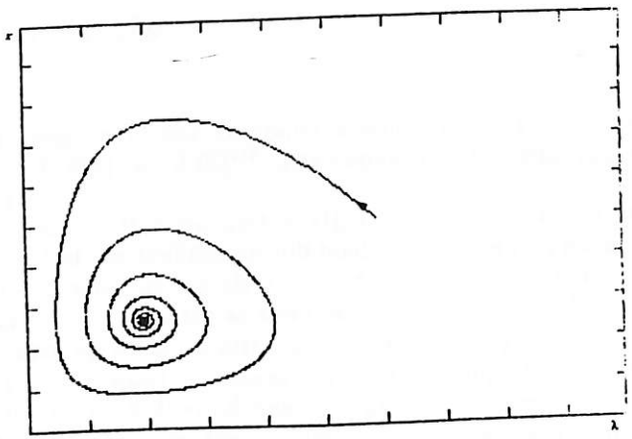

Fig. 1. Convergence of dynamic I.

$\delta=\delta_1-\varepsilon$. Here, realism seems to suggest that $\beta_2<\beta_1$, $\mu_1<\gamma_1$ and $\delta_1>\varepsilon$. By simplifying eqs. (7′) and (8′) as indicated above we can write our system of differential equations, called system (I), as

$$\hat{\lambda}=\alpha-\beta r-\varepsilon_1\lambda, \qquad (9)$$

$$\hat{r}=-\gamma+\delta\lambda-\varepsilon_2 r.$$

Equation system (9) is a nonlinear system of differential equations of Lotka-Volterra type – with ε_1 and ε_2 as perturbation terms. In system (9) no further perturbations appear yet. As will be demonstrated in section 5 the system (9) has three equilibria $(\lambda^*=0, r^*=0)$, $(\lambda^*=\alpha/\varepsilon_1, r^*=0)$ and $(\lambda^*>0, r^*>0)$. The first two are saddle points and the last one is a globally attracting point. With the exception of those which start on one of the axes all of the trajectories converge to the unique attracting point $\lambda^*>0$, $\gamma^*>0$. The dynamic of system (9) is simulated by chosing economically realistic parameters.

For the simulation study the following parameters were used: $\alpha=0.1$, $\gamma=0.07$, $\varepsilon_1=0.045$, $\beta=0.6$, $\delta=0.7$, $\varepsilon_2=0.078$. The economically relevant equilibrium is $\lambda^*=0.12$, $r^*=0.15$.

Fig. 1 depicts the trajectories of system (9) where it shows that the trajectories, though they are oscillating, asymptotically approach the equilibrium $\lambda^*>0$, $r^*>0$.

4.2. Dynamic II

The second type of dynamic where the function $h(\cdot)$ is included is to be

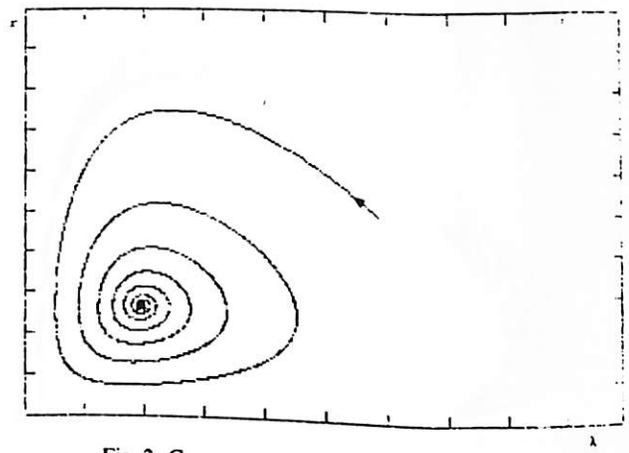

Fig. 2. Convergence case for dynamic II ($v=0.2$).

elaborated. As aforementioned the function $h(\cdot)$ represents the idea that in business contractions lenders willingness to provide credit may depend strongly on the state of firms. In addition, agents faced with bankruptcy risk may tend to be reluctant to use liquidity for current spending (but tend to preserve financial assets for bad times). The dissipation of liquidity,[14] however, will entail a decline in capital outlay and investment of firms setting in motion a complicated dynamic.

Concerning the function $h(\cdot)$ we presume that if the rate of return falls below a certain rate of return ϕ $(r<\phi)$, with $\phi<r^*$) or/and simultaneously liquidity drops below a certain ratio μ $(\lambda<\mu)$ with $\mu<\lambda^*$ liquidity is dissipating, correspondingly affecting capital outlay and investment of firms. We then replace (9) through the following system of differential equations

$$\hat{\lambda}=\alpha-\beta r-\varepsilon_1\lambda-h(\lambda, r), \qquad (10)$$

$$\hat{r}=-\gamma+\delta\lambda-\varepsilon_2 r.$$

Formally, the term h in (10), is a control term in our dynamic system, representing the response of banks and firms to a decrease of the liquidity ratio below μ and the rate of return below ϕ. We shall assume that h in (10) is a smooth function satisfying

(i) $0\leqq h(\lambda, r)$ $(\lambda\geqq 0, r\geqq 0)$,
(ii) $0=h(\lambda, r)$ $(r\geqq 0, \lambda\geqq\gamma/\delta)$,

[14] One may also argue that a symmetric effect might occur in expansions. Since booms usually are resource constrained we want to neglect this slight complication.

(iii) $\alpha - h(\lambda, 0) > 0$ $(\lambda \geqq 0)$,
(iv) $h \neq 0$.

For the purpose of our computer simulation study we choose $h(\lambda, r) = v[\max(\phi - r, 0) \max(\mu - \lambda, 0)]^{1/2}$. The nonlinear differential eqs. (10) we call system (II).

The proposition that the system (I), represented by (9), is stable in the neighborhood of the equilibrium still holds for system (II), since the Jacobian for (II) is the same as for (I) at λ^*, r^*. Whereas the term h, pushes the trajectories toward the axes as soon as λ and r decline below μ and ϕ, the terms ε_1, and ε_2 generate attracting forces, keeping the trajectories in a compact set. The exact analytical study of the impact of the perturbation terms on the Lotka-Volterra dynamics is given in section 5.2 and 5.3. Here, it may suffice to illustrate the possible scenarios by again referring to a simulation study.

We can distinguish three scenarios. For a small reaction coefficient v the trajectories still converge toward the equilibrium values of λ, and r for any initial condition – similar to the trajectories of system (I). This case is analytically studied in section 5, remark 3. The simulation results are depicted in fig. 2.

For a greater reaction coefficient v the system (II) still converges toward the equilibrium for small shocks. For stronger shocks, i.e., for farther departure from the equilibrium values of λ, and r, however, system (II) becomes unstable until it finally approaches a limit cycle. On the other hand, for initial conditions, farthest away from the equilibrium, the limit cycle is approached from the outside. The existence of a limit cycle outside an asymptotically stable region is studied in the Theorem in section V and the simulation results are shown in fig. 3.

As also shown in fig. 3 for trajectories starting close to the equilibrium the system is stable. Only a stronger shock, i.e. initial conditions far enough from the equilibrium will generate limit cycles. Thus, the system exhibits corridor-stability.

In the last case depicted here, fig. 4, we have allowed the reaction parameter v to become even larger. The immediate effect is that the trajectory approaches zero. This problem is studied in remark 1 in section 5.

More generally, it can be shown that the system (II) has at least two limit cycles which can be revealed when time is reversed (cf. section 5).

5. Analytical treatment of systems (I) and (II)

The analysis of the equilibria and dynamics of our proposed systems (I) and (II) is undertaken as follows. Starting with the original Lotka-Volterra

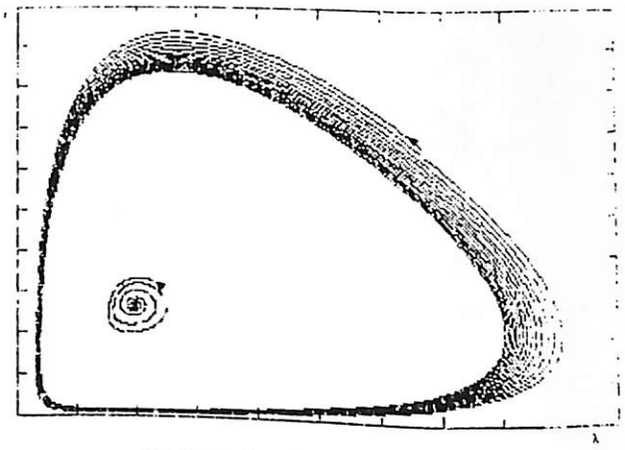

Fig. 3. Limit cycle of dynamic II ($v = 0.6$).

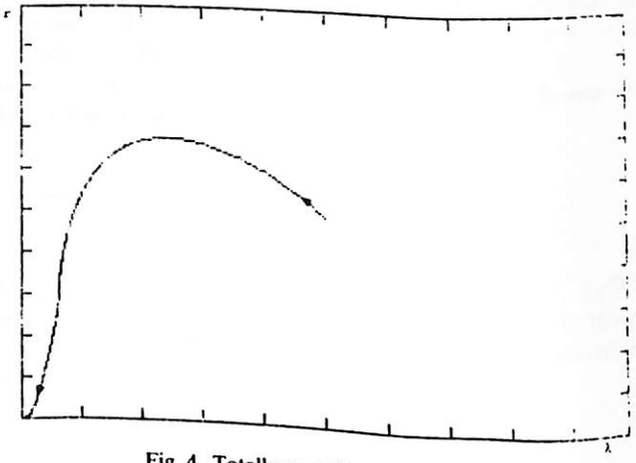

Fig. 4. Totally unstable dynamic II ($v = 3$).

system the perturbations representing the attracting and the repelling forces will successively be introduced and the resulting dynamics studied.

5.1. *The Lotka-Volterra system*

The original Lotka-Volterra system is given by

$$\dot{\lambda} = \lambda(\alpha - \beta r)$$
$$\dot{r} = r(-\gamma + \delta\lambda) \text{ for } \lambda \geqq 0,\ r \geqq 0. \tag{11}$$

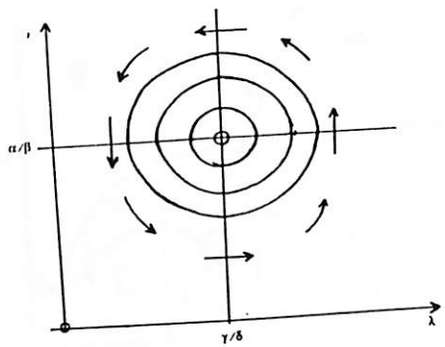

Fig. 5. Closed orbits of (11).

This system is most simply analyzed with the aid of the function $H(\lambda, r)=\alpha \log r+\gamma \log \lambda-\beta r-\delta \lambda \quad (\lambda>0, r>0)$ which is easily shown to be constant along trajectories of (11) with positive coordinates. These trajectories therefore coincide with the sets

$$H^{-1}(y)=\{(\lambda, r) \in(0, \infty)^2 \mid H(\lambda, r)=y\}.$$

As a consequence all of the orbits of (11) are closed orbits around $(\gamma/\delta, \alpha/\beta)$ with the exception of the following three: $(0,0)$ $\{0\}x[0, \infty)$ and $[0, \infty)x\{0\}$.

5.2. *A first perturbation*

Here we add a vector field to the system (11) which forces the trajectories to spiral outward. The analysis is greatly facilitated by the fact that the perturbation is confined to the region $\lambda \leqq \gamma/\delta$.

The perturbed system is given by

$$\dot{\lambda}=\lambda(\alpha-\beta r-h(\lambda, r)), \tag{12}$$

$$\dot{r}=r(-\gamma+\delta \lambda),$$

where h is a smooth function satisfying the conditions (i)–(iv) above. Let $a=(\gamma/\delta, a_2)$ be a point on the line $\lambda=\gamma/\delta$ having $a_2>\alpha/\beta$ and let $(\lambda(t), r(t))=x(t)$ be the solution of (12) starting at $x(0)=a$.

Claim 1. There is a first time $t>0$ when $x(t)$ meets the segment $\{\gamma/\delta\}x[\alpha/\beta, \infty)$ again and this happens at some $b=(\gamma/\delta, b_2)$ with $b_2(a_2) \geqq a_2$.

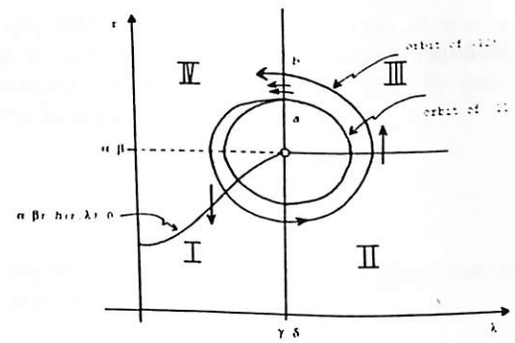

Fig. 6. Orbits of (12) spiraling outward.

Proof. It is easily seen that trajectories of the system (12) cannot enter the closed orbits of (11) or put equivalently that the function H increases along the trajectories of (12). Since both systems coincide for $\lambda>\gamma/\delta$ it suffices to show that $\lambda(t)=\gamma/\delta$ for at least one $t>0$.

If this was not the case then $\lambda(t)<\gamma/\delta$ for all $t>0$ and $r(t)$ was strictly decreasing. Now consider the limit set

$$L_\omega(a)=\left\{y \mid \exists t_n \in[0, \infty) \lim_n t_n=+\infty, \quad \lim x(t_n)=y\right\}.$$

If $y=(y_1, y_2) \in L_\omega(a)$ then $y_2=\inf_{t \geqq 0} r(t)$ and therefore $y_1 \leqq \gamma/\delta$ implies $y_2=0$. Now $L_\omega(a)$ is positively invariant and the only positively invariant subset of $[0, \gamma/\delta] \times\{0\}$ is $(0,0)$. Therefore $L_\omega(a)=\{(0,0)\}$, that is $\lim x(t)=(0,0)$ which is impossible, since by (iii) λ is increasing near $(0,0)$.

Claim 2. $b_2(a_2)>a_2$, if a_2 is properly chosen.

Proof. By property (iv) of the function h there is a point $c=(c_1, c_2)$ such that $0<c_1<\gamma/\delta$ and $h(c)>0$. There is a solution x to (11) such that $x(0)=(\gamma/\delta, a_2)$ for some $a_2>\alpha/\beta$ and $c=x(t)$ for some $t>0$. The corresponding solution y to (12) with $y(0)=x(0)$ may go the same way as x for a while but will part form x not later than at time t. Therefore when it reaches $(\gamma/\delta, b_2)$ for some $b_2>\alpha/\beta$ according to claim 1 we have $b_2>a_2$.

5.3. *A second perturbation*

It is fairly obvious by now that all of the orbits of the system (12) except those which stay at the coordinate axis may be spiraling outward without

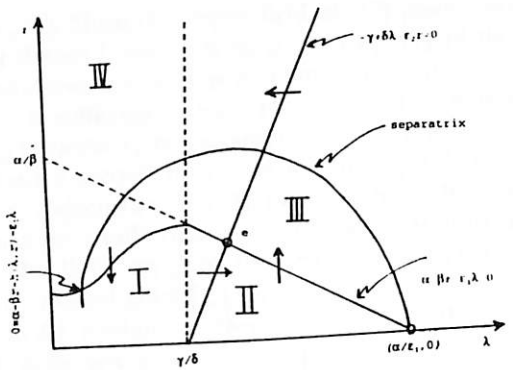

Fig. 7. Isoclines and equilibria of (13).

converging to a limit cycle. We therefore introduce a second perturbation which contracts the orbits in such a way that all the trajectories stay bounded but some of the spirals are retained – at least if the parameters ε_1, $\varepsilon_2 > 0$ are chosen sufficiently small. The system reads

$$\dot{\lambda} = \lambda(\alpha - \beta r - h(\lambda, r) - \varepsilon_1 \lambda) = f_1(\lambda, r), \tag{13}$$

$$\dot{r} = r(-\gamma + \delta\lambda - \varepsilon_2 r) = f_2(\lambda, r).$$

Claim 3. All of the trajectories of (13) are bounded no matter how small $\varepsilon_1 > 0$ and $\varepsilon_2 > 0$ are chosen.

Proof. Obviously $f_1(\lambda, r) < -$ for $\lambda > \lambda_0 = (\alpha+1)/\varepsilon_1$, $r \geqq 0$. Therefore any trajectory eventually enters the region $\lambda < \lambda_0$ and stays there forever. But if $0 \leqq \lambda \leqq \lambda_0$ and $r > r_0 = (\delta\lambda_0 + 1)/\varepsilon_2$ then $f_2(\lambda, r) \leqq -r_0$. Therefore every trajectory eventually enters the box $[0, \lambda_0] x [0, r_0]$ and stays there forever.

Obviously $(0,0)$ is an equilibrium of (13). The remaining ones are easily determined by $(\alpha/\varepsilon_1, 0)$ and $e = e_\varepsilon$, the intersection of the two lines $-\gamma + \delta\lambda - \varepsilon_2 r = 0$ resp. $\alpha - \beta r - \varepsilon_1 \lambda = 0$. The Jacobian of (13) in $(0,0)$ reads

$$\begin{bmatrix} \alpha - h(0,0) & 0 \\ 0 & -\gamma \end{bmatrix}.$$

Therefore $(0,0)$ is a saddle point, the r-axis (λ-axis respectively) being the stable respective unstable manifold. The Jacobian at $(\alpha/\varepsilon_1, 0)$ is

$$\begin{bmatrix} -\alpha & (-\alpha/\varepsilon_1)\beta \\ 0 & -\gamma + \delta\alpha/\varepsilon_1 \end{bmatrix}.$$

Assuming $\gamma/\delta < \alpha/\varepsilon_1$ (like in the figure above) $(\alpha/\varepsilon_1, 0)$ is a saddle point, with the λ-axis being the stable manifold. The unstable manifold is formed by a trajectory (separatrix) which emanates from $(\alpha/\varepsilon_1, 0)$ into the $\lambda > 0$, $r > 0$ region. Finally the Jacobian of e is

$$\begin{bmatrix} -\varepsilon_1 e_1 & -\beta e_1 \\ \delta e_2 & -\varepsilon_2 e_2 \end{bmatrix}$$

and both of its eigenvalues are seen to have negative real parts. Therefore e is a sink that is asymptotically stable.

5.4. *Limit sets of the complete dynamical system*

First recall the definition of the ω-limit set $L_\omega(c)$ of a solution $x(t)$ of (13) starting from $x(0) = c$:

$$L_\omega(c) = \{y = (y_1, y_2) \in R^2 \mid \text{there is a sequence } (t_n) \subset [0, \infty)$$

$$\text{such that } \lim x(t_n) = y \text{ and } \lim t_n = +\infty\}$$

Claim 4. If $c_1 > 0$, $c_2 > 0$ then neither $(0,0)$ nor $(\alpha/\varepsilon_1, 0)$ is contained in $L_\omega(c)$.

Proof. Suppose $(\alpha/\varepsilon_1, 0) \in L_\omega(c)$ and $c_1 > 0$, $c_2 > 0$. Then if $x(t)$ is the solution of (13) starting from $c = (c_1, c_2)$ there is $x(t)$ arbitrarily close to $(\alpha/\varepsilon_1, 0)$. Now in region II and III (see figure above) r is increasing. Therefore if we follow $x(s)$ backwards for $s < t$ then $r(s)$ decreases, showing that if $(\alpha/\varepsilon, 0)$ $L_\omega(c)$, then $\delta/\gamma, 0) \in L_\omega(c)$. Since ω limit sets are positively and negatively invariant this implies that also $(0,0) \in L_\omega(c)$. It will therefore suffice to derive a contradiction from $(0,0) \in L_\omega(c)$.

Now if $x(t)$ is sufficiently close to $(0,0)$ it stays in region I where λ is increasing and r is decreasing. Therefore if $(0,0)$ $L_\omega(c)$ then necessarily $(0, y_2) \in L_\omega(c)$ for some $y_2 > 0$. Again since $L_\omega(c)$ is negatively invariant the whole segment $\{0\} x [0, +\infty)$ must belong to $L_\omega(c)$. But $x([0, +\infty))$ is bounded and therefore $L_\omega(c)$ too. We thus arrive at a contradiction which proves our claim.

Theorem. If $\varepsilon_1 > 0$ and $\varepsilon_2 > 0$ are sufficiently small then the system (13) possesses at least two limit cycles. One of the limit cycles is obtained as the ω-limit set of the separatrix emanating from the equilibrium $(\alpha/\varepsilon_1, 0)$. This limit cycle however contains a second one (which is unstable from the inside).

Proof. Choose $a = (\gamma/\delta, a_2)$ according to claim 2 and consider the set Γ which is bounded by the curve $x([0, t])$ and $\{\delta/\gamma\} x [a_2, b_2]$. Here $x(s)$ is the solution of (12) which starts at a and meets $\{\delta/\gamma\} x [\alpha/\beta, \infty)$ for the second

time at t in $b=(b_1,b_2)$. Since the vector field of (12) points strictly to the left on $\{\gamma/\delta\}x[\alpha/\beta,\infty]$ the set Γ may not be entered by any of the trajectories of (12). Now since solutions of (13) depend continuously on $\varepsilon=(\varepsilon_1,\varepsilon_2)$ the same is true for (13) if ε is sufficiently small: there is a set Γ_ε bounded by $x_\varepsilon[0,t_\varepsilon]$ and $\{\gamma/\delta\}x[a_2,b_{\varepsilon,2}]$ where x_ε is the solution of (13) which starts at a and meets $\{\gamma/\delta\}x[\alpha/\beta,\infty)$ a second time t_ε at $b_\varepsilon=(b_{\varepsilon,1}b_{\varepsilon,2})$. If $\varepsilon>0$ is sufficiently small none of the trajectories of (13) ever enters Γ_ε from outside and in addition Γ_ε contains the equilibrium $e=e_\varepsilon$ (cf. sect. V.3) in its interior.

Now consider the limit set L of the separatrix emanating from $(\alpha/\varepsilon,0)$. Since the separatrix cannot enter Γ_ε, L does not contain the equilibrium $e=e_\varepsilon$. According to claim 4 L contains neither $(0,0)$ nor $(\alpha/\varepsilon_1,0)$. Since L is compact by claim 3 and does not contain an equilibrium it is a limit cycle by Poincaré–Bendixson's theorem. Now consider a trajectory for the reversed system of (13)

$$\dot\lambda=-\lambda(\alpha-\beta r-h(\lambda,r)-\varepsilon_1\lambda), \tag{13*}$$

$$\dot r=-r(-\gamma+\delta\lambda-\varepsilon_2 r).$$

If the trajectory starts within Γ_ε it may not leave it and therefore has a compact nonvoid limit set L^-. Since L^- is contained in Γ_ε it does not contain any of the equilibria $(0,0)$ or $(\alpha/\varepsilon,0)$ but neither e_ε since – by section V.3 – e_ε is a repellor for (13*). Therefore – again by Poincaré–Bendixson's theorem – we conclude that L^- is a limit cycle, contained in the interior of the first one. Q.E.D.

Remark 1. Suppose h is increased in such a way that condition (iii) is violated and we have in fact

$$\alpha-h(0,0)<0.$$

Then $(0,0)$ is asymptotically stable and for a nonvoid open subset of starting points the system collapses to $(0,0)$. Let us assume that the set $\alpha-\beta r-\varepsilon_1\lambda-h(\lambda,r)=0$ is a curve which cuts the λ axis exactly once between $\lambda=0$ and $\lambda=\gamma/\delta$. The intersection point $\tilde e=(\tilde e_1,\tilde e_2)$ is an equilibrium which in fact will be a saddle point. Consequently there is a separatrix s_1 emanating from $\tilde e$ and we may distinguish two cases with respect to the position of s_1 relative to the separatrix s_2 emanating from $(\alpha/\varepsilon_1,0)$.

Case 1. s_2 lies above s_1 (see fig. 8). In this case the limit set of s_1 for the time reversed system is a limit cycle because for the reversed system e is a repellor (source).

Case 2. s_2 lies below s_1 (see fig. 9). In any case a trajectory will tend to $(0,0)$ if it cuts the line $-\gamma+\delta\lambda-\varepsilon_2 r=0$ above s_1. If however s_2 tends to e – which is at least conceivable – then in case 2 there are only two possibilities:

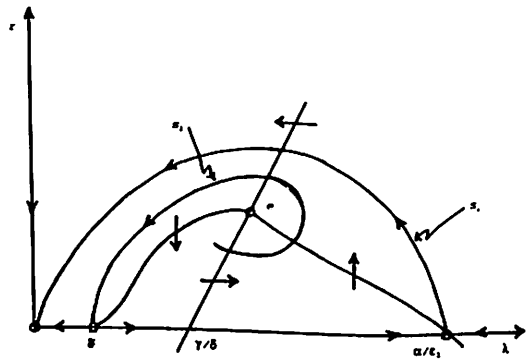

Fig. 8. s_2 lying above s_1.

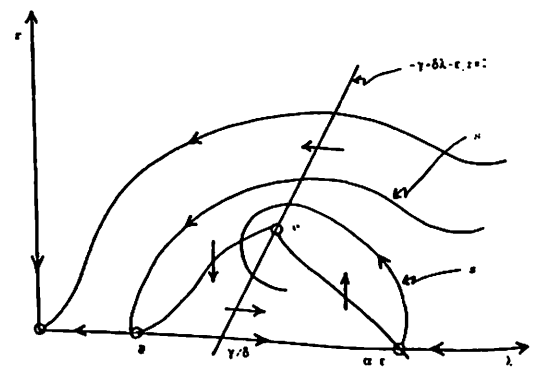

Fig. 9. s_2 below s_1.

either a trajectory converges to $(0,0)$ or to e, exception made by s_1, and those trajectories which lie on the λ axis to the right of $\tilde e$.

Remark 2. If $\alpha/\varepsilon_1<\gamma/\delta$ then every solution $x(t)$ of (13) converges to the λ-axis as t tends to infinity. This is because for $\lambda>\gamma/\delta$ $\dot\lambda$ is negative and for $\lambda<\gamma/\delta$ $\dot r$ is negative (see fig. 10).

Remark 3. We shall show that $e=e_\varepsilon$ is a global attractor for (13) if $\varepsilon=(\varepsilon_1,\varepsilon_2)$ is kept fixed and h is made so small that

$$h(\lambda,\lambda)<\varepsilon_1(e_1-\lambda) \text{ for } \lambda<e_1.$$

To do so we first consider the system

$$\dot\lambda=\lambda(\alpha-\beta r-\varepsilon_1\lambda),$$

$$\dot r=r(-\gamma+\delta\lambda-\varepsilon_2 r). \tag{14}$$

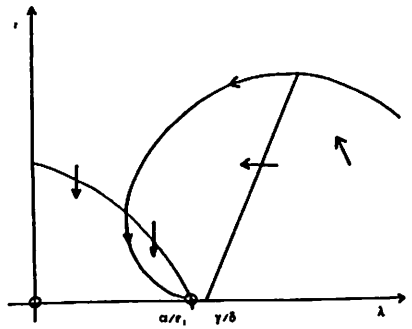

Fig. 10. Vanishing of r for $\alpha/\varepsilon_1 < \gamma/\delta$.

Using the fact that $e=e_\varepsilon=(e_1,e_2)$ is an equilibrium for (14) this may be rewritten as

$$\begin{aligned}\delta\lambda^{-1}\dot{\lambda}(e_1-\lambda)&=\beta\delta(e_2-r)(e_1-\lambda)+\delta\varepsilon_1(e_1-\lambda)^2\\ \beta r^{-1}\dot{r}(e_2-r)&=-\beta\delta(e_2-r)(e_1-\lambda)+\beta\varepsilon_2(e_2-r)^2.\end{aligned}\tag{15}$$

Taking the sum we find

$$\delta\lambda^{-1}\dot{\lambda}(e_1-\lambda)+\beta r^{-1}\dot{r}(e_2-r)=\delta\varepsilon_1(e_1-\lambda)^2+\beta\varepsilon_2(e_2-r)^2$$

or

$$\frac{\mathrm{d}}{\mathrm{d}t}H(x(t))=\frac{\partial H}{\partial\lambda}\dot{\lambda}+\frac{\partial H}{\partial r}\dot{r}=-\delta\varepsilon_1(e_1-\lambda)^2-\beta\varepsilon_2(e_2-r)^2,$$

where $H(\lambda,r)=\delta(\lambda-e_1\log\lambda)+\beta(r-e_2\log r)$.

Therefore H is a global Liapunov function for (14). Let us investigate if H is also a Liapunov function for (13).

Let $y(t)$ be a solution of (13). Then

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}t}H(y(t))&=\frac{\partial H}{\partial y_1}\dot{y}_1+\frac{\partial H}{\partial y_2}\dot{y}_2=\frac{\partial H}{\partial y_1}(\alpha-\beta y_2-\varepsilon_1 y_1)\\ &\quad+\frac{\partial H}{\partial y_2}y_2(-\gamma+\delta y_1-\varepsilon_2 y_2)-\frac{\partial H}{\partial y_1}y_1 h(y_1,y_2)\\ &=-\delta\varepsilon_1(e_1-y_1)^2-\beta\varepsilon_2(e_2-y_2)^2-\delta(y_1-e_1)h(y_1,y_2),\end{aligned}$$

and this is negative for $y\neq e$ in case $h(y_1,y_2)<\varepsilon_1(e_1-y_1)$ for $0\leqq y_1<e_1$. In that case H is a Liapunov function for the system (13) too and hence e is a global attractor.

6. Some conclusions

As suggested in the paper, our proposed dynamics with the control term h satisfying properties (i)–(iv) above can be considered an enriched formalization of the role of liquidity in macrodynamics. A drain on financial liquidity of firms initiated by falling rates of return and dissipating cash balances, can give rise to scenarios that many economists have linked to the role of money and credit in macrodynamics. In fact, in our model different scenarios can arise according to different types of shocks and different values of the parameters of the system. If all other quantities are held fixed and $\varepsilon_1>0$, $\varepsilon_2>0$ are made small enough limit cycles will occur outside a stable vicinity of the equilibrium with positive coordinates. Technically, and contrary to other models, the equilibrium does not have to be unstable in order to generate a macroeconomic limit cycle. Such a model with corridor-stability, however, results in some technical difficulties to analyze the dynamics since the well-known Hopf-bifurcation theorem cannot be applied. An extension of the Poincaré–Bendixson theorem, developed in Sieveking (1988), was utilized instead.

By way of concluding we want to remark that the following problems may warrant a further study. First, one can turn the differential eqs. (10) into a problem of optimal control where h is the control variable and a suitable defined value of the firm is to be maximized by chosing h in the best possible way. In this context the question will then naturally arise whether the optimally controlled system exhibits a cyclic behavior again.[15] Second, it still remains a task to estimate the periods of the occurring limit cycles. In particular it may be interesting to compare the frequency of the undisturbed Lotka–Volterra system with the one of the disturbed system. Both problems are left open for future research.

[15] Limit cycles are also admitted in optimally controlled systems, cf. Semmler and Sieveking (1991).

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Nonlinear liquidity-growth dynamics with corridor-stability

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The paper presents a dynamic model of the financial/real interaction. In particular, it shows that (i) liquidity, when facilitated through credit, can operate procyclically, (ii) credit may add to the asymmetry of business cycles and (iii) endogenous propagation mechanisms in monetary economies are shock dependent. Using a variant of Foley's growth cycle model, we demonstrate that the portrayal of financial/read forces exhibits corridor-stability. In this case, small shocks have no lasting effects, but large enough shocks can lead to persistent cycles or unstable non-periodic fluctuations. The Hopf-birfurcation theorem is rendered inapplicable due to the fact that the trajectories are stable in the vicinity of equilibrium. A global characterization of the dynamics is required instead.

'As credit by growing makes itself grow, so when distrust has taken the place of confidence. failure and panic breed panic and failure' (Marshall 1879:99)

1. Introduction[1]

As the above citation indicates there is a long tradition taking the view that liquidity when facilitated through credit, may magnify cyclical expansions and contractions. Liquidity, of course, played a central role in Keynes' General Theory and in IS/LM variants of it. Recent advances in this vein have shown how various types of dynamic behavior arise from intrinsic monetary/real interactions. Various lines of work have embellished this basic theme and have emphasized several important implications of the financial role. First is that indeed liquidity can operate procyclically, amplifying business expansions or contractions. Second, the financial/real interaction is

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STUDIES ON MARIO BUNGE'S *TREATISE*

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Chapter 11

SOCIAL SCIENCES AND TECHNOLOGY

To A. Shaikh
with best wishes
Barceló

ARE THERE ECONOMIC LAWS?

Alfons Barceló*

It is clear that there are no "purely economic acts". The proper understanding of the segment of social activities we call "economic" thus constantly requires that account be taken of wider social and ecological contexts. Mario Bunge is perfectly justified in repeatedly stressing the fact that the economic sphere should be understood as one of several components of society, intimately linked with politics and culture. It may however be objected that the connections with psychology and ecology are of even greater importance in this respect. It is by no means easy to decide between such arguments.

There are nevertheless good reasons for maintaining that an economic system as a whole has a certain degree of autonomy (or "limited sovereignty") that allows scientific research conceptually to isolate this level in order to discover essentially economic relationships and properties that are also robust, that is, relatively uninfluenced by political and cultural contexts. I do not consider such approaches to be entirely sterile, but I do believe that the only way to deal with this problem is to move the debate from the level of principles to that of practice and testing. Economic laws play a privileged role in this respect since their existence or non-existence, together with their possible features and peculiarities, should provide a decisive basis for clarifying the numerous arguments involved.

The present paper has two parts. The first is a brief outline of the current state of economic theory from a perspective inspired by the work of Mario Bunge. The second part presents a simple theorem which aspires to the status of an "economic law", presented here for the first time in English, although the results have previously been published in Spanish (Barceló & Sánchez 1988). We believe that this statement of law has important epistemological implications. Moreover, the philosophical orientations of Mario Bunge have provided a significant background to the investigations leading to its formulation.

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1.1 An Overview of Economics as a Science

Although not exactly a *locus communis*, it is not difficult to find general agreement that economics has not yet gone beyond the stage of a "proto-science" or primitive science. Various symptoms and pieces of evidence support this opinion. Amongst these we may cite the lack of general agreement among experts on the "object" of economics; it is not clear if economics deals with "decisions", "thoughts", "rational behaviour", "wealth", "production and distribution", "economic man", "modes of production", or all of these and more. Careful thought easily reveals that the basic concepts are often vague and sometimes inscrutable: "value", "utility", "money", "capital", "technical progress", "scarcity" and "growth" are all ambiguous terms whose exact meanings have yet to be defined and about which there is by no means unanimous agreement. If we focus on the various sections into which (for reasons of specialisation, fashion or pedagogy) substantive economic science has been divided (Microeconomics, Macroeconomics, Growth, International Trade, Regional Economics, Business Economics, *etc.*), consideration of the connections between these various branches reveals the very clear lack of any basic underlying structure and thus the limited extent of mutual support. There is similarly little indirect support from associated disciplines: as theorists, most economists ignore psychology, sociology, history, ecology and industrial technology, thus denying these aspects suitable external controls and concern for systematisation.

If we add to this some of the blunders made with respect to false predictions and unsuccessful programmes of action, it is not surprising that little trust is placed in recipes based on theoretical work, nor indeed in the corpus of inherited systematic knowledge. With respect to retrospective knowledge, historians frequently express dissatisfaction with the conceptual constructs furnished by economists when analysing the structures and trajectories of social formations.

There is however some good to be said of economics. A whole series of concepts, analytical techniques and relationships between variables have been studied in depth. Huge quantities of data have been processed and powerful econometric techniques have been developed. Although the theoretical and conceptual bases are often somewhat less than solid, a vast empirical register has been made of numerous tendencies, providing important guidelines for both research and action. An extensive range of theoretical models has been formulated to represent some prominent features of economic activity, even though many of them have no realistic referent or are extreme caricatures. With respect to logico-formal criteria, the quality control of theoretical constructions is generally excellent.

In the final analysis, this must be taken as evidence of considerable progress in economic theory, the present situation of which is, in comparison with other social sciences, extremely healthy. Economics is not a pseudo-science, nor a system of

meaningless sentences, but an immature science nowadays at a stage that, in certain aspects at least, might be compared with the situation of biology or chemistry at the beginning of the nineteenth century.

1.2 The Three Sources and Three Constitutive Parts of Economics

When we speak about "economic sciences" we generally refer to a wide range of knowledge comprising components of various epistemological statuses. We also assume this knowledge to exist within a wider field of knowledge known as the social sciences.

It should immediately be pointed out that economic knowledge is a mishmash of ideological, technological and scientific elements that are extremely difficult to separate from each other. There are clearly numerous connections between the various fields concerned, and their frontiers are not always well defined. But it is nevertheless possible to delimit within each field a robust core in which it is not difficult to determine whether or not certain criteria are applicable. Thus, for pure economics, the criterion of validity would be based on the question "Is it true or false?"; within economic technology, validity is gauged by means of the question "Does it work?"; and for economic ideology, without any validity criterion of its own beyond possible scrutiny of its internal coherence, the more illuminating questions tend to be of the kind "Which social, professional or individual interests are favoured by this conception?", "What ideas are these propositions jousting against?", or "Within which socio-economic context do these evaluations appear and flourish?".

Despite possible dissent, such a classification would appear to be reasonable. It should however be realised that this procedure assumes scientific laws to be axiologically neutral. Despite the fact that the present century has seen attempts to found a "proletarian mathematics" and a "fascist biology", to label cybernetics a "bourgeois science", or, in response to demands by biblical fundamentalists in the United States, to teach Creationism as a biological doctrine comparable to Darwinism, it would nevertheless seem somewhat less than convincing to regard the Snell or Mendel laws, the Mendelekhev table or the Newton binomial as mental constructions with immanent ideological charges.

The distinction between science and technology should also be stressed in this context. The Challenger or Chernobyl disasters do not invalidate the physical and chemical laws at the basis of the knowledge used to design and construct such artefacts, nor does the death of a patient jeopardise the (real or presumed) validity of molecular biology or Mendelism. Yet these are the kind of fallacies being advanced when economic science is said to be unserviceable because it has not succeeded in eradicating hunger and misery. To push this logic to its limit, this would be like saying that meteorology does not work because it has not succeeded in eradicating droughts or torrential rains.

With respect to its ideological or propagandistic aspect, economic knowledge

must clearly be recognised as being contaminated, to varying degrees, by elements that evaluate, defend, correct or criticise existing economic structures. The more or less concealed propaganda values of certain economic ideas must thus be seen as an inherent feature of such discourse. This kind of value weighting may vary greatly between pure and applied science, but it is always present in some form or another, positive or negative, at the centre or on the periphery.

It should similarly be clear that different technologies have different degrees of scientific foundation, that ideologies are also influenced by scientific progress and that the development of pure economics is largely conditioned both by technological demands and results and by existing ideological currents. But the truth value of a natural or social law has nothing to do with the motives, intention or ideology of the person discovering that law, no matter how interesting the study of such connections may be for cultural sociology or the psychology of science. At the same time, the affirmation that theorems are neutral and that the nucleus of a science is free of value judgements does not mean that scientists and technicians are suddenly liberated from their permanent involvement in situations where they have to choose between options with various moral implications. Neither pure nor applied science evolve in a sterile or immaculate sphere, but are constantly framed by relationships and interests of all kinds. The laws concerned in the operation of a nuclear reactor are free of value judgements, but this cannot be said of the reasons why some people study nuclear energy and others study solar energy, nor why and in what proportions some institutions or departments provide grants and subsidies for specialisation in one field or the other. The ecological, political and economic implications of such options are firmly embedded in a multitude of necessary value judgements. Clearly, the different research fields dealt with by economists do not derive directly from theoretical or practical problems, but are extensively conditioned by the global social context. There is undoubtedly ample free ground here for unwarranted apologetics and mystifications, but if the denunciation of ideological burdens is allowed to obscure the various levels involved, it is at the risk of descending to the level of purely electoral slogans and strategies.

We should finally point out that the distinction defended here is profoundly at variance with two major theoretical currents: firstly with the instrumentalist vision which conceives economic theory as a "tool-box" and waves the banner of "economic analysis" instead of "economic theory" or the old "political economy"; and secondly with the formalist vision that tends to see economic theories as artefacts existing independently of the contents or "interpretations" they may receive, thus attaching all importance to syntactic aspects and leaving aside questions of semantics or empirical testing.

1.3 Models and Theories

Humanity has engaged in extremely long and laborious processes to distill a

progressively refined body of knowledge within which the "sciences" occupy the foremost positions. The creative process behind the constitution of all sciences begins from the recognition of problems and culminates in the construction of theories or systematised sets of laws that then become the nucleus or quintessence of the results achieved within the science concerned.

A distinction may generally be made between fundamental and specific theories. Fundamental theories would be those that do not presuppose any other theory bearing on the same referent or field. Specific theories, on the other hand, presuppose at least one general or specific theory. Economic science as it stands does not yet have any fundamental theories: there are only outlines of several mutually competing theories that aspire to become fundamental. It could be said that such aspirations are to be found in marxist economic theory, in neoclassical theory or in sraffian theory, each of which, despite various mutual imbrications, has its own axiomatic nucleus.

On the other hand, the study of certain sub-processes or sub-systems has given rise to various specific economic theories such as those of consumption, business, capital, growth, money and international trade. There are also specific theories straddling economics and other disciplines, as is the case with organisation theory, economic psychology and economic anthropology. Although all specific theories presuppose some further, fundamental theory, this dependence is sometimes weak. In some cases a specific theory may be in conflict with or open to absorption by other theories. In other cases, it is precisely in confronting specific theories that fundamental theories find their most illuminating conflicts. To mention just one well-known example, in the mid-1960s the theory of capital became the battleground for conflict between neoclassical and sraffian theories.

Models are a further and similarly prestigious way of presenting the progress and achievements of knowledge. Harrod once had occasion to compare himself to Monsieur Jourdain, discovering that he had been constructing a model without knowing it, in the same way as Molière's character discovers that he speaks in prose. As representations of a limited and stylised segment of reality, models allow the inherent obstacles of complex phenomena to be eluded through the selection of only certain features. They may be free or bound, depending on their degree of dependence on an underlying theory or approach. It may well be impossible to draw a definite boundary between a specific theory and a generalised model, and some theoretical constructions may indeed be considered either as authentic models or as embryonic theories. Yet the distinction remains important when it comes to testing: the hypotheses presented in models may be confirmed but never be refuted on the basis of empirical evidence, whereas the constructors of theories can never remain indifferent to anomalies or refutations, and thus in this sense take on far greater risks.

Given that the construction of theoretical models is nowadays one of the main modalities of research in economic science, it is worth looking at this question a little

more closely. It is by no means easy to determine which criteria might allow the above models to be considered as scientifically relevant. There is undoubtedly at least one preliminary filter which would generally be accepted as such, namely formal correctness. However, this possible attribute may in no way be considered a sufficient condition when we are dealing with factual sciences. Beyond this first elimination process, it remains to be determined which criteria have to be met in order for a model to be accepted as valid within the field of economic theory. This may appear a somewhat idle task, but the reasons often adduced for legitimating some models ("elegance" or "simplicity") are certainly a little ridiculous when considered from a realist perspective (be it vulgar or refined).

The validation rule we suggest is as follows: To determine the relevancy of a model, imagine a hypothetical model-object such that the model under examination may be judged to be the basic mould or "photograph" of the model-object. It is clear that this model-object should not enter into contradiction with well-established physical, chemical or biological laws, that is, there should be no instantaneous production, machines should not last forever, economic subjects should have to eat and inexorably age, *etc.*

If it is not possible to invent a hypothetical object that conforms to the presumed model, this latter mental construction should be downgraded to the category of metaphor and no faith should be placed in its explicative or analytical capacity. If, on the other hand, it is possible to conceive of a concrete situation like that which the model is supposed to represent, the relevance of the model may be affirmed since the set of its real or potential referents is not void. It should then be determined if one is dealing with a limit case or with a strategic nucleus able to withstand a weakening of its assumptions. If it is a limit case, we are looking at a genuine model; and if the second criterion is met, the construct deserves to be upgraded to the category of a "specific theory" or even to that of an incipient or skeleton theory.

Application of this selective filter has the epistemological virtue of leading to a "literal interpretation" of the model, stripping it of the verbal tinsel and glitter that may mask its true nature. It is not unusual to find that, once in its naked form, a construct purporting to refer to an industrial system in fact models no more than economies based solely on gathering or with only one product. Similarly, a formal characterisation of "fixed capital" may well be found to be adequate to no more than "land" or to a "homogeneous stock of circulating capital". Or again, models presumably designed to analyse "machinery" in general may effectively exclude certain "biological machines" controlled by humanity ever since the Neolithic revolution (livestock and arboreal cultivations).

Confirmation of the adequacy and illuminating nature of this criterion should rid economic theory of the considerable surplus ballast that currently impedes scientific progress, such being in effect the role often played by pseudo-problems. It would moreover then be easier to resist temptations to project the theorems of models directly onto the infinitely more complex level of real economies. For despite

repeated warnings to the contrary, attempts are at present habitually made to graft the conclusions of metaphors and models onto realities that hardly ever fulfil the prerequisites stipulated in the initial hypotheses.

1.4 Economic Reality and Alternative Approaches

It would appear to be no exaggeration to say that the dominant economic theory is a hotch-potch of science, technology and ideology including many elements of a theological nature that are transmitted as doctrine. Many of the central propositions of economic theory are moreover either simple tautologies containing no substantial truth, or references to "possible worlds" which have little to do with terrestrial historical realities.

In order to deal with comparable cases, biologists have invented a new field of research known as "exobiology", that is, the study of the properties of living beings that may exist in one or several of the numerous galaxies of the universe. The endeavour is not without its picturesque qualities. This new field would appear to be ideally suited to speculative minds and may indeed shed indirect light on some more immediate problems. The fact that a small number of researchers dedicate themselves to affairs of this kind is not to be judged as out and out folly, although it might be supposed that they will habitually end up with results like those noted by the science fiction writer Harry Kuttner: "For a long time it was believed that the inhabitants of Ceres were invisible. Then it was discovered that Ceres does not have any inhabitants".

Curiously enough, economic theorists have spent decades cultivating what could analogously be described as "political exo-economics". Some conjectural models may well be justified to the extent that processes of contrast allow them to shed indirect light on real cases. But it is difficult to find good reasons why a great many researchers in pure economics should be dedicating their time to such tasks. Our complaint may be supported by one of the currently prestigious economists who admits that "[...] it cannot be denied that there is something scandalous in the spectacle of so many people refining the analyses of economic states which they have no reason to suppose will ever, or have ever, come about" (Hahn 1970, p. 1).

These brief remarks on the irrelevance of much research leads us to another essential question underlying use-focused economic theory. Pasinetti has acutely observed and convincingly demonstrated (albeit with some exceptions: *cf.* Bliss 1986) that the economic approach based on use reflects a "mercantile" conception according to which the central problem is the exchange-affected assignation of given resources in a static context. On the other hand, visions focused on features of the industrial world lead to quite a different problematic: instead of a static rationality, they conceptualise the interdependence of man and nature in terms of cyclical dynamic processes frequently incorporating learning processes (Cf. Pasinetti 1981, pp. 1-25).

There can be no doubt that all points of departure imply selection and bias. But it is one thing to exclude valid elements, and quite another to attempt to build on foundations made of weak and badly assembled components. It should be pointed out here that the currently-reigning theoretical tendency in fact owes it heritage to the "marginalist counter-revolution" of the 1870s. Its defining feature is the decisive role it attributes to the "utility" or "preferences" of economic subjects in the determination of basic economic variables, particularly of prices and quantities. This vision has enjoyed considerable academic success, but it has yet convincingly to reply to certain substantial objections clearly formulated by Maurice Dobb many years ago: "To be sufficient anchorage for a determinate theory of value, even formally viewed, it was necessary that utility should be conceived as an expression of some fairly permanent and consistent aspect of human psychology. This is not to say that human preferences had to be assumed to be unchangeable; but they must not be so contingent and fickle as to make it improbable that they were independent of other variables in the system they were intended to determine" (Dobb 1937, p. 156). In a footnote Dobb moreover insists that it is not enough simply to postulate a determined behaviour: "It is necessary to premise that this behaviour (or certain determining elements underlying it) is independent of the movement of market-prices".

To put it simply, certain hypotheses on consumer behaviour play a central role in standard economic theory. The problem then lies in the fact that these hypotheses are generally not validated through reference to well-established psychological laws, nor indeed to reputedly trustworthy empirical generalisations, but are instead posited as conventional assumptions. Their "a priori" nature is sometime stated explicitly, but they are more often considered valid simply because held to be commonly accepted essential data. In this way, research can from the outset turn a blind eye to otherwise quite palpable facts like the effects modifications in the preferences of immediately surrounding people have on the preference "map" of the subject under consideration, or the modifications undergone by such a map in the course of time. Most importantly, these attributes are assumed to be both exact and robust, an assumption that is clearly dubious. Even without context change, even ignoring learning processes and restricting attention to one moment in time, it is simply not possible to do away with the sequential aspects of good part of consumption when dealing with goods functioning as fixed capital or deposits of circulating capital (clothing and housing belong to the first group, liqueurs and bottles of eau-de-cologne to the second). In neither case can purchase and consumption be correlated in a simple way, and to suppose that a buyer is capable of calculating the exact future satisfaction flow (which, for the fastidiously minded, should be updated in terms of the specific future discount and weighted by adequate risk indicators) and balancing this against the purchase cost, is thus to attribute most mortal beings with predictive powers of titanic proportions.

What is more, these weak fundamentals do not find compensation in substantial results derived from any similar hypotheses in technological areas, beyond those

propositions which could be considered common knowledge. This situation not only has deplorable repercussions from the analytical perspective, but also contributes to the discredit of economic teaching, which sometimes appears to be a set of scholastic doctrines. Excessively credulous beginners risk a brainwashing from which it is by no means easy to recover. The absence of verification mechanisms habitually leads to a certain schizophrenia, even amongst those who deal with the systematisation and presentation of technological rules concerning these areas, as can be confirmed simply by examining the introductory chapters of advertising or business textbooks. After several pages of pettifoggery in support of standard economic theory, these texts immediately abandon the theory in question in order to expound and justify the techniques or results of whatever speciality they are concerned with.

If the above criticisms should be thought to be based on absolutely marginal positions, it is worthwhile referring to authoritative arguments like that recently presented by the Nobel prize winner Herbert Simon: "I think the textbooks [of microeconomics] are a scandal. I think to expose young impressionable minds to this scholastic exercise as though it said something about the real world, is a scandal [...]. I don't know of any other science that purports to be talking about real phenomena, where statements are regularly made that are blatantly contrary to fact" (Simon 1986, p. 23).

We have already suggested that the scientific level of conventional economic theory leaves much to be desired. But this does not imply that "heterodox" currents are in a better state. I believe that, strictly speaking, we have as yet no economic theory, despite the existence of two outlines or skeletons that aspire to become such a theory —the walrasian general equilibrium approach and the ricardan-marxist approach—, plus the availability of many praiseworthy "free" models. The basic elements of the neoclassical vision are consumers and producers. All attention is focused on the "market" through which the relations of interdependence between these two groups of components are articulated. The aim is to predict the behaviour of these subjects and the consequences of such behaviour. Behaviour is usually presumed to be optimising and the circumstances surrounding and informing this behaviour are deemed "given". The underlying principle is the logic of exchange, with scarcity and decision-making acting as key concepts whilst temporality and institutional aspects are hidden in a corner to await future refinements.

The alternative vision (classical, marxist or sraffian) bases its research on the logic of production and reproduction, with its constitutive elements being the industries and processes that, through activities revealing profound technological interdependence, generate flows of products and require flows of various other factors. Such schemata readily allow the introduction of institutional features and conflicts of interest. The temporal dimension is an inherent part of this approach, with behaviour being explained through reference to history, psychology and adherence to one group or another, rather than through application of maximising rules. Scarcity stops being a central concept as soon as reproducible commodities and networks of virtual

trajectories are examined.

This reproductive approach – inaugurated by Quesnay – has been enriched considerably over the last thirty years and is, in my opinion, the most fruitful of the existing orientations, in addition to being capable of incorporating many highly valuable elements from other traditions and perspectives. Much work undoubtedly remains to be done; many fields have yet to be explored; numerous rough edges need to be smoothed down and elements of diverse origins await to be fitted it. But this does not mean that any non-aggression pact has to be proposed. The only way of knowing which ideas are true (or truer than others) is to submit them to criticism. Conceptual refinement, discussion of assumptions, empirical testing and systematic observation will thus be necessary if this by no means mediocre legacy is to be extended and improved and new elements are to be incorporated into a powerful and promising approach based on economic and social reproduction.

If the above-defended orientation is correct, it follows that the reactions of the many critical economists who accept the message of standard theory and restrict themselves to peripheral battles, have sadly missed the point (and this on both the scientific and political levels). Debate is thus sometimes centred on the level of political preferences, especially on the degree of state intervention proposed. On other occasions, the main accusations against standard economics are that it is not concerned with the context within which economic activity is carried out, that basic theoretical discourse in economics has no place for ecological environments, institutional structures, the existence of social classes or strata and interconnections between the economic level and the political, social and cultural levels. It must be conceded that such criticisms are partially justified, but it should also be emphasised that their theoretical foundations are themselves rather shallow. When ophthalmologists set about curing blindness, they have no real need to concern themselves with the educational, social, psychological, architectural or urbanistic aspects of the problem. But such considerations should be taken into account if the effects of blindness are to be mitigated. All pertinent dimensions and implications must be dealt with if one is to formulate a global policy designed to help people suffering this handicap.

Further foreseeable obstacles come from different sources and tend to be viscerally resistant. It is for example a little tedious to have to comment here on a topic like "Economics and Mathematics", but obtuse ideas on the question are still being propounded from certain isolated bunkers. The matter has been discussed numerous times for more than a century now. It would be enlightening and instructive to revise the old debates and attest the extent to which "anti-formalist" positions have been ceding ground and numerous arguments have become invalid. Of course, none are as blind as those who will not see, but I believe that consensus could be reached on the following pair of propositions: firstly, that formalisation of ideas has the great virtue of increasing rigour and precision; secondly, that this neither exempts one from having to think nor provides content. It is moreover worth

noting that theological theses and theories about ghosts can also be translated into logico-formal language.

Some arguments should also be brought to bear on the superficial suspicion that, within the social sciences, quantification implies a generally qualitative distortion of phenomena. There can be no doubt that economics has seen unfounded quantifications, but this is no grounds for rejecting all attempts at quantification: what is perceived as being qualitative may well be linked to some quantitative property or set of quantitative properties. Although caution must be taken against abusive, dishonest or unfounded quantifications, one should nevertheless aspire to the direct or indirect quantification of relational properties. Moreover, since the object of quantification is not things in themselves but our ideas about things, there are no essentialist barriers against such a project.

It is clear that formalisation cannot be detached from semantic content. To illustrate this, let us look at just one prominent economic concept. The concept of price must carefully be distinguished from, on the one hand, the mathematical entity (a function) with which we represent it, and on the other, from the numerical values this function takes on, that is, the prices of goods measured in terms of a system of units. Functions are mathematical objects with certain properties allowing certain operations to be carried out, some operations being specific to certains kinds of functions. However, the concept of price is not a mathematical concept and one thus cannot be justified in submitting it to mathematical operations, no matter how acceptable such operations may be when applied to formal entities like price functions. This means that when one extracts mathematical components or structures from a non-mathematical concept, the latter does not simply vanish without trace but instead becomes the referent of the formal manipulations carried out. It is thus logically invalid to establish identity relationships between non-mathematical concepts and their mathematical representations. Our comments here are not gratuitous, nor are they quite asking the waves to keep away from the shore: they simply denounce the semantic faults made when it is asserted that an economy "is lineal", when a price system is defined as "a point in an n-dimensional Euclidean space", or when it is said that "a *coalition* is a set of family households".

The desire to arrive at a more rigorous and exact theory is not mere rigoristic obsession. It must be insisted that only those theories able to provide in-depth explanations of the laws governing the evolution of economic and social reality can hope to lead to conscious and efficient modifications of that reality. Although there can be no denying that certain pre-scientific technologies had their virtues, it is clear that the social costs involved in trial-and-error learning systems have increased greatly as a result of the extremely complicated chains of interrelationships in which human beings are nowadays enmeshed. If we add to this the enormous power of contemporary technology, it becomes even more patent that improvised actions run the risk of incurring high social costs.

It thus follows that, on the level of scientific ideas, subversion of the established

order cannot involve making *tabula rasa* of the fruits human intelligence has slowly generated through countless laborious and complicated processes. There can be no sense in turning one's back on such a valuable heritage. Yet this does not mean that every legacy should be adopted in its entirety, without scrutiny or without application of a careful inventory. It is moreover clear that some knowledge will become invalid when social reality changes, that new conditions will lead to properties previously only guessed at or indeed not yet conceived of, and that, more importantly, changes in the dominant scale of values will require new selection criteria, new evaluations of aims and outcomes, and a general revision of the meaning and function of certain techniques and mechanisms. At the same time, it is obvious that one never begins from scratch, that certain results are lasting human conquests, and that special attention should be paid to easily recycable elements that can be rescued from the debris of other theories and usefully incorporated into more profound and truthful theoretical schemata.

1.5 Reality and Approaches

The world in which we live is extremely diverse, subject to tensions of numerous kinds and threatened by enormous dangers. Opulence and misery, liberty and oppression, dominance and dependence all coexist and are attaining overwhelming extremes. Modern civilisation has made enormous achievements in both the pure and applied aspects of the physical and biological sciences. In the social sciences, on the other hand, we would appear to have reached a deplorable situation. Vital questions like unemployment, foreign debt, under-development, armament build-ups, the impact of new technologies, the population explosion or the deterioration of the environment find experts in social questions with little to say that is of analytically solid form.

This scientific under-development may be attributed to various causes. Some difficulties result from objective features: social systems are not only extremely complicated with respect to the number of their elements and the quantity and quality of their internal interrelationships, but are also evolving at a rapid rate, with enormous deployments of artefacts of all kinds. Moreover, they are made up of individuals who change and react, and who are subjected to strong influences on numerous levels (ecological, biological, economic, political and cultural) and to acute conflicts of interest such as those between exploiters and the exploited, oppressors and the oppressed, those who are dominant and those who are dependent. Furthermore, isolation and experimentation are usually only possible in extremely marginal cases. Other obstacles have to do with hegemonic ideologies: social scientists are, before all else, private citizens with certain needs, weaknesses and inclinations. This means that their work is always strongly conditioned by three factors: 1) the theory or theories inherited along with pending internal problems; 2) individual or mercenary political or ideological tendencies; 3) the central problems of

the epoch (filtered and masked by 1 and 2). It follows, at least up to a certain point, that the social sciences originally evolved as an apology of the then developing capitalist institutions, and have indeed continued to support those institutions.

But this is only one aspect. Even when it is perfectly legitimate, ideological critique alone does not resolve the problem and, more importantly, is of limited power. The presence of value conditioning does not stop truth from being the truth, whether it be in the mouth of Agamemnon or in that of his swineherd. Thus, if it is accepted that every reality is thinkable, that every society is subject to laws and that scientific research can progressively discover these laws, there is then room in which the social sciences may develop. Instead of the naïve aim Adam Smith attributed to political economy ("to enrich both the people and the sovereign"), we should aim to develop a whole series of fields of knowledge which, in both their pure and applied aspects, should deal with the main manifestations of social existence. Furthermore, we should seek a certain balance between the theoretical (pure), observational (direct or historical), and technological aspects of research, all of which should be placed within wider frameworks and coordinated with research in neighbouring disciplines.

There is of course a wide gap between intention and action, and it has often been repeated that good sentiments do not make good literature. Paraphrasing, I would suggest that they do not make good economics either. For better or for worse, authentic scientific discoveries have little to do with the lofty or abject motivations of the researchers involved. In any case, the coexistence of different approaches can only be considered ill-omened if and when sectarian hermetics are cultivated and communications between the various currents of thought are lacking. When, on the other hand, rival theories confront each other, the result is a creative tension that makes it possible to improve perspectives.

If the above assessments are correct, it may be inferred that the search for an exclusive and excluding unifying principle is not a good alternative if old and new problems are to be dealt with in an objective and rational way. It is preferable to back an opportunist strategy based on the accumulation of mutually-controlled evidence, and to fix one's sights on an ideal economics in which everything will eventually tally up. We should moreover be capable of escaping from old recipes and doctrines, which is by no means an easy task. Inherited ideas can be restrictive yokes, and it takes a certain daring to break with them. They moreover often contain highly valid elements that it would be senseless to reject, although their identification may not be as easy as the baby and bathwater analogy might suggest.

2. *An Economic Law*

2.1 On Economic Laws

In his *Treatise on Basic Philosophy*, Mario Bunge poses the vital question, "Are there natural laws of the economy?". Then, in the volume on the social sciences, he concedes this title to the law of diminishing returns and the Cobb-Douglas production function. The first of these is described in the following terms: "The output of an economic system increases at first, and then grows at a decreasing pace, as the input increases" (1985, p. 182). This description is incorrect. The manuals generally explain that this law (also called the law of variable proportions) is limited to saying that if one increases the quantities of a variable factor applied to a given quantity of a fixed factor, the marginal and average products will eventually diminish. It thus predicts the consequences of variations in the proportions in which production factors are used, and is not related to temporal trajectories but rather to alternative situations. With respect to the second law cited, it should be pointed out that it concerns a theoretical construct that has been discredited (*cf.* Fisher 1969; Shaikh 1974; Fisher 1982), although it is still presented in the less strict manuals and is frequently used in econometric studies, since it is a convenient mold for packing data into.

One cannot hold Mario Bunge exclusively responsible for these slips. A considerable part of the guilt must be attributed to economists themselves, who habitually enshroud the question of economic laws in confused and obscure wordage and thus make it easy to get bogged down in complex networks of contradictory affirmations. If a curious but untrained reader were to thumb through economic manuals in search of the laws economists have discovered, he or she would no doubt be somewhat perplexed. Firstly, the term "law" would be found fairly frequently, but predicated with extremely diverse propositions including definitions, postulates, empirical generalisations, real or supposed tendencies, mathematical theorems dressed in economic nomenclature, and even statements considered to be false. At the same time, the reader may come across sentences like the following: "*In fact economists [...] have not available any genuine, relevant, non-trivial laws*" (Hutchison 1977, p. 21), or again – more prudent, but less precise –: "if by laws we mean well-corroborated universal relations between events or classes of events deduced from independently tested initial conditions, few modern economists would claim that economics has so far produced more than one or two laws" (Blaug 1980, p. 161).

If the quantity and quality of the laws discovered constitute a good index of a scientific discipline's state of health, economics must be said to be still at the proto-scientific stage. This situation demands that several questions be formulated. Perhaps we should firstly point out that, if there are to be any economic laws, there must exist societies that produce, distribute and consume. Similarly, biological laws depend on

the existence of living beings. Economic knowledge can thus not be imputed to be transhistorical and economic laws must be considered temporal: in the absence of the referents, they would be like empty boxes. Furthermore, since economic systems are evolutive, they undergo changes and modifications that lead to the emergence or disappearance of various traits and properties. Modern journals of economic theory do not carry articles on bimetallism, no matter how important the issue may have been in the nineteenth century. If the assumed facts become obsolete, the knowledge derived from them cannot escape the same fate. To aspire to a genuine "economic science" thus does not imply any proposition that the body of knowledge worthy of this name should be complete, unchronic or scrupulously neutral in all its dimensions. Concepts, analytical schemata, derived techniques and patterns of action will always be contextually conditioned to a lesser or greater degree.

Yet none of this implies that economic laws do not or cannot exist, nor that they might only be detected in mercantile systems, nor that laws can have only a narrow temporal or institutional field of applicability, nor indeed that they need be merely qualitative. There would appear to be no basis for the pessimism many economists have in this respect, a pessimism reflected by Hahn when he states that "[...] A theorist will then be surprised if there are 'laws of economics', in the sense of propositions holding universally, to be discovered. He will be surprised if deep knowledge of 'affairs' were to reveal some fundamental or invariant structure of an economy" (Hahn 1985, p. 27). On the other hand, the classical epistemological perspective appears to be much more optimistic. Nagel, for example, has shrewdly indicated that the historically conditioned character of social phenomena "does not preclude the possibility that these specific uniformities are specializations of relational structures invariant for all cultures" (Nagel 1961, p. 462), although he does warn that "if a law in any domain of inquiry is to cover a wide range of phenomena exhibiting admittedly relevant and important differences, the formulation of the law must ignore these differences, so that the terms employed in the formulation make no explicit mention of traits specific to the phenomena occurring in special circumstances" (Nagel 1961, p. 463).

This small sample of opinions is designed to underline the epistemological interest of the question of economic laws, and of course the degree of confusion reigning in this matter. We shall present below a recently discovered "local" economic law. Its range of referents is very restricted, but this is compensated for by the fact that it possesses the rather unusual features of quantitative precision and trans-systemic validity.

2.2 Theorem on Self-reproducing Goods

The intuitive conception behind the argumentation below is as follows. Present economic systems (if indeed there are more than one) are made up of enormous quantities of productive and distributive processes involving millions of individual

commodities and thousands or millions of subjects. There are complex interdependences between all these elements. But the reasonable assumption of a generalised interdependence does not imply that all relationships are equal. It should thus be possible, at least in principle, to detect privileged connections between some particular elements.

We are going to present a discovery that fits into these considerations. The argumentation is supported by the sraffian approach and is built around two simple key ideas that, as far as we have been able to check, have never previously been combined.

Economists frequently refer to the fact that two commodities – especially from the perspective of final consumption – may be "complementary" or "substitutive". This is a contingent and not particularly robust relation, but remains descriptively useful. However, emphasis is rarely placed on a parallel property that becomes immediately obvious when the commodities are contemplated at the end of the productive process that has generated them. Our first idea consists in underlining that certain commodities are "kins" from the point of view of production, and that they are thus in a close mutual value relationship independently of their final destination. One might imagine two books with the same number of characters, the same number of pages, the same binding and the identical print run, but designed for quite unconnected segments of the population – grandmothers and teenagers –; or again, two pieces of metal that are similar in all respects except that one is for sports cars and the other for tractors. The limit case, which might metaphorically be labelled as that of "Siamese twins", would be when two processes using exactly the same factors (raw materials, machinery services, labour) respectively produce, in the same time lapse, f units of A and g units of B. A situation of this kind could be modeled in the following way (assuming distribution rules of the capitalist type):

$$(a_{1\,1}p_1 + \ldots + a_{1n}p_n)\,(1 + r) + L_1.W = f.p_A$$

$$(a_{1\,1}p_1 + \ldots + a_{1n}p_n)\,(1 + r) + L_1.W = g.p_B$$

Thus,

$$f.p_A = g.p_B$$

and

$$p_A / p_B = g / f.$$

That is, the value relationship between A and B is constant. A drop in the price of oil or a rise in salaries will not modify this particular relationship, whereas they would generally alter the relative prices of two randomly chosen goods. In other words, the indicated relationship is affected neither by changes in the distribution between salaries and profits, nor by the modification of any parameter of the economy. Two commodities related in this way may be said to have exactly the same "distinguished input". Although it may be difficult to find pairs of commodities that scrupulously fulfil the stipulated conditions, it would not be rare to find some kind of "kinship", in terms of a single or composite "distinguished input", between goods produced within the same economic sector.

The second pivotal idea of our economic law is as follows. A few commodities are self-reproducing. This generally concerns animals and vegetables that have undergone social control, but it also concerns hypothetical "von Neumann robots" able to construct replicas of themselves. The reproduction rate of these commodities is a biotechno-economic variable that could be considered as a specific parameter for a given historical period, although not as an atemporal constant. We shall call this quantity the "specific rate of surplus", defined (in the simplest cases) as

τ_A = (harvest of A – seeding of A) / seeding of A

Now equipped with the basic elements we need, we can analyse the case of two agricultural commodities that operate as "circulating capital" (wheat and beans, for example), over the same time span, within an extensive and complex economy, and "close kins" thanks to a distinguished input comprising land services, labour hours and machinery.

A compact representation of this situation would, in value terms, be as follows:

$a.p_A + DI + R_A = (1+\tau_A)\, a.p_A$

$b.p_B + DI + R_B = (1+\tau_B)\, b.p_B$

(R_A and R_B represent the value of the other inputs and added values; a and b are technical coefficients; DI is the distinguished input assumed to be the same in both equations; and τ indicates the values of the respective "specific rates of surplus".)

It directly follows that:

$DI + R_A = \tau_A \,.\, a.p_A$

$DI + R_B = \tau_B \,.\, b.p_B$

If we now suppose that $R_A = R_B$ (or that their value is insignificant when compared with that of DI), we have:

$\tau_A \,.\, a \,.\, p_A = \tau_B \,.\, b \,.\, p_B$

or, expressed in a clearer form:

$$\frac{p_A}{p_B} = \frac{\tau_B}{\tau_A} \,.\, \frac{b}{a}$$

This "Theorem on Self-reproducing Goods" would seem to be of some relevance. It has the peculiarity of relating a coefficient of prices with technical and biological parameters that are perfectly quantifiable, and moreover commits itself to giving a precise prognostic. Its field of reference is clearly very restricted, but it deals with elements that are not without importance in human history and its temporal field, on the other hand, is extremely wide. Furthermore, it provides a well-determined value relationship that refers to one of the rare segments where all theoretical approaches in economics inevitably intersect, since the explanation of prices – either as a central concern or as a peripheral aim – is an aspiration they all share.

In short, the theorem's avowedly local character and reduced field are compensated for by its trans-systemic validity and quantitative precision, both of which tend to be unexpected features in the human sciences. Since it is predicable

independently of whether or not the economy concerned be slave-based, feudal, capitalist or socialist, we believe that we can also assert that economic systems enjoy a certain degree of non-ephemeral autonomy, even though the refinement of prognostics requires the introduction of institutional variables (Cf. Barceló & Sánchez 1988, pp. 23-25) and possibly cultural variables as well. If these judgements are correct, this theorem constitutes a "statement of law" which may be brandished as a counter-example to many explicit or implicit general propositions, and is thus of significant epistemological interest.

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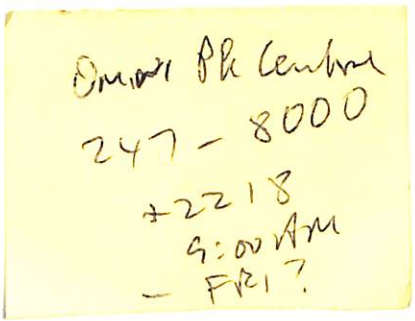
ON A MACROFOUNDATION OF MACROECONOMICS
Parts 1–3

Clifford Goalstone



ON A MACROFOUNDATION OF MACROECONOMICS

Cliff Goalstone*

...we must consider the common weal in terms of its essence, and humanity as a whole in terms of its roots, *subsistence*. All moral and physical parts of which society is constituted derive from this and are subordinated to it. It is upon subsistence, upon the means of subsistence, that all the branches of the political order depend.

from a Physiocratic document: 'Rural Philosophy'
(as translated in Meek, The Economics of Physiocracy, p. 57.)

1. During the last generation macroeconomists have devoted their attention to the microfoundations of macroeconomics. In this endeavour

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they have increased our knowledge in various ways. And yet we may wonder if their attention has perhaps been too one sided. Have they forgotten the search for the macrofoundations of macroeconomics?

Conceptually there are four basic possibilities in the micro-macro distinction: the microfoundations of microeconomics, the microfoundations of macroeconomics, the macrofoundations of microeconomics and the macrofoundations of macroeconomics.

The search for the macrofoundations of macroeconomics began with the Physiocrats. They did not use this expression; nor did they use the kind of vocabulary popular today. Still, we may view their three fold division of society, their subsistence-surplus distinction, and their Tableau Economique as the first coherent attempt at the macrofoundations of macroeconomics.

After the Physiocrats came Ricardo; after Ricardo, Marx; after Marx, Keynes. Each of them, in at least sections of their work, reached for macrofoundations.

The development of a social science is in part determined by social necessity, in part by the reward-structure within the profession, and in part by fashion. Necessity, reward and fashion may converge in political economy on a new direction: in favour of the macrofoundations. In what follows I shall consider subsistence, surplus and social reproduction, abstracting from the questions of distribution.

2.

Many economists have traditionally begun with a corn model. Since we shall be interested in subsistence relationships in this paper, I will follow this approach.

We seek a simple model; thus we begin with the following assumptions:

(i) only corn is produced.

(ii) corn is produced by corn and a given quantity of labour.

(iii) the production period is one year.

Using notation we may write the following production relationship

(aX, tX) produce X (1),

where a is the amount of corn-seed necessary to produce a unit of corn, t is the amount of labour time to do so and X is the output of corn.

We shall consider two periods, year 0, the current year, and year 1, the next year. In order to create a diagram relating consumption in year 0, C_0, with consumption in year 1, C_1, we need to find the simplest algebraic relationship containing both.

The constraint for year 0 may be written as

$$X_0=C_0+aX_0+I_0 \quad (2),$$

where aX_0 is the amount of corn to be reserved as replacement for this year's corn-seed used in the production of X_0, and I_0 is the new investment in corn-seed.

aX_0+I_0 is the corn-seed used to produce the output of year 1, X_1, Thus we may write

$$aX_0+I_0=aX_1 \quad (3).$$

From (2) and (3) we get

$$X_0=C_0+aX_1 \quad (4).$$

So much for year 0. When we shape our assumptions for year 1, we need to craft the algebra in the spirit of our intended focus on subsistence, surplus and social reproduction. The easiest way to do so may be found in the idea of *perpetual* investment. Perpetual investment means the amount which can be maintained if the total investment in seed-corn in year 0 determines the non-consumption of corn in year 1. Then we may write

$$aX_1=X_1-C_1 \quad (5).$$

Equation (5) may be rewritten as

$$X_1=C_1/(1-a) \quad (6).$$

From (4) and (6) we may find the fundamental equation of this paper

$$X_0=C_0+[a/(1-a)]C_1 \quad (7),$$

which relates consumption in years 0 and 1 to the output of year 0 and the technical corn-seed factor.

3. On the basis of our fundamental equation we may construct its geometrical interpretation. In this paper I shall follow the convention of marking the origin as '0' then lettering the points on the diagrams sequentially in alphabetical order—*A*, *B*, *C*...—as they appear. We begin with Figure 1.

Consumption in year 0 is on the horizontal axis; consumption in year 1 is on the vertical. The distance *OA* represents the maximum possible consumption in year 0, if consumption in year 1 is zero; from the fundamental equation this is calculated as X_0, the total output. The distance *OB* is the maximum possible consumption in year 1, if consumption in year 0 is zero; from our fundamental equation we may calculate this as $[(1-a)/a]X_0$. Although this is quite an ordinary way to begin, we should be somewhat uncomfortable; for neither *OA* nor *OB* make any *physiological* sense, and, moreover, they violate the spirit of our inquiry into sustainable consumption. However, let us put these objections to the side for the moment and inquire into the relative sizes of *OA* and *OB*. At first we may conclude that *OB* must be greater than *OA*, for if nothing is consumed this year—everything is saved and invested—then the maximum possible consumption next year would seem to always be greater than the maximum possible this year. But we can see from the fundamental equation that *OA* will equal *OB* if $a=1/2$, if a seed is only capable of producing two seeds. Fortunately, the Author of Nature has been more generous than that. So the condition $OB>OA$ only if $a<1/2$ may be accepted as logically binding in our framework but not agriculturally relevant.

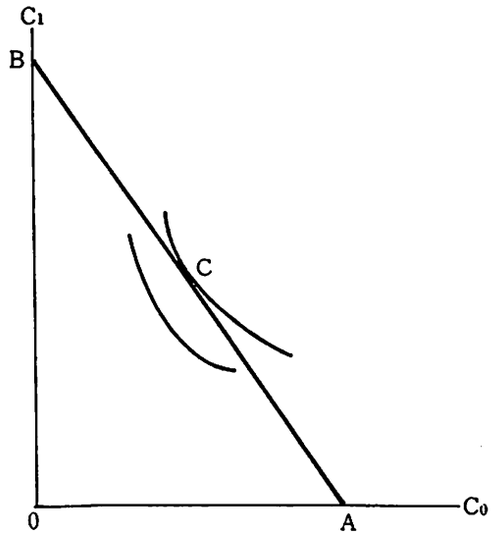

Figure 1

At this point a neoclassical friend may ask, 'What point on the *AB* line will be chosen?' And he may answer, 'That depends upon the preferences of the community.' By the nature of his training, he would be inclined to draw a few indifference curves on the diagram. Since it would be inefficient to choose a point within the *AB* constraint, such as represented by the indifference curve within the space *OAB*, a neoclassical would proceed immediately to the highest indifference curve feasible—that is, subject to the constraint imposed by *AB*. He could depict the 'optimum' possibility by point *C*. But on the basis of our fundamental equation, what sort of diagram may we construct?

4. Before looking for a 'maximum' or an 'optimum' one should first consider subsistence to see how it affects the constraint.

We should consider how this may be done. We may draw a diagram related to Figure, 1, using the same axes, consumption in year 0 on the horizontal, consumption in year 1 on the vertical. Consider Figure 2.

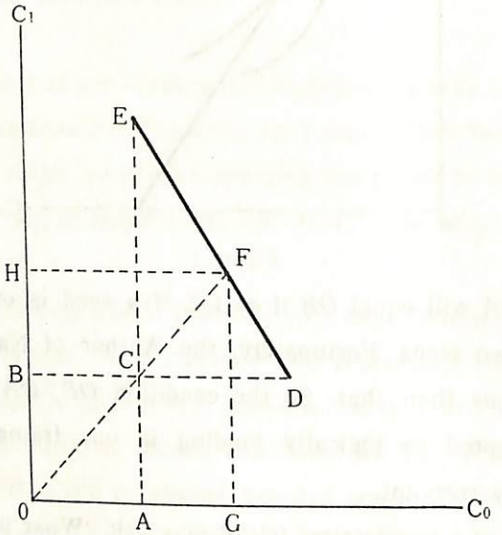

Figure 2

It is useful to bring in two simplifying assumptions. First, concerning distribution, let us allow equal distribution of product. Second, concerning population, let us assume zero-population growth. Then we may define the distance OA as is the minimum consumption in year 0 consistent with maintaining the population intact; in our algebra we may call this C^*. And the distance OB is the minimum consumption in year 1 achieving the same goal; this too, in terms of our algebra, may be called C^*.

Since the population is unchanged (or the death rate equals the

birth rate), then $OA=OB$. Extend perpendiculars out from points A and B; they meet at point C. Any point within the square $OACB$ would involve a decrease in the population due to insufficient corn consumption.

We may now take advantage of our fundamental equation, using it to derive the production and consumption frontier which does not violate the subsistence requirement. Since we know the productive capacities of the means of production, we can extend the line BC until we find the maximum possible consumption in year 0 without endangering life in year 1, that is, if consumption in year 1 equals C^*. This is marked by point D. From the fundamental equation it is calculated as

$$X_0-[a/(1-a)]C^*,$$

which is the total output of year 0 minus subsistence consumption multiplied by the corn-seed factor over one minus the corn-seed factor.

Now we can extend the line AC until we find the maximum possible consumption in year 1 without endangering life in year 0. This is marked by point E. From the fundamental equation it is calculated as

$$[(1-a)/a](X_0-C^*).$$

The distance AE is greater than the distance BD when, as we saw in the previous section, the corn-seed factor is less than one half. We may now draw a line from point D to point E. This is the consumption-possibilities frontier.

Next, draw a line out of the origin passing though point C and hitting the frontier at point F. (Given our assumptions it is a 45 degree line.) Point F represents the maximum stationary state feasible. Drop a line from point F to the horizontal axis (to point G),

and draw a line from point F to the vertical axis (to point H). The distance OG equals the distance OH, and they both may be calculated from the fundamental equation as $(1-a)X_0$.

Can we say anything about the likelihood of different points on the ED-frontier? In general, points near F are probably more likely than points near E or D. They involve relatively steady levels of consumption year to year. If we adopt the assumption of a preference for increases in consumption over time, then the *relevant range* on the frontier is found on the segment FE with points near F probably more relevant than points near E.

We should observe one more thing. This diagram depicts a community in which stationary-state consumption (point F) is almost double the minimum consumption (point C). So the length of CF, relative to the distance OC, is a measure of the surplus-consumption capability of a community.

For a wealthy country the relative length of CF would be long; for a poor country it would be short. A starving country would not have a CF line, or it would be negative.

5. One of the things we saw on the consumption-frontier diagram was a stark representation of sacrificing consumption in year 0 for the benefit of consumption in year 1 and sacrificing consumption in year 1 for the benefit of consumption in year 0. The clarity of this issue on this diagram inspires another way to depict the frontier. But in order to see this clearly we need to consider our fundamental equation again.

Dividing both sides of (7) by C_0 yields

$$X_0/C_0=1+[a/(1-a)](C_1/C_0) \quad (8).$$

Let us define the ratio of consumption in year 0 to subsistence

consumption as alpha ($\alpha=C_0/C^*$). And let us define the growth rate as consumption in year 1 minus consumption in year 0 divided by consumption in year 0 [$g=(C_1-C_0)/C_0$]. Putting α and g into (8) yields

$$(X_0/C^*)(1/\alpha)=1+[a/(1-a)](1+g)$$

which may be simplified to

$$\alpha=[X_0(1-a)]/[C^*(1+ag)] \quad (9).$$

This is evidently non-linear. For any X_0, C^* and a (assuming $X_0>C^*$), we may draw a diagram depicting the relationship—an inverse relationship—between α and g. Consider Figure 3*.

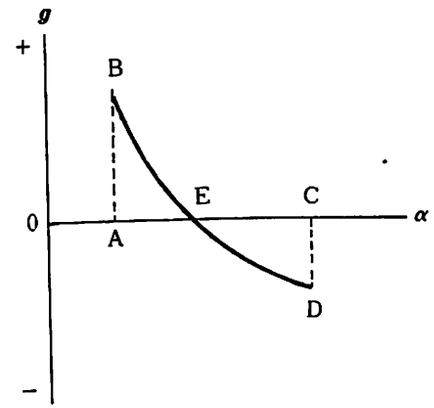

Figure 3

α, the ratio of total consumption to necessary consumption, is on the horizontal axis. g, the growth rate in consumption, is on the vertical. It is shown for positive and negative values because it will be worth our while to consider the entire frontier, not just points

* In the previous draft, using geometry only, I drew the BED relation as a straight line. But according to equation(9), BED is non-linear. So, again, I would like to thank Professor Okishio.

seeming most likely or relevant. A curve is drawn on Figure 3 which corresponds to the *EFD*-constraint found on Figure 2 and conforms to equation (9). We should consider its meaning.

Point A represents $\alpha=1$; this is the case with the largest g (point E on Figure 2). The growth rate is marked by point B on Figure 3, and may be calculated as

$$\{[(1-a)/a][(X_0-C^*)/C^*]\}-1.$$

Next let us consider the other end of the constraint, with the largest negative g (point D on Figure 2). α is noted by point C on Figure 3 and is equal to

$$X_0/C^*-[a/(1-a)],$$

while g (which is marked by point D on Figure 3) is equal to

$$\{C^*/\{X_0-[a/(1-a)]\}\}-1.$$

Finally, point E, which corresponds to point F on Figure 2 is the stationary state; $g=0$. α at this point is the maximum *sustainable* ratio of total consumption to subsistence consumption currently possible. In terms of our algebra, $\alpha=(1-a)X_0/C^*$. For well-off nations it will be significantly higher than one; for poor (but socially reproducible) nations it will be rather close to one.

We should also observe that the distance AE (relative to the distance OA) on Figure 3 serves the function of the distance CF (relative to the distance OC) on Figure 2. It is our basic measure of surplus-consumption capacity.

If we assume a preference for increases in consumption over time, then the EB part of the curve is the relevant range.

6. Focus attention once more on the horizontal axis, measuring α, keeping in mind that we have drawn the curve on Figure 3 for a community capable of producing considerable surplus corn. Run

your eyes from left to right, from 0 to A to E to C. Each of these points correspond to distinct human situations as well as *attitudes and moods*. At point 0 total consumption would be zero; no one would be alive. Let us check the other points.

Point A: The attitude is rigidly one of current sacrifice in order to have extraordinary consumption in year 1. But why should such a (relatively) well-off society make such a sacrifice?

Point E: If physically comfortable—and if it does not require a treadmill life, with long working hours—the contradiction at point A never comes into mind. Conventional behaviour can be the basis of social reproduction.

Point C: People consume as if the end of the world is near, although they hedge their bets by setting aside corn-seed sufficient for subsistence consumption in year 1. But what a spectacle. Attitude: who cares. Mood: who cares.

I think we can see in this—indeed, in this whole paper—a reason the indifference-curve approach is so lacking in consumption-possibilities analysis. For it fails to consider some of simplest concrete realities human beings face.

Moreover, we have seen that only a small part of the constraint is relevant and much of it is pathological. We should take this as a warning that we need to understand the diagrams we draw more carefully.

7. In this paper I have discussed a macrofoundation of macroeconomics using a simple corn model. I believe the idea of macrofoundations is relevant for any kind of economy. But I would like to close with an observation on applied rural philosophy.

There may be a close link between understanding the macrofounda-

tions of macroeconomics and developing the macrofoundations of microeconomics; and then there may be a close link between both of these and the knowledge necessary to solve some of the problems caused in our world by wealth inequality and mass poverty.

The majority of people in the world live near subsistence. Economists, government officials, international-agency workers and others have tried—often with the best of intentions—to alleviate mass poverty. This has often meant urban bloat and rusting industrial-development schemes. Are the majority of people in the poor countries better off for all the effort?

Perhaps we need for much of the world a rural philosophy to replace a failing industrial philosophy. There are people working on this possibility. I would like to share with you an article from the Christian Science Monitor,* written by Kristin Helmore, titled 'Loan Yields Piped-in Water':

Cyrus Mwathi lives in the fertile farming region near Nakuru in western Kenya. As is typical, his farm is small (two acres), his family is large (seven children), and his income, until recently, was the equivalent of less than $300 a year.

Until two years ago, the farm produced only maize. Life was hard, especially for Mr. Mwathi's wife, who daily had to walk four kilometers (2.5 miles) each way to fetch a few gallons of water for her family.

Two years ago, the Mwathis received a loan—not of money but an in-calf heifer (pregnant cow), from a local development agency, Farming Systems Kenya.

The heifer was worth $600, but Mwathi paid only $150 for it, with the understanding that the cow's first heifer calf would be given to the agency as soon as it was a year old.

During the cow's first lactation, she produced 30 kilos (8 gallons) of milk per day. The family has been selling the milk ever since, and during the first

* 30 September 1987, p.17. The last section of an article called 'Banking on the Poor: Changing the Face of Foreign Aid'.

year they managed to save about $1,000 from the profits.

One of the first things they did was to bring piped water to their home, at a cost of about $450.

They also bought a bicycle for $95, which their eldest son uses to collect fodder for the cow. The manure she produces goes to fertilize the Mwathis' maize crop, and as a result the yield is much higher than in previous years.

Subsistence, surplus and social reproduction. Old ways of thinking are sometimes also new ways of thinking.

ON A MACROFOUNDATION OF MACROECONOMICS PART 2

Cliff Goalstone*

Man is compelled to obtain subsistence and induced to obtain enjoyments; and it follows from this that the subsistence which is least troublesome to obtain is naturally that which suits him best.

from a Physiocratic document: 'Rural Philosophy'

(as translated in Meek, The Economics of Physiocracy, p. 59.)

1. In Part 1, published in this journal in December 1988, I introduced a relationship which I called alpha—the ratio of total consumption to subsistence consumption. This relationship is the main fruit of that paper. There is much more to be said about alpha and much to be built around it; the name 'alpha', itself, hints at this. For alpha is a starting point.

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Alpha should be understood, first of all, as a fundamental social-accounting relationship. Although social accounting has been elaborated as one of the by-products of the Keynesian revolution, we have still not defined the material standard of living by way of a simple social-accounting ratio. Alpha, I feel, fills some of this gap. It does so by looking back to the social-reproduction tradition of the Physiocrats, by adopting their starting point: subsistence. Because of this connection, I would call alpha *neoPhysiocratic*.

But alpha is more than a piece of social-accounting. In this paper I will begin the task of spelling out and interpreting some of its contents. Since alpha has a general content which transcends the corn-model from which it first emerged, I will begin with the more general statement. With that behind us, I will return to the corn model to clarify a point on labour productivity. I will then suggest some interpretations.

2. The analysis in the first paper took the supply of labour as given and said no more about it. This was a convenient way to by-pass a number of complications. But it is not at all helpful if we want to penetrate deeper into alpha. In this section I will build the formula for *sustainable* alpha—the ratio of sustainable consumption to subsistence consumption—which takes into account the role of labour in the production of output.

Before presenting the formula, something should be said about the meaning of 'sustainable' and 'subsistence'. By sustainable consumption I mean the highest stationary state within reach, subject to technical knowledge and hours of work. In such a situation, net investment is zero. Thus, changes in sustainable consumption only occur with changes in technology and/or changes in hours of work.

Subsistence consumption should be distinguished from two concepts: (1) material sustenance and (2) the poverty line. Material sustenance only refers to the consumption required to preserve life from day-to-day. This depends mostly on climate and personal health. This is a physiological, not a social, concept. Subsistence requirements are different, and generally much larger. They are the bundle required by workers and their families for establishing an on-going and stable pattern of work life and home life—including the preparation of young people for assuming adult responsibilities. This bundle is required to reproduce working-class people without whom there is no social reproduction. The subsistence-consumption bundle, thus defined, may be greater than or equal to what is called the 'poverty line'. The poverty line refers to what is needed for 'minimally decent' living. This is a social concept, since it will be based on community norms. But it is not a social-reproduction concept since it looks only at consumption, abstracting from labour and the education necessary to prepare people for labour.

We can proceed, now, by presenting sustainable alpha (α^*) as a per person relationship.

α^*

EQUALS

sustainable consumption DIVIDED BY population

DIVIDED BY

subsistence consumption DIVIDED BY population.

These ratios can be written for any unit of time we may choose. Throughout this section I will assume we are taking one year as our unit of time.

Our task is to elaborate the contents of the numerator. There are three elements, all related to labour, which belong here.

First, any and all production occurs within the limits of technical knowledge and hours of work. The simplest measure of technology for our purposes here is the sustainable consumption relative to the hours of work required (directly and indirectly) to produce it. This includes the workers producing investment goods; their contribution to consumable product is indirect but vital. From this we define labour-productivity (λ)

λ EQUALS sustainable consumption DIVIDED BY hours of work.

Second, we need to introduce the number of workers required (directly and indirectly) to produce the sustainable consumption. Then the hours of work divided by the number of workers tells us the average hours of work per worker. This is our hours-of-work ratio (h)

h EQUALS hours of work DIVIDED BY number of workers.

Finally, only a part of any society is engaged in production. Some of the population may be too young or too old; some may be incapable of work while others may be in a position to avoid work. So we need to know the per cent of the population engaged (directly and indirectly) in the production of consumable product. From this consideration we get a working ratio (ω)

ω EQUALS number of workers DIVIDED BY total population.

We may now bring the ratios together. The formula for sustainable alpha is

$$\alpha^*=\frac{\dfrac{\text{sustainable consumption}}{\text{hours of work}}\cdot\dfrac{\text{hours of work}}{\text{number of workers}}\cdot\dfrac{\text{number of workers}}{\text{total population}}}{\dfrac{\text{subsistence consumption}}{\text{total population}}}$$

Let us call the denominator σ. Then the formula for sustainable alpha may also be written in symbols

$$\boxed{\alpha^*=\frac{\lambda h\omega}{\sigma}}$$

3. This formula can be derived algebraically using the corn-model presented in the first paper. This will help clarify the concept of labour productivity used above.

The corn model begins with the following production relationship

$$(aX,\ tX) \text{ produce } X \qquad (1),$$

where a is the amount of corn-seed necessary to produce a unit of corn, t is the labour-time necessary to do so and X is the output of corn. Since sustainable consumption is the output minus the corn-seed which must be reserved for a stationary state, we may write alpha* as

$$\alpha^*=(1-a)X/C' \qquad (2),$$

where C' is subsistence consumption.[1] This can be written in its per person form

$$\alpha^*=[(1-a)X/P]/(C'/P) \qquad (3),$$

where P is the population.

Let us now introduce sigma and omega from above

$$\sigma=C'/P \qquad (4)$$

$$\omega=N/P \qquad (5),$$

where N is the number of workers.

The labour time necessary to produce a unit of output times the output tells us the time necessary to produce the output. The hours of work per worker times the number of workers gives us the same figure. So we may write

$$tX=hN \qquad (6),$$

(1) In the first paper I used C^* for subsistence consumption. I now feel it is better to use C' for subsistence and reserve the star for sustainable values.

where h is the hours of work per worker.

Substituting (4), (5) and (6) into (3) yields

$$\alpha^*=(1-a)h\omega/t\sigma \quad (7).$$

h, ω and σ in this equation are already known from the social-accounting presentation of the formula; a and t appear in the corn-model derivation. What is the economic meaning of $(1-a)/t$? If we introduce an algebraic expression for the amount of labour required directly and indirectly to produce a unit of product, which we denote by ρ, ρ is determined by

$$\rho=t+a\rho \quad (0<a<1) \quad (8).$$

This can be rewritten

$$\rho=t/(1-a) \quad (9).$$

Since ρ measures the total labour required to produce a unit of product, its inverse, $(1-a)/t$, shows the productivity of labour. In the previous section we called the productivity of labour λ; thus (7) may be written

$$\alpha^*=\lambda h\omega/\sigma \quad (10),$$

which is the result of section 2.

4. Since alpha* is a measure of the upper limit of the standard of living with subsistence as its base, we can use it as an index to compare different communities. The subsistence bundle required to reproduce working-class families in Timbuktu is such-and-such; the sustainable consumption there is so-and-so. In New York the composition of the subsistence bundle will be different, as will the sustainable consumption. But the figures from Timbuktu can be got and its alpha* can be calculated; likewise for New York. This can done without using exchange rates or price deflators. Alpha* cuts through a tangle of problems.

Within a single community we may be tempted to conclude that an *increase* in alpha* is always desirable, or is always desirable with a given distribution. Some people may want to use it as an index of this sort. Is this necessarily valid?

There are a number of objections to this way of thinking. In this section I will only deal with an objection which can be stated on the basis of the formula for alpha*.

For any *given* subsistence bundle per person (σ constant), alpha* can only be increased if one or more items in the numerator are increased. Either the productivity of labour, or the hours of work per worker or the percent of the population employed—or some combination of these—must increase.

Suppose the productivity of labour, as defined above, is unchanged. Then an increase in alpha* can only occur by increasing labour time. With a given active work force this would require a longer period of work; with a given period of work this would require a larger active work force.

A longer period of work is almost universally resisted or resented; a larger alpha* got in this way can hardly be said to be 'better' since hours of work are also a part, an important part, of material conditions. The evaluation of an increase is the ratio of the working population to the total population is more ambiguous. If it is brought about by decreasing unemployment of people in need of work, the resulting increase in alpha* may be called an improvement. But if the increase in employment (to give two examples) takes children away from schools and parents away from nurturing their children, the increase in alpha* is not a clear improvement.

To sum up: we cannot unambiguously use changes in alpha* as an index of changes in material well-being without looking at the

labour required to bring this about.

5. Our attention has largely focused on the numerator of the formula for alpha*. We should now consider the denominator. The denominator measures subsistence consumption per person. Surely the subsistence requirements differ from community to community, and change within communities over time. Is there any simple distinction which can help us get a handle on these differences?

I would suggest the distinction we want is the difference between *simple social reproduction* and *complex social reproduction.*

Consider a community adhering to old traditions; the Amish of Lancaster County Pennsylvania are a good example. The number of items in the subsistence bundle is rather small; it contains food, shelter, clothing, health care, education—and not much more. All of these items are derived from local resources. Very little social capital is required to reproduce the working population, let alone the entire society. Nature is preserved without depletion or pollution. This would be the archetype of simple social reproduction.

Now consider a community in very different circumstances; if it helps to think of a concrete example, perhaps Japan, by all means do so. This community also has the basic needs already listed. But in addition, it requires schools, hospitals, roads, railways, motor vehicles, electricity, telephones, radios, televisions, flush toilets..... and watches—lots of watches! *All of these items* are required for the reproduction of the working population. All of these items enter into the subsistence bundle. To maintain this system, nature is depleted and polluted. This should give you a picture of complex social reproduction.

Let us compare two communities of equal population, both with

an alpha* of two: both communities have a ratio of sustainable consumption to subsistence consumption equal to two. Let us suppose that one of them is in simple social reproduction, the other, complex. Complex is 'developed' and 'modern'; Simple is 'underdeveloped' and 'primitive'. Some may wonder if Simple can have an alpha* as high as two; for the sake of this thought experiment, let us assume it is possible. Which community has the higher material standard of living?

If we look only at the social accounting figures for aggregate consumption expenditures (or national income or gross national product) we may think the answer is unmistakable. Complex has more of every *thing* per person than Simple. Bigger is better; more is preferred to less.

This may not be the answer we would get from considering the formula for alpha*. Let us look at the question from this point of view.

$$\alpha^* = \frac{\lambda h \omega}{\sigma}$$

Our two communities—Simple and Complex—have the same alpha* but they have clearly different σ's. Simple has a smaller σ than Complex. If they have the same h and ω, then Complex must have a greater labour productivity (λ) to *achieve and maintain* its larger subsistence requirements. The people in Complex may pride themselves on their higher productivity, and their mass consumption; they may look down their noses at Simple. They may even feel they have a duty to extend 'development assistance' to Simple.

I would evaluate the situation differently. Since Simple and Complex have the same $\alpha^*[=2]$, h and ω, it seems impossible to me to say that the Complex community is better off than Simple; all I can say

that they are *different.* Moreover, since the Complex way of life depends upon depleting natural resources, its sustainability may be an illusion.

As Gandhi asked: if every country tries to achieve industrialism, how many globes will we need?

6. An alpha* equal to two was chosen for a simple thought experiment in the last section. It was used, in part, because such a figure, which implies one unit of surplus for every unit of subsistence, can conjure up a picture of a materially well-off community; and I wanted to contrast two rather different communities sharing some characteristics. But the choice of the number two was not at all arbitrary. I had it in mind for something else, for an empirical and macrofoundational hypothesis. Before presenting this hypothesis we need a little preparation.

Let us think once again about Complex because this hypothesis relates to fully-industrialized societies. In the last section we looked at an example where

α^* EQUALS

sustainable consumption DIVIDED BY subsistence consumption

EQUALS 2.

Sustainable consumption is defined by the highest stationary state within reach, subject to technical knowledge and hours of work. In this situation net investment is zero; so sustainable consumption equals net income. Let us also equate subsistence consumption with subsistence income. Then we may write

α^* EQUALS

net income DIVIDED BY subsistence income

EQUALS 2.

This should be put in its per-person form. Net income per person is average income; and subsistence income per person is average subsistence income. So

α^* EQUALS

average income DIVIDED BY average subsistence income

EQUALS 2.

We will now make assumptions about the numerator and denominator, both of which can be relaxed. First, the average income will equal the median income in two simple cases: (a) equal distribution and (b) symmetrical distribution around the average. Next, from what was said in section 2, average subsistence income will be greater than or equal to the (per person) poverty line. Choosing either (a) or (b) for the numerator, and choosing the equality for the denominator allows us to consider a special case

α^* EQUALS

median income DIVIDED BY the poverty line

EQUALS 2.

I have followed a somewhat tedious path (using some restrictive assumptions) to convert alpha* [=2] for our hypothetical Complex community into an equality which may be restated: the poverty line equals one-half the median income. This may sound familiar:

....some economists have argued that poverty thresholds can only be defined relative to some measure of general well-being, such as the median income, and should be indexed to changes in that measure. One idea, originally advanced by Victor Fuchs, would be to define as poor all those with incomes less than one-half the median income. In 1965, when the U. S. official poverty line was

first introduced, it stood at 46 percent of the median for a family of four.(2)

We may make some observations. If the poverty line is defined as one-half the median income, if the poverty line is close to the subsistence requirements for social reproduction, and if the median income is close to the average, *then alpha* will be close to two.* Alpha* will differ systematically from two as the median income differs from the average and as the poverty line differs from subsistence consumption. Average income is generally higher than the median; but the subsistence requirements for social reproduction are also generally higher than the poverty line. So an alpha* close to two, if the one-half rule applies, is not a bad guess.

An hypothesis can now be stated. Complex social reproduction can and has achieved alpha* values of two. If the intuition of Victor Fuchs is corroborated by further studies, and if the difference between median and average income is fairly narrow and stable, then alpha* values somewhat near two may identify the *natural rate (or natural range) of alpha* in complex social reproduction.*

7. Let us refer to the formula for alpha* once again, this time to look at the movement from Simple to Complex as well as to understand some of the nature of being in Complex. Although this will be a highly stylized story, it may shed some light on the 'natural rate' hypothesis while looking beyond it.

$$\alpha^* = \frac{\lambda h \omega}{\sigma}$$

'England, at the beginning of the Industrial Revolution, was not, by the standards of the time, a poor country; and the same is true, as Kuznetz reminds us, of each of the other countries that have successfully industrialized.'(3) The movement, the successful movement, from Simple to Complex, started with an alpha* above one; otherwise there would not have been a (domestic) source of savings. With increases in the productivity of labour (λ), in hours of work (h), and in work-force participation (ω), alpha* rose. But along with these changes the requirements of subsistence (σ) also rose, especially because of urbanization and the rise of standardized (eventually) mass education, mitigating somewhat the rise in alpha* We may call this the first phase of the movement.

In the second phase, there was pressure on h to fall, because it was abusive; labour organized to fight this. This was more than offset by increases in λ; but the increases in λ were in turn offset somewhat by increases in σ, as the new social capital required for urban life spread to the country side and as the cities got ever more 'modern'. Thus while alpha* increased in the second phase, its increase was smaller than in the first.

In the third phase, the present phase, the pressure on h to fall is now called 'demand for leisure'. There is also pressure on ω to fall—

(2) Isabel V Sawhill, 'Poverty in the U.S.: Why is it So Persistent?' *Journal of Economic Literature,* (*September* 1988), p. 1076. See also Victor Fuchs, 'Redefining Poverty and Redistributing Income' *The Public Interest* (Summer 1967), pp. 88–95.

Unfortunately, during the 1980's the United States statistics for the poverty line are unreliable and, as such, are useless for this paper. They measured bare-subsistence; we need information which sheds light on the requirements to reproduce working-class families. The Reagan administration, it seems, underestimated the real cost of the subsistence bundle in order to understate the extent of poverty, to underfund (or eliminate) poverty-fighting programs and to freeze the minimum wage. 'Star Wars was more important than Slum Wars.'

(3) John Hicks, *Economic Perspectives,* (Oxford: Clarendon Press, 1973), pp. 28–9. The title of that chapter is 'Industrialism'.

the ageing society—while policy makers debate how to pay for the expected increase in retirees. λ seems to roar ahead as we enter an information age, and if it really is, its friend σ follows it like an afternoon shadow; average people learn to depend upon VCR today and HDTV tomorrow. But people realize that many of the past increases in λ result in environmental degradation of awesome proportions making further increases in λ difficult; much labour will have to go into environmental preservation which does nothing to increase sustainable consumption. The movement of alpha* is therefore unclear; I would guess it is a stalemate.

And the rat race continues. We are stuck with industrial systems which must grow or face crisis. But we know the impossibility of unlimited economic growth on a *global* scale. And the fight over markets and resources could be a fight to the death. There are no easy choices; it is a closing circle. And some of us wonder: Will Mother Nature scold us as bad children? Will She throw up her hands, in despair, and force us to start over?

(Recieved 10 July. 1989)

ON A MACROFOUNDATION OF MACROECONOMICS: PART 3

Cliff Goalstone*

... we must consider the common weal in terms of its essence, and humanity as a whole in terms of its roots, *subsistence*. All moral and physical parts of which society is constituted derive from this and are subordinated to it. It is upon subsistence, upon the means of subsistence, that all the branches of the political order depend.

from a Physiocratic document: 'Rural Philosophy'

(as translated in Ronald Meek, *The Economics of Physiocracy*, p. 57)

1. The first two papers in this series are based upon the surplus approach to social-reproduction analysis. As such, we should expect to find a link with Marx. What is the relationship between the neoPhysiocratic concept of surplus and the Marxian?

From the outset I wish to beg the readers indulgence. This paper

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requires a great deal of simple algebra, much more than the first two papers. I have not found any way to avoid it. There are a number of basic issues which need to be discussed with precision. I hope the readers patience will be rewarded by a new understanding of some critical issues in the requirements for social reproduction.

Since we wish to draw out the relationship between Marx's analysis and the concept of sustainable alpha developed earlier, we will confine our attention to the stationary-state corn model in the first two papers.

We begin with subsistence consumption

$$C'=\sigma P \qquad (1),$$

where C' is the social subsistence, σ is subsistence consumption per person and P is the population. Next, we have sustainable consumption

$$C^*=C'+(C^*-\sigma P) \qquad (2),$$

Where C^* is total sustainable consumption and $(C^*-\sigma P)$ defines the surplus product. Dividing (2) through by subsistence consumption yields

$$C^*/C'=1+(C^*-\sigma P)/C' \qquad (3).$$

This may be written more compactly

$$\alpha^*=1+m^* \qquad (4),$$

where m^* is the neoPhysiocratic rate of surplus product and α^* is our old friend. We can see, at a glance, when alpha* equals 2, this rate of surplus product equals one.

For later convenience we can write a per person expression for alpha*

$$\alpha^*=c^*/\sigma \qquad (5),$$

where c^* is sustainable consumption per person (C^*/P).

In order to see the relationship between the neoPhysiocrat way of defining the rate of surplus product and the Marxian, we introduce

social classes. It is only necessary to make the simplest distinction. We will divide the population into those who live off of income from work and those who live off of income from property. I will avoid the word 'capitalist' in this construction; to use this word would needlessly reduce the scope of our analysis. Then the total population may be indicated by

$$P=P_W+P_P \qquad (6),$$

where P_W is the population in the working class and P_P is the population in the propertied class. When we divide through by the total population, we get

$$1=\eta_W+\eta_P \qquad (7),$$

where η_W is the proportion of the population in the working class and η_P is the proportion in the propertied class.

For completeness (although we will not require this equation until later) we may distinguish sustainable consumption by its class components

$$C^*=C_W+C_P \qquad (8),$$

where C_W is the working-class consumption and C_P is the propertied-class consumption.

With these preliminary considerations behind us, we may turn to Marx. Marx's definition for the rate of surplus product is derived from his concept of surplus value. In volume one of *Capital* he has little to say about surplus product. But chapter nine, on 'The Rate of Surplus-Value', ends with a brief section on surplus product[1]

> We call the portion of the product that represents surplus-value... by the name of 'surplus product'. Just as the rate of surplus-value is deter-

(1) pp. 338-9, (Penguin Books, 1976)

> mined by its relation, not to the sum total of the capital, but to its variable part, in the same way, the relative amount of the surplus product is determined by its ratio, not to the remaining part of the total product, but to that part of it in which necessary labour is incorporated. Since the production of surplus-value is the determining purpose of capitalist production, the size of a given quantity of wealth must be measured not by the absolute quantity produced, but by the relative magnitude of the surplus product.
>
> The sum of the necessary labour and the surplus labour, i. e. the sum of the periods of time during which the worker replaces the value of his labour-power and produces surplus value, constitutes the absolute extent of his labour-time, i. e. the working day.

With one parenthetic remark removed, that is the entire section! Marx did not give surplus product much thought.

When Marx refers to 'necessary labour', in the aggregate, he is only referring to the labour-time required to produce the subsistence bundle consumed by the working class (σP_W). Therefore, for a stationary state, we may write a formula for the Marxian rate of surplus product

$$m^*_{\text{Marx}}=(C^*-\sigma P_W)/\sigma P_W \qquad (9).$$

This should be compared with the neoPhysiocrat formula for the rate of surplus product, contained in (3) and (4)

$$m^*=(C^*-\sigma P)/\sigma P \qquad (10).$$

The two concepts of surplus product differ because Marx is concerned with the analysis of profit based upon the surplus-value approach, while the neoPhysiocrat analysis grows out of the relationships between subsistence consumption, surplus consumption and total consumption. In the neoPhysiocrat framework, the subsistence requirements of the propertied class must also be taken into account.

When we multiply both of the formulas for the rate of surplus product through by $(1/P)/(1/P)$, keeping (5) and (7) in mind, we arrive at

$$m^*=(c^*-\sigma)/\sigma \qquad (11)$$

$$m^*_{\text{Marx}}=(c^*-\sigma\eta_W)/\sigma\eta_W \qquad (12).$$

With these handy formulas we may make some calculations.

I insisted, in part 2 of this series of papers, on the importance of an alpha* value of two in fully-industrialized nations; we now know that this implies a neoPhysiocrat rate of surplus product of one. Marx, in *Capital*, used extensively a rate of surplus value (and hence, in his way of reckoning, a rate of surplus product) of one (or 100%). Using (11) and (12) we may make some cross calculations if we know the percent of the population in the working class. What figure should we choose? In the *Communist Manifesto* we find the following sentence(2)

> ...in your existing society, private property is already done away with for nine-tenths of the population; its existence for the few is solely due to its non-existence in the hands of those nine-tenths.

Let us use this figure and set η_w equal to 9/10. Then, when c^* equals two and σ equals one—which implies alpha* equals two—we may calculate the Marxian rate of surplus product

$$m^*_{\text{Marx}}=(2-.9)/.9=1.22$$

Now we should check to see the implications of assuming a Marxian rate of surplus product equal to one. In this case, from (12) we know

$$c^*=2\sigma\eta_W$$

When $\sigma=1$ and $\eta_W=9/10$, c^* will equal 1.8. So, in Marx's work we find an *implicit value* of 1.8 for alpha*; and the neoPhysiocrat rate

(2) p. 69, Frederic L. Bender, (Norton Critical Edition, 1988).

of surplus product equals 0.8.

2. We turn our attention to the fundamental theorems behind the Marxian and neoPhysiocratic work. They may be stated briefly in terms of the corn model. Before stating the theorems we will find it convenient to establish the equivalence of the two concepts of labour productivity used in the previous paper.

One of them, λ, was thrown up by social accounting; the other $1/\rho$ was derived algebraically. Recall the meaning of λ

$$\lambda=C^*/T=[(1-a)X]/tX \qquad (13),$$

where T is the total hours of labour during the period, a is the corn-seed required to produce a unit of corn, t is the labour-time necessary to do so and X is the total output during the period. The ratio of total sustainable consumption to the total hours of work in the period of production is our social-accounting concept of labour productivity.

The other concept of labour productivity is derived from an algebraic expression for the amount of labour required directly and indirectly to produce a unit of product. Denote this by ρ; ρ is determined by

$$\rho=t+a\rho \qquad (0<a<1) \qquad (14).$$

This may be rewritten

$$\rho=t/(1-a) \quad \text{or} \quad 1/\rho=(1-a)/t \qquad (15).$$

Since ρ measures the total labour required to produce a unit of product, its inverse shows the productivity of labour.

The equivalence of (13) and the second expression in (15) is easily shown

$$\lambda=C^*/T=[(1-a)X]/tX=(1-a)/t=1/\rho \qquad (16).$$

We will use this equivalence several times in the following derivations.

Now we can turn to Marx. The Fundamental Marxian Theorem

is concerned with identifying the condition required for profits to exist. Marx asked: what is behind the following sequence?

Money—Commodities—Money+ΔMoney.

Where does this ΔMoney come from? According to Marx, the increment comes from surplus labour-time. Professor Okishio has provided the algebra which shows the logic of Marx's assertion.(3) In the corn model we may indicate the existence of profits by

$$1>a+tw \qquad (17),$$

where w is the corn wage-rate per hour of work. Rearranging this expression, and using (16), yields

$$(1-a)/t=1/\rho>w \qquad (18).$$

When this expression is multiplied through by ρT we arrive at

$$T>\rho wT=\rho B \qquad (19),$$

where B is the bundle which workers can buy with their wages (wT). So, in order for profits to exist, the total labour-time must exceed the labour-time required directly and indirectly to produce a unit of product *times* the bundle which workers can buy with their wages. From this, profits are a residual; they are a surplus value.

(19) may be written

$$T>\rho C_W \qquad (20),$$

when all wages are be spent.

The neoPhysiocratic work begins with a different concern: *What is a necessary* (although by no means sufficient) *condition for the existence of a viable society?* In the absence of total equality in the

(3) See 'Constant and Variable Capital', p. 581, in *The New Palgrave: A Dictionary of Economics* (1987). In that paper Professor Okishio presents the Fundamental Marxian Theorem for a two sector model, assuming, first, equivalent exchange (prices exactly proportionate to unit labour values), then showing its validity when exchange is not equivalent.

distribution of final product, we observe

sustainable consumption *must exceed* subsistence consumption

$$C^*>C' \qquad (21).$$

What does this require? Multiplying (21) through by $1/T$, and recalling (16), yields

$$C^*/T=\lambda>C'/T \qquad (22).$$

This may be put into a form similar to the Marxian inequalities (19) and (20). Multiply (22) through by ρT

$$T>\rho C' \qquad (23).$$

The existence of surplus product—which is required for social reproduction in the presence of any inequality—requires that the total labour time exceed the time required directly and indirectly to produce a unit of product *times* the consumption required for social subsistence.

(23) is the embryonic form of the alpha* formula developed in the previous paper. In that paper we saw two derivations of the alpha* formula. We will derive it here more compactly—and more competely.

Multiply (23) through by λ/C'

$$\lambda T/C'>1 \qquad (24).$$

Next, multiply (24) through by $1/P$ over $1/P$

$$[\lambda(T/P)]/(C'/P)=[\lambda(T/P)]/\sigma>1 \qquad (25).$$

Finally, multiply the numerator of (25) by and N (the number of workers) over N

$$\lambda[(T/N)(N/P)]/\sigma>1 \qquad (26).$$

Recall from the previous paper

$$(T/N)=h \text{ and } (N/P)=\omega \qquad (27).$$

Using (27) and (16) we may rewrite (26) in three forms

$$\lambda h\omega/\sigma>1 \text{ or } h\omega/\rho\sigma>1 \text{ or } (1-a)h\omega/t\sigma>1 \qquad (28),$$

which are forms of the alpha* formula in the context of the Fundamental neoPhysiocrat Theorem.(4)

What, in sum, is accomplished in this section? We have established two surplus labour-time conditions in the macrofoundations of macroeconomics. Both are a part of the requirements for social reproduction. Marx saw only the first one. His failure to see the second one has a serious implication.

3. The Fundamental Marxian Theorem was conceived by Marx to carry two loads simultaneously. He not only wanted to shed a light on the condition for the existence of profits—which I have accepted above—he also wanted to build a revolutionary but 'scientific' analysis of exploitation. Great power was unleashed by his notion of exploitation; violently revolutionary governments were established upon it. Can the Fundamental Marxian Theorem really carry its second load?

The neoPhysiocrat response grows—first of all—out of an argument from humanity as a whole, prior to recognizing considerations from sectional interests. This is shown by our opening assumption

$$C'=\sigma P \qquad (1).$$

First we recognize social subsistence and the labour required to secure it, since they are the raw basis of social reproduction. This, I believe, is the first step in the macrofoundations of macroeconomics. From this first step we can have a concept of surplus product. Only after establishing these do the questions of profit and exploitation come

(4) Each of these forms of the alpha* formula is useful. The first form was used extensively in the previous paper. The second form is specially suited for expansion of the model to include more commodities. The third form is handy for looking at different kinds of technical change.

up. Let us look at the fundamental theorems in their proper order.

Consider the surplus labour—time conditions (23) and (20) in the case when the working class is restricted to its subsistence requirements. This does not affect the neoPhysiocrat condition and alters the Marx-Okishio condition only slightly

$$T > \rho C' = \rho\sigma P \qquad \text{(neoPhysiocrat)}$$

$$T > \rho C_W = \rho\sigma P_W \qquad \text{(Marx-Okishio)}$$

The first condition shows the requirement for the existence of surplus product; the second shows the requirement for the existence of surplus value, and hence profits. Each has its place. When we multiply these labour-time conditions through by λ, we convert them into surplus-product conditions

$$C^* > \sigma P \qquad \text{(neoPhysiocrat)}$$

$$C^* > \sigma P_W \qquad \text{(Marx-Okishio)}$$

But the second surplus-product condition is misleading; for some of what Marx calls surplus product is a part of subsistence consumption. It is a part of *necessary consumption* for social reproduction in *any* society with private property. Marx would have us believe that the subsistence requirements of the propertied class (σP_P) come from exploitation: 'they reap and yet they do not sow'; 'they make the fundamental economic decisions in society and the working class must obey'. *But subsistence consumption is required by propertied-class people as human beings—without it, they are denied life.* Even Herr Moneybags is a human being. To attribute all of his consumption to exploitation, including his subsistence bundle, dehumanizes in a thoughtless, even a violent, way.

In the drama of twentieth-century history, this dehumanization has taken an appalling form. From Marx's analysis, propertied-class

people have been depicted as 'parasites', devoid of human qualities. This depiction has had its own inner logic. For if they are 'parasites', they are seen as things, things living off of healthy bodies, things to be eliminated. How many 'revolutionary tribunals' have reached this conclusion? By following Marx's concept of exploitation to a bitter end, revolutionary Marxists stepped far beyond an analysis of class conflict, plunging into the spiritual wasteland of class hate.

Should we look to the neoPhysiocrat rate of surplus product as an alternative basis for an analysis of exploitation? When the working class receives exactly its σP_W we may be tempted to do so. I would reject this temptation. We have been working entirely in a non-monetary model; the question of finance, and its relation to social reproduction, does not come up in this macrofoundation. (For example: is interest on debt 'exploitation'?) An analysis of exploitation, I think, cannot be established within the first macrofoundation of macroeconomics.(5)

If we adopt this view, we refrain, at least, from reducing exploitation to one simple ratio. Ironically, Marx, himself, provides some heartrending evidence against focusing too much on one ratio. In his chapter on 'The Working Day' in volume one of *Capital,* he reports on the realities of child labour in the Britain of his time. Many children were pressed into labour at an early age. Some of them lived under the most horrible conditions, were semi-starved and then were worked to death. In some cases, they died before they were twenty years of age. Can the degree of exploitation here be measured by the rate of surplus value, or surplus product, extracted? Such measures

(5) In another paper ('Marx and the Managers: The Accounting Identity for Capital') I will take another look at productivity and exploitation.

would surely understate the crime; the exploitation was far deeper. These children had their lives stolen!

I bring this section to a close. The Fundamental Marxian Theorem still has some validity; but it cannot carry all of the load Marx heaped upon it. The Fundamental neoPhysiocrat Theorem, and other considerations, bring some balance to Marx's one-sided analysis. They may even be the basis for surpassing it.

4. We return to the main line of analysis. There are some distributional topics still to be addressed. In order to complete the macrofoundation of macroeconomics derived from the sustainable-alpha concept, we now turn to inequality in distribution.

Let us recall an equation introduced earlier but not yet used

$$C^*=C_W+C_P \qquad (8).$$

This may be worked up into an alpha* formula written as a weighted average of the working-class and propertied-class alphas. Divide this expression through by subsistence consumption

$$\alpha^*=(C_W/\sigma P)+(C_P/\sigma P) \qquad (29).$$

Now multiply the first parenthetic expression by P_W over P_W and the second by P_P over P_P

$$\alpha^*=[(C_W/\sigma P_W)(P_W/P)]+[(C_P/\sigma P_P)(P_P/P)] \qquad (30).$$

$(C_W/\sigma P_W)$ is the working-class alpha and $(C_P/\sigma P_P)$ is the propertied-class alpha. (P_W/P) is the proportion of the population in the working class and (P_P/P) is the proportion of the population in the propertied class. Thus (30) may be written

$$\alpha^*=\alpha_W\eta_W+\alpha_P\eta_P \qquad (31).$$

We may use (31) to determine formulas for the maximum α_W and the maximum α_P. The maximum working-class alpha occurs when

the propertied-class alpha equals one

$$\alpha_{W\,max}=(\alpha^*-\eta_P)/\eta_W \qquad (32).$$

(As we shall see shortly, this formula is technically accurate; but it is not very relevant.) The maximum propertied-class alpha occurs when the working-class alpha equals one

$$\alpha_{P\,max}=(\alpha^*-\eta_W)/\eta_P \qquad (33).$$

Suppose alpha* equals two and ninety percent of the population is in the working class. From (32), $\alpha_{W\,max}$ equals 2.11; from (33), $\alpha_{P\,max}$ equals 11.

Suppose, instead, an alpha* value of 1.8. Earlier we saw this figure implicit in Marx's assumptions. In this case $\alpha_{P\,max}$ equals 9. Since Marx assumed the working class would only get its subsistence requirements, he implicitly assumed that (in a stationary state) the propertied class would live at nine times the standard of the working class. No wonder he predicted the overthrow of capitalism! Such a differential in living standards would seem to invite a strong reaction.

We may have recourse to a geometric representation of (31) through (33). Consider Figure 1. The propertied-class alpha is on the horizontal axis and the working-class alpha is on the vertical. The distance OA represents a propertied-class alpha of one; the distance OB shows a working-class alpha of one. These set the lower limits in social reproduction. Draw perpendiculars out of A and B; they meet at point C. A society is viable only if it can produce beyond point C (This is the Fundamental neoPhysiocrat Theorem.) Let us assume alpha* equals two. We may find a point on the horizontal axis twice the distance of OA; it is marked at point D. Draw a 45 degree line out of the origin passing through point C; and draw a perpendicular line out of point D. They meet at point E. Point E

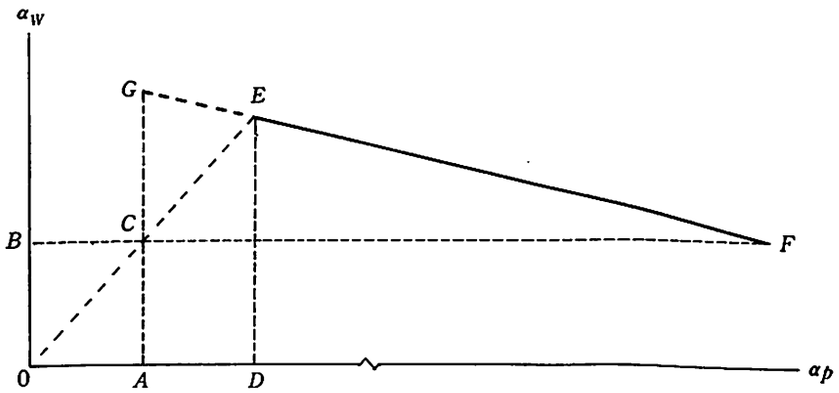

Figure 1

represents equal distribution.

A distribution curve may be constructed out of point E. When we assume that ninety percent of the population is in the working class and ten percent in the propertied class, the slope of the distribution curve will reflect their ratio. On Figure 1, the resulting distribution curve FG is constrained by the subsistence requirements. (The maximum propertied-class alpha in this case equals 11, as we saw above. In order to fit this on the diagram, I have shortened the horizontal axis.)

But not all of the distribution curve is relevant. An outstanding feature of class-based society has yet to be taken into account. Such a society can only reproduce itself when the propertied class exercises one of its decision-making privileges: when it chooses inequality in distribution, inequality in its own favour. To the left of point E the working class lives at a higher standard than the propertied class. The propertied class would fall apart in such a case.(6) So the

(6) This may be called a 'conventional-behaviour' assumption. A conventional-behaviour assumption was used in section 4 of the first paper to define the relevant range on the distribution curve is restricted to points between E and F.

5. Inequality is only one aspect of distribution. In order to get a fuller picture, we need to bring in the rate of profit.

Let us recall the first condition for the existence of profits in the corn model

$$1>a+tw \qquad (17).$$

When profits exist, a rate of profit (r) will also exist

$$1=(a+tw)(1+r) \qquad (34).$$

With some rearrangement this may be written as a rate-of-profit equation

$$r=(1-a-tw)\div(a+tw) \qquad (35).$$

In traditional analysis, this equation is used to find a curve, an efficiency curve (to use Hicks' convenient expression). The maximum rate of profit is calculated at a zero wage rate and the maximum wage rate is calculated at a zero rate of profit. Both of these calculations violate the conditions for social reproduction since they leave subsistence requirements out of account. In the sustainable-alpha framework, we can do a little better.

Multiply (35) through by $1/tw$ over $1/tw$; and recall our labour-productivity equivalence (16). Then we may write

$$r=[(\lambda/w)-1]\div[(a/tw)+1] \qquad (36).$$

When the denominator is multiplied through by $(1-a)/(1-a)$, again using (16), we arrive at

$$r=[(\lambda/w)-1]\div\{[a/(1-a)](\lambda/w)+1\} \qquad (37).$$

If we can find another expression for (λ/w) in terms of alpha*—which will restrict us to a stationary state—then we will have the

the relevant range on Figure 2 of that paper.

rate-of-profit equation we seek. We will use the following sequence

$$(\lambda/w)=[(1-a)/tw](tX/T)$$
$$=(1-a)X/wT=C^*/C_W \qquad (38).$$

The last step restricts us to a stationary state. From there we may build another sequence

$$C^*/C_W=(C^*/C')/(C_W/\sigma P)$$
$$=\alpha^*\div(C_W/\sigma P_W)/(P_W/P)$$
$$=\alpha^*/\alpha_W\eta_W \qquad (39).$$

So, in a stationary state

$$(\lambda/w)=\alpha^*/\alpha_W\eta_W \qquad (40).$$

From (37) and (40) we get

$$r=\frac{\frac{\alpha^*}{\alpha_W\eta_W}-1}{\left(\frac{a}{1-a}\cdot\frac{\alpha^*}{\alpha_W\eta_W}\right)+1} \qquad (41)$$

With this equation we may complete our analysis.

6. This equation may be evaluated at three significant points: (1) when the working-class alpha equals one, the rate of profit is at its maximum; (2) when the propertied-class alpha equals one, the rate of profit is at its absolute minimum; (3) when the working-class alpha equals alpha*, the rate of profit is at its effective minimum.

$$r_{\max}=\frac{\frac{\alpha^*}{\eta_W}-1}{\left(\frac{a}{1-a}\cdot\frac{\alpha^*}{\eta_W}\right)+1} \qquad (42)$$

$$r_{\text{absolute min}}=\frac{\frac{\alpha^*}{\alpha^*-\eta_P}-1}{\left(\frac{a}{1-a}\cdot\frac{\alpha^*}{\alpha^*-\eta_P}\right)+1} \qquad (43)$$

$$r_{\text{effective min}}=\frac{\frac{1}{\eta_W}-1}{\left(\frac{a}{1-a}\cdot\frac{1}{\eta_W}\right)+1} \qquad (44)$$

Let us look at a numerical example. In keeping with our previous examples, let us again set alpha* at two and the proportion of the population in the working class at ninety percent. In the absence of any intuition for the value of a, let us arbitrary set it at 1/4. Solving for (42)-(44) we get the following results

$$r_{\max}=70.2\%$$
$$r_{\text{absolute min}}=3.9\%$$
$$r_{\text{effective min}}=8.1\%$$

We can proceed to a diagram (Figure 2) in terms of the rate of profit and the working-class alpha. The working-class alpha is on the horizontal axis; the rate of profit is on the vertical. The distance OA represents a working-class alpha of one. The distance OB represents the rate of profit when the propertied-class alpha equals one. The distance OB will be a fraction of the distance OA for any reasonable figures we may choose. Draw perpendiculars out of

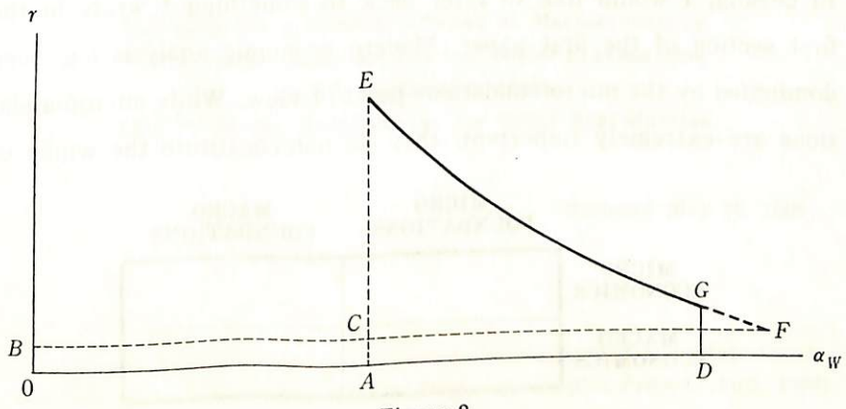

Figure 2

points *A* and *B;* they meet at point *C*. At point *C* the subsistence requirements of both classes are guarantied. From the Fundamental neoPhysiocrat Theorem, we know that the efficiency curve must appear above and to the right of point *C*. An alpha* value of two may be represented on the horizontal axis as twice the distance of *OA;* this is marked at point *D*.

The distance *AE* represents the maximum rate of profit when the working-class alpha equals one. The distance *BF* represents the maximum working-class alpha when the property-class alpha equals one. But we know, from our discussion on inequality, that point *F* is not very relevant. In order to determine the relevant range on the efficiency curve, draw a perpendicular out of point *D;* it hits the curve at point *G*. The relevant range is restricted to points on the *EG* segment of the efficiency curve.

If we know the rate of profit, we can determine the working-class alpha. If we know the working-class alpha, we can determine the rate of profit.

7. I now bring this paper, and this series of papers, to a close. In closing, I would like to refer back to something I wrote in the first section of the first paper. Modern economic analysis has been dominated by the microfoundations point of view. While microfoundations are extremely important, they do not constitute the whole of

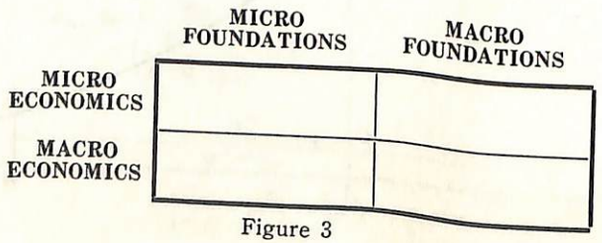

Figure 3

analysis. We will not have an adequate understanding of economics and political economy, until all four boxes of Figure 3 are filled in with content. Progress in that direction will depend upon an openness in our profession towards people serious about macrofoundations.(7) Not only openness; also, funding.

At present, microfoundations scholars often dismiss neoRicardian, Marxian and postKeynesian economists with sneers. But these schools are the main carriers of macrofoundations work; they have kept it alive. This needs to be recognized and appreciated. Unfortunately, non-orthodox economists have not done everything they could to further their own work. They have failed to sort out the macrofoundational from the microfoundational parts. Especially, when confronted by the question, 'Where are your microfoundations?' they have failed to stand up and say, 'Look, in these parts of our work, we are talking about macrofoundations!'

I am hopeful our profession will achieve its own *glasnost* and its own *perestroika*. When will we be able to provide our students with both micro and macrofoundational courses?

This ends 'On A Macrofoundation of Macroeconomics'
Part 1: Subsistence, Surplus and Social Reproduction
Part 2: Sustainable Alpha
Part 3: On the Requirements for Social Reproduction

(Recieved May 10, 1990)

(7) I would like to draw your attention to a recent book on macrofoundations: see Keizo Nagatani, *Political Macroeconomics,* (Clarendon Press-Oxford, 1989). Professor Nagatani's approach is rather different from mine.

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A MACROFOUNDATION RESTATED

Cliff Goalstone

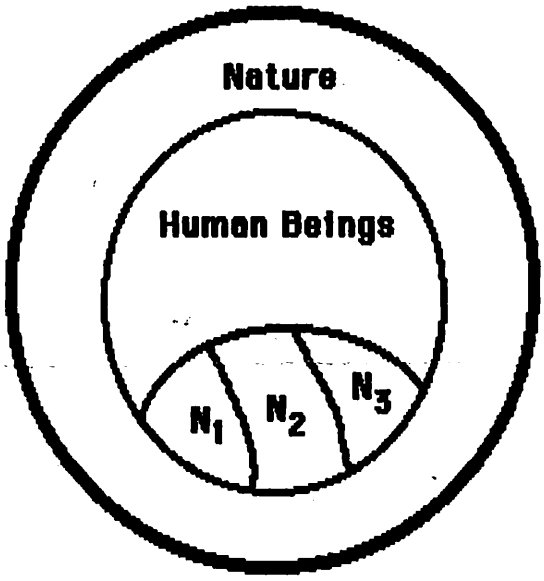

Figure 1: The neoPhysiocrat Hypothesis

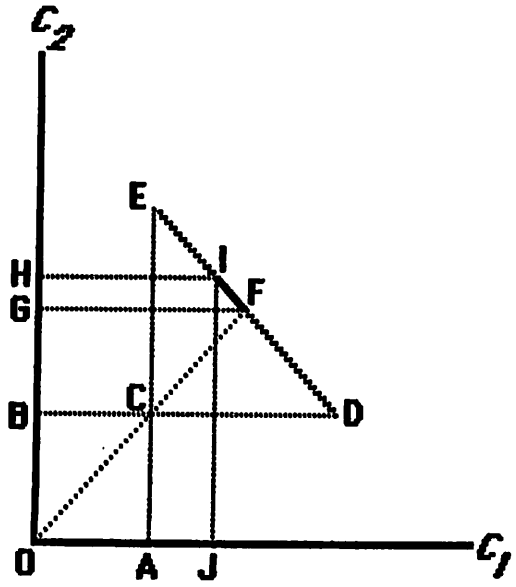

Figure 2: Fundamental neoPhysiocrat Diagram

Figure 3: Core of the Part 1 paper

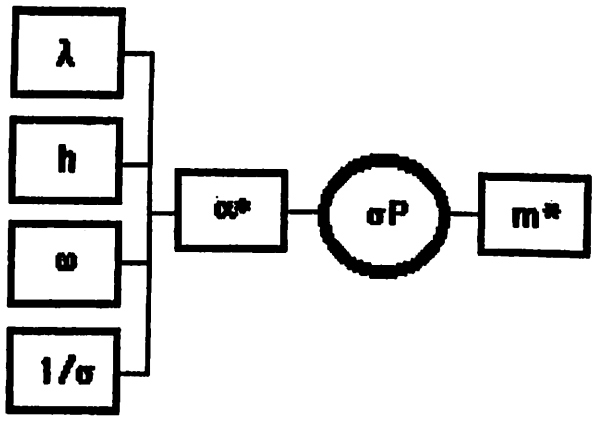

Figure 4: Core of the Part 2 paper

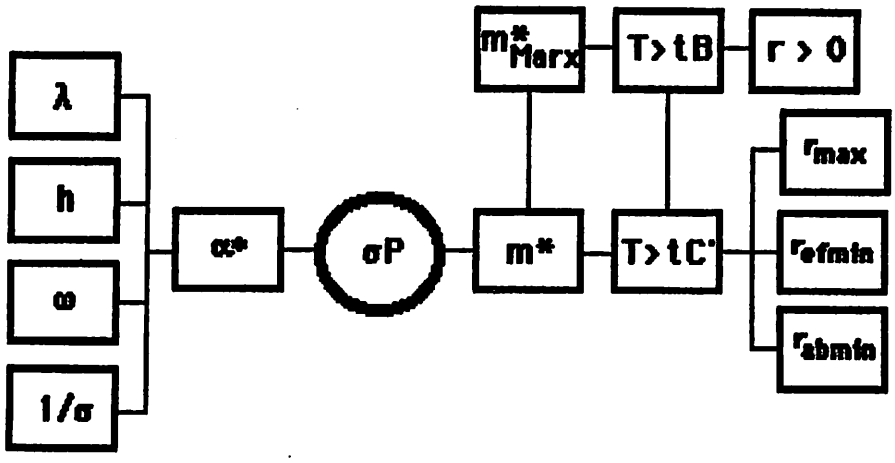

Figure 5: Core of the Part 3 paper

Figure 6: The Entry-Point of Okishian Marxism

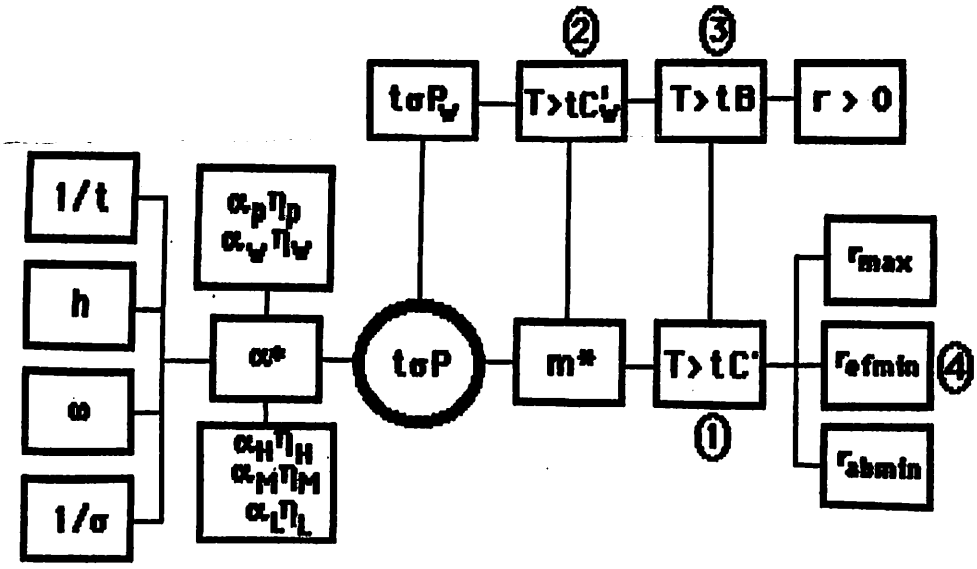

Figure 7: The Conditions of Social Existence
(1) Existence of a Society
(2) Existence of a Working-Class
(3) Existence of Profits
(4) Existence of a Propertied-Class

Potential Growth, Productivity, and Capital Accumulation

By Richard W. Kopcke*

From 1950 to 1965 the average annual growth of output per hour for nonfarm business was 2.5 percent; from 1965 to 1978 labor productivity grew only 1.5 percent per year, a decline of 1 percentage point. In manufacturing, the decline was somewhat less, .6 of a percentage point. This erosion of productivity growth suggests that the rate of expansion of potential Gross National Product (GNP) may have dropped a full percentage point in recent years — whereas potential growth was commonly believed to be almost 4 percent until the mid-1960s, many now believe it is nearer 3 percent.[1]

This article concludes that one-half of the decline in labor productivity for nonfarm business is due to a slower rate of capital accumulation. For manufacturing, slower capital formation may account for the entire drop in productivity growth.

Much of the slump in productivity and potential GNP growth resulted from a slower rate of capital accumulation. This was due, in turn, to a declining demand for capital partly caused by rising inflation since the late 1960s. From the mid-1950s to the early 1970s investment tax incentives increased the demand for capital, but rising inflation rates generally have raised business income tax burdens since then, thereby depressing the demand for capital.

New investment incentives introduced during the 1950s and the early 1960s caused the capital stock to grow much faster than employment, *temporarily* boosting the expansion of potential GNP. Since 1965, however, rising inflation has depressed investment incentives and the rate of capital accumulation, *temporarily* retarding the expansion of full-capacity GNP. This study's analysis suggests that a policy designed to insulate the demand for capital from high inflation could achieve a potential growth rate of 3.5 percent or more during the 1980s.

I. The Growth of Nonfarm Business Output

Two common methods for studying the sources of productivity and output growth use either "growth accounting" or production relationships. Growth accounting assumes that the earnings of each factor of production equals the value of its product when it is fully employed.[2] Output growth may then be attributed to labor or capital by weighing the growth in hours worked and the expansion of the capital stock by their respective earnings. For many well-known reasons, though, the earnings of labor and capital may seldom match the value of their product, even in years of "full employment," so growth accounting may poorly describe the sources of productivity growth.[3]

The other common method of studying the sources of productivity growth compares output with the employment of labor and capital services directly. This approach shares one weakness with growth accounting: it is difficult to measure the overall quantity of labor and capital services because differences in quality among people or plants are difficult to assess. According to the production relationship, current engineering knowledge determines the maximum, or potential, output per "unit" of material input that can be produced with a given stock of labor and capital. In this view, the growth of potential output is then determined by the expansion of the labor force and the capital stock as well as by the pace of technical progress that enables a given stock of labor and capital to produce more output from a given flow of material inputs. If the flow of output is compared to the use of only one factor of production — labor, for example — then its *productivity* depends not only on overall technical progress but also on the employment of the other factors of production — the more capital labor uses, the more output labor can produce. The growth of output per hour worked, therefore, depends on technical progress and the growth of the capital stock.

Using the production relationships described in the Appendix, the remainder of this section compares the growth of value-added with the employment of capital and labor to show how slower capital accumulation since the mid-1960s has depressed the growth of labor productivity. The following two sections of this study then describe how the higher income tax burdens on capital, due to higher inflation rates since the mid-1960s, have depressed capital accumulation, thereby reducing the growth of potential output.

Labor Productivity: All Nonfarm Business

From 1950 to 1965, the average annual growth of output per hour for all nonfarm business was 2.5 percent; from 1965 to 1978, however, labor productivity grew only 1.5 percent per year, a decline of 1 percentage point.[4] This

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* Assistant Vice President and Economist, Federal Reserve Bank of Boston. The author is grateful to Jarius DeWalt for his research assistance.

[1] See, for example, various issues of the *Economic Report of the President;* the issues published in 1962, 1965, and 1979, among others, provide useful comparisons. This paper is not suggesting that 1965 is *the* year when productivity fell. Analysts first noted a slower productivity growth in the late 1960s and early 1970s. Because 1965 roughly divides the postwar period in half, separating the period of high growth from the years of slower growth, and because the pace of capital accumulation began to drop after 1965, this year provides a useful benchmark for measuring the recent productivity slump. The growth of output per hour did not drop dramatically in any single year, rather it has progressively declined over many years perhaps commencing as early as 1965.

[2] In many cases, it is the marginal product which presumably equals the factor cost.

[3] First, the market value of corporate capital (essentially the prospective value of its product) seldom equals its replacement cost. In many respects, skilled labor and managers, like plant and equipment, represent an investment whose product may also seldom match its cost. Second, a growing business may hire more labor and capital than it needs to satisfy current orders if it is preparing to increase future capacity. Third, businesses often do not know in advance how much of their product they can sell at particular prices; consequently, the value of labor's product, for example, may sometimes exceed its wage, and, at other times, this product may fall short of labor's wage. Wages may not even match the average value of labor's product because risk-averse firms may hire labor only so long as the expected value of its product exceeds the wage by some protective margin. Fourth, whenever businesses or labor do not merely passively supply their products or services at market prices over which they exert no influence, the earnings of capital and labor are not determined solely by their productivity. For these reasons, among others, factor earnings reflect more than factor productivity alone.

[4] As discussed in the first footnote, 1965 only divides the years of faster productivity growth from those of slower growth. In fact, both the declining rate of capital accumulation since 1965 and the nonlinear trend for technical change in the production function indicate that productivity growth did not decline in one consummate step, it eroded slowly during the late 1960s and 1970s.

According to the estimates shown in the Appendix (equation (6)) the pace of technical progress has fallen throughout the postwar period for nonfarm, nonresidential business. The rapid accumulation of capital offset the modest decline in the growth of technical change in the 1960s, but in the 1970s slower capital accumulation coupled with a more rapid decline in the growth of technical change has severely depressed the growth of labor productivity.

drop in productivity growth supports speculation that the rate of expansion of potential GNP may have dropped a full percentage point in the last 15 years. The causes of this decline are often attributed to rising energy prices, a diminution of innovation, a changing composition of the labor force, or other "structural changes" in the economy. According to this view, we must learn to accept a slower expansion of real living standards until these (often vaguely defined) structural impediments to growth have been surmounted.

The relation between labor productivity and capital accumulation described in the Appendix tells another story, however. Of the 1 percentage point drop in the expansion of labor productivity since the mid-1960s, 50 percent, or .5 of a percentage point, is due to a slower expansion of the capital stock, and the remainder can be attributed to other, unspecified structural changes.[5] Half of the slump in productivity and potential GNP growth, therefore, can be attributed to a decline in the demand for capital rather than forces beyond the grasp of traditional macroeconomic policy.

As shown in Charts 1 and 2 (the solid lines). the capital-labor ratios for nonfarm business generally increased from 1950 to 1978, rising especially rapidly until the late 1960s. Whereas the average annual growth of the stock of equipment exceeded hours by 2.8 percentage points before 1965, the growth of equipment, on average, surpassed hours by only 2.2 percentage points thereafter. From 1973 to 1978 the annual expansion of equipment exceeded hours by only 1 percentage point. The slump is even more pronounced for structures. Before 1965 the stock of nonresidential structures grew on average 2.8 percentage points per year faster than hours worked; after 1965, however, the average annual growth of structures exceeded hours by only 1 percentage point. From 1973 to 1978 the expansion of the stock of structures has only matched the growth of hours. Altogether, then, the expansion of the capital stock surpassed the growth of hours by 2.8 percentage points before 1965, but during the 1970s the rate of capital accumulation has barely exceeded the growth of hours worked. Though postwar demographic and social changes caused the labor force to expand much more rapidly in the late 1960s and 1970s than it had previously, there has been no comparable surge in fixed investment spending for want of adequate incentives.

Labor Productivity: Manufacturing

If the slower accumulation of capital has been so detrimental for labor productivity growth, the effect should be especially important for manufacturing businesses which are generally capital intensive.

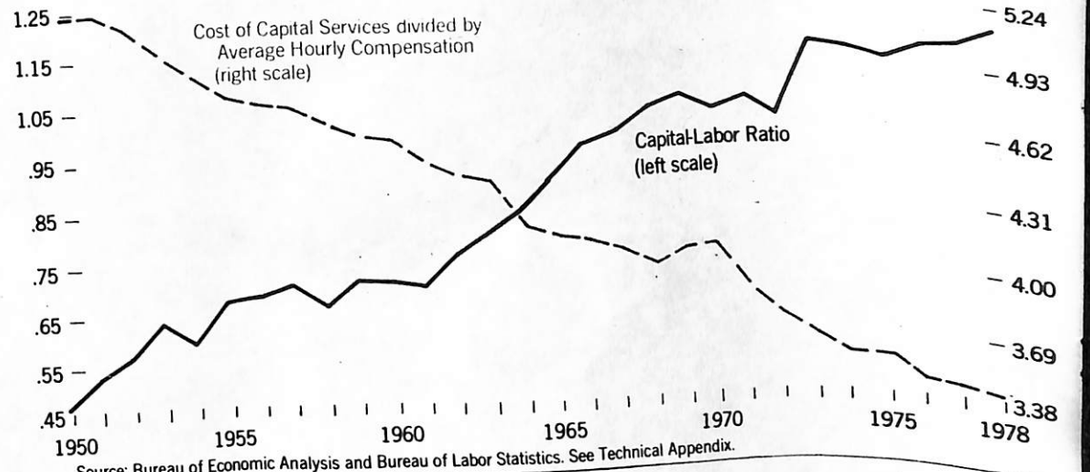
From 1950 to 1965, the average annual expansion of output per hour was 2.7 percent for manufacturing firms, but from 1965 to 1978 labor productivity grew only 2.1 percent per year, a decline of .6 of a percentage point. According to the description of labor productivity discussed in the Appendix, the slower expansion of capital since the late 1960s has depressed the growth of manufacturing productivity by .7 of percentage point. In other words, slumping investment incentives have accounted for all of the decline in manufacturing output per hour — in fact, slower capital formation may have even

[5] Some research attributes much of the change in productivity growth to a changing industrial mix that undoubtedly is included in the "unexplained residual" here. Anticipating an argument from the next section of this paper, however, just as the capital-labor ratio changes with investment incentives so may the mix of industries. The same incentives that encourage any industry to hire more labor than capital also favor the growth of labor-intensive industries.

Furthermore, research and development spending and worker training programs are natural complements to capital expansion. Thus, the same incentives that encourage capital formation also stimulate investments in people and ideas.

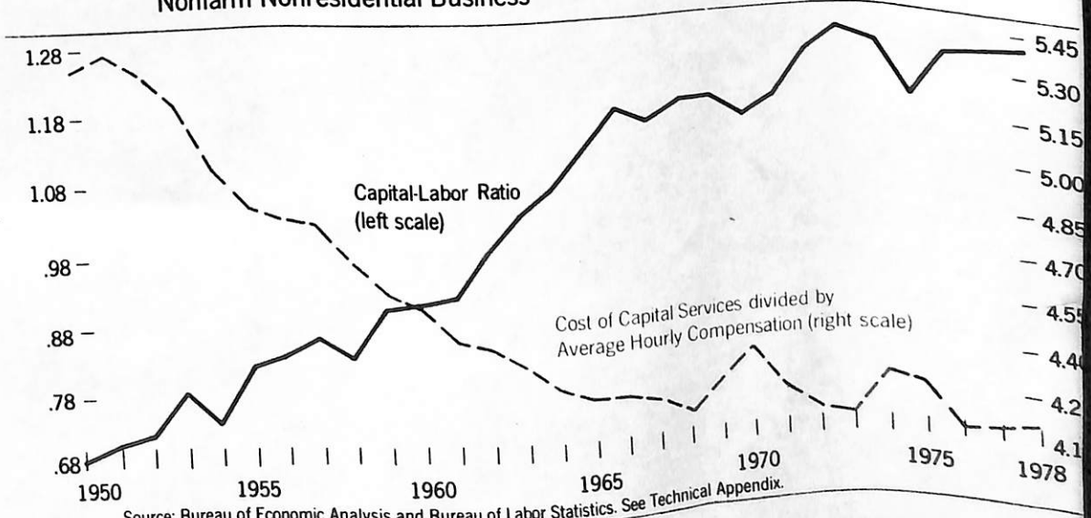
For these reasons perhaps more than half of the productivity slump can be addressed by traditional macroeconomic policies that stimulate investment spending.

Chart 1 Ratio of Equipment to Manhours and the Relative Cost of Capital — Nonfarm Nonresidential Business



Source: Bureau of Economic Analysis and Bureau of Labor Statistics. See Technical Appendix.

Chart 2 Ratio of Structures to Manhours and the Relative Cost of Capital — Nonfarm Nonresidential Business



Source: Bureau of Economic Analysis and Bureau of Labor Statistics. See Technical Appendix.

masked a small increase in productivity due to technical progress.[6]

As shown in Charts 3 and 4, the capital-labor ratios for manufacturing firms generally increased from 1950 to 1978, rising especially rapidly until the late 1960s. Throughout the postwar period, the average annual growth of the stock of equipment exceeded hours by a relatively constant 2.6 percentage points. Before 1965 the stock of nonresidential structures grew, on average, 1 percentage point faster than hours worked; after 1965, however, the average annual growth of structures only matched the growth of hours. From 1973 to 1978, the expansion of the structures was 1 percentage point less than the growth of hours.

In summary, for manufacturing the expansion of the capital stock surpassed the growth of hours by 2 percentage points before 1965, but during the 1970s the rate of capital accumulation exceeded the growth of hours worked by only 1 percentage point. This slump in manufacturing investment has reduced the average annual growth of labor productivity by .7 of a percentage point, essentially the entire drop in manufacturing productivity growth.

II. Inflation and the Cost of Capital Services

Although rising material prices may have been responsible for a considerable portion of the recent drop in potential growth, much of the slump can be attributed to the failure of the income tax codes to measure and tax business income accurately during periods of high inflation. In fact, rising energy prices may have indirectly depressed the demand for capital through the income tax codes to the extent these prices have been a cause of inflation. Economic policy may not be able to restore the relative price of energy to levels that prevailed in the 1960s, but it can measure and tax business income more realistically.

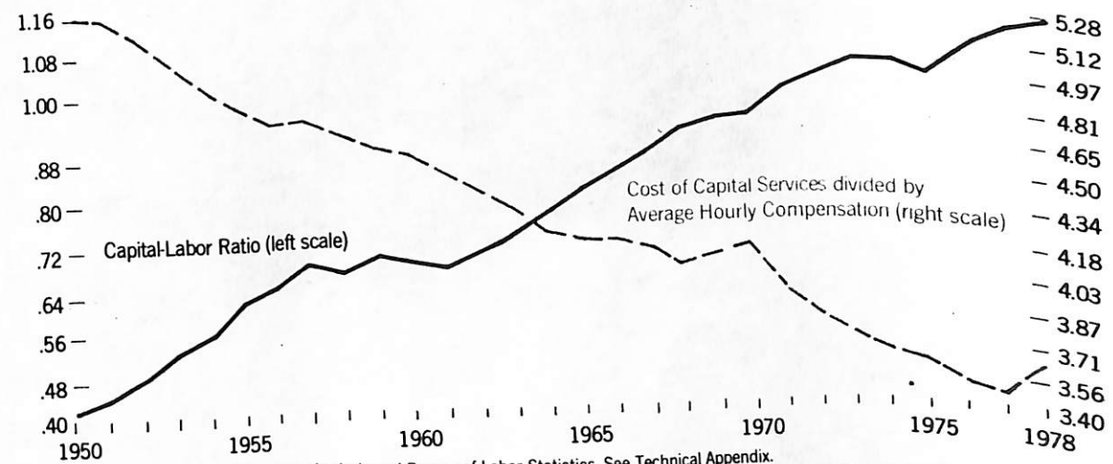
Because capital assets, plant and equipment, are consumed during production, a portion of the price paid for these assets is included in production costs throughout their "service lives." During periods of rising prices, however, the current replacement cost of plant and equipment exceeds the *original* purchase price; consequently, the value of capital assets consumed in production exceeds depreciation allowances tied to original purchase prices. Thus, business profits apparently rise when the inflation rate increases because illusory "depreciation profits" arise from the underestimate of capital consumption costs.[7]

These "depreciation profits" are taxed like any other business income so rising inflation increases the income tax burdens for business. The effective income tax rate increases most for those firms using the most capital-intensive production methods, and during periods of inflation the prospective costs of business expansions or renovations increase; the more capital-intensive the project, the more its expense rises. Rising inflation rates, therefore, increase the relative cost of capital services as long as depreciation allowances are tied to capital assets' original purchase prices. The costs of structures and other longer lived assets have risen most rapidly due to inflation. Because depreciation allowances for these assets are allocated over many

[6] According to the estimates reported in the Appendix, the pace of technical progress for manufacturing increased in each year from 1950 to 1969; since then, the growth rate of technical change has declined. This recent decline in the pace of technical progress has been sufficiently modest that the average annual growth rate of technical change since 1965 exceeded its growth before 1965.

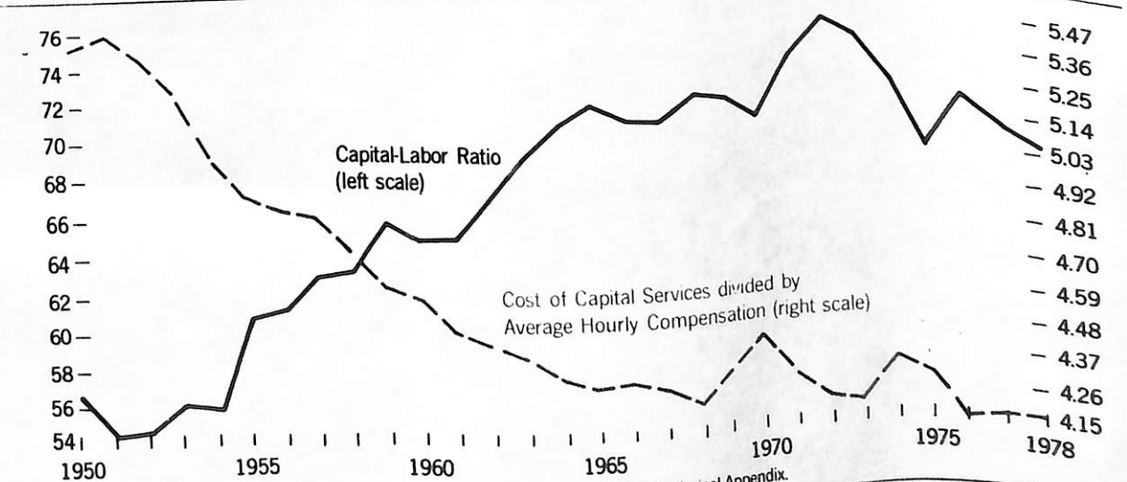
[7] "Service lives" are often dictated by statutory schedules rather than useful economic lifespans. Though the economic life of an asset may exceed its service life, rising inflation rates increase the cost of capital services nonetheless.

Chart 3 Ratio of Equipment to Manhours and the Relative Cost of Capital — Manufacturing



Source: Bureau of Economic Analysis and Bureau of Labor Statistics. See Technical Appendix.

Chart 4 Ratio of Structures to Manhours and the Relative Cost of Capital — Manufacturing



Source: Bureau of Economic Analysis and Bureau of Labor Statistics. See Technical Appendix.

years, the gap between these allowances and actual capital consumption costs can become especially large before the assets are retired.[8]

Charts 1 through 4 not only show capital-labor ratios for all domestic nonfarm business and for manufacturing firms (the solid lines), they also show the cost of capital services relative to the cost of labor services (the dashed lines). The cost of capital services for producers' durable equipment for nonfarm, nonresidential business fell 7.3 percent per year from 1950 to 1965; since then, capital costs fell only 5.7 percent per year. From 1973 to 1978, these costs declined, on average, only 4.9 percent annually. The cost of capital for nonresidential structures fell, on average, 7.5 percent per year before 1965; since then, however, these costs declined only 1.2 percent per year. The cost of capital for manufacturing behaved almost identically to that of all nonfarm business.

It is no coincidence that capital accumulation was most rapid when capital costs were declining most swiftly, from 1950 until the late 1960s, and that investment has waned recently now that these costs are no longer declining so rapidly. Furthermore, Chart 5 shows that the changing mix of business's capital assets — equipment compared with structures — closely corresponds to changes in the relative costs of these assets. From the mid-1950s to the early 1970s tax credits, accelerated depreciation, and lower corporate income tax rates increased the demand for capital, especially equipment, after 1962. Since 1973, however, rising inflation rates generally have retarded the decline in the cost of capital services, thereby depressing the demand for capital assets, especially structures.

The Cost of Capital Services

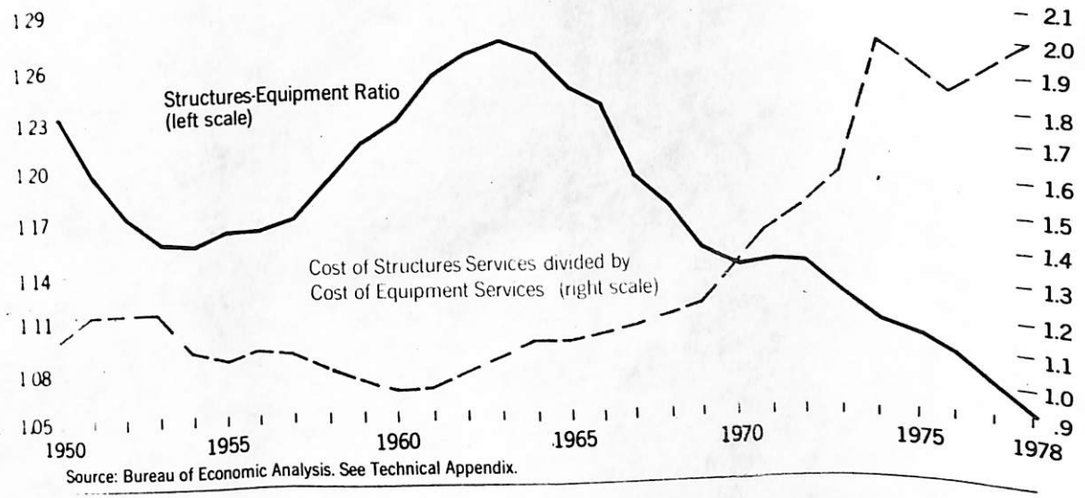
Table 1 shows how the changes in the relative cost of capital services can be allocated to the changing price of capital goods relative to labor compensation, required rates of return, and business income tax burdens. These components are not entirely independent, of course. For example, a higher tax burden will depress the demand for capital, and as a result (depending on the pricing practices in capital goods markets) the price of new capital assets may decline, perhaps offsetting much of the higher tax burden. In this event, however, even though the cost of capital rises less than its tax burden alone, the lower relative price of capital depresses the supply of new investment goods. Thus, falling market prices for equipment and structures cannot maintain capital formation when business income tax burdens are rising.

Higher tax burdens that ultimately depress capital accumulation may also increase the discount rate, especially in the short run. If the tax liability on "depreciation profits" rises sharply due to an unanticipated increase in the inflation rate and if inflation rate forecasts are received

[8] It is a common belief that businesses, as debtors, reap gains from inflation that offset the taxation of "depreciation profits." In the article cited below, I reported that business has not benefited from purchasing-power holding gains on long-term debt — purchasing-power losses on pension fund reserves have been at least as large. Yet it is important to distinguish past from prospective investments. For prospective projects, *expected* inflation erodes the real value of depreciation allowances, but *expected* inflation does not necessarily offer borrowers any holding gains on newly issued debt, partly because debt yields will include an inflation premium. High expected inflation rates, therefore, discourage investment spending, and the yet unknown errors in these inflation forecasts cannot influence the demand for new capital, even though these unknown forecast errors eventually will influence the return on these capital assets after they have been purchased and installed.

See Richard Kopcke, "Are Stocks a Bargain?," *New England Economic Review*, May/June 1979, pp. 13–15; P. J. Corcoran, "Inflation, Taxes, and the Composition of Business Investment," Federal Reserve Bank of New York *Quarterly Review*, vol. 4 no. 3 (Autumn 1979), pp. 13–34; and T.N. Tideman and D.P. Tucker, "The Tax Treatment of Business Profits Under Inflationary Conditions," in H.J. Aaron, editor, *Inflation and the Income Tax* (Washington: The Brookings Institution, 1976). Unlike "depreciation profits," "inventory profits" arise whenever goods or materials are stockpiled whether the production process is labor-intensive or capital-intensive, so the tax burden of "inventory profits" presumably does not influence the capital intensity of production.

Chart 5 Ratio of Nonresidential Structures to Equipment and the Relative Cost of Capital— Nonfarm Nonresidential Business



Source: Bureau of Economic Analysis. See Technical Appendix.

with less conviction, then investors may discount future earnings more severely, and the risk premium embedded in discount rates may rise substantially. In other words, high and variable tax rates, due to high and variable inflation rates, depress current after-tax returns to capital while tarnishing the prospects for future returns; one manifestation of such bearish sentiments is a higher discount rate as investors seek more lucrative and secure projects. Of course, inflation itself is not necessarily the only source of investor insecurity: attempts to "fight inflation" with recessions may have increased business risks while diminishing prospective rewards.[9]

According to Table 1, capital goods prices relative to labor compensation (column 1) fell fairly steadily from the early 1950s to 1978: the relative price of equipment declined, on average, 5.6 percent per year while the price of structures fell 4.7 percent. While these falling relative prices contributed to the rapid decline in the cost of capital services until the late 1960s, they surely cannot explain the more moderate decline in capital costs since then. The explanation lies elsewhere.

Estimates of the contribution of income tax liabilities to the user cost of capital are shown in the third column. For equipment, investment tax credits, accelerated depreciation, and lower corporate income tax rates generally reduced the tax burden from the early 1950s to the mid-1960s. In 1954 a revised income tax code first permitted businesses to use accelerated depreciation allowances — sum-of-the-years'-digits and double declining-balance schedules — in place of straight-line and 150 percent declining-

[9] Because the empirical estimates of the discount rate rely heavily on stock prices, the figures appearing in the second column of the table probably reflect these sentiments about inflation, real returns, and growth in recent years.

Table 1
Decomposition of the Relative Cost of Capital Services for Nonfarm Business

	A. Producers' Durable Equipment			B. Nonresidential Structures			
	Relative Price of Equipment[1]	Required Yield[2]	Corporation Income Tax Burden[3]		Relative Price of Structures[1]	Required Yield[2]	Corporation Income Tax Burden[3]
1950	100	.26	.66	1950	100	.16	.71
1951	93	.25	.73	1951	97	.15	.81
1952	87	.25	.73	1952	92	.15	.81
1953	82	.25	.69	1953	87	.15	.76
1954	80	.24	.65	1954	81	.14	.70
1955	77	.23	.64	1955	78	.13	.69
1956	75	.23	.61	1956	78	.13	.67
1957	73	.23	.62	1957	74	.13	.67
1958	71	.23	.62	1958	69	.13	.67
1959	68	.22	.62	1959	65	.12	.68
1960	65	.22	.62	1960	61	.12	.67
1961	62	.22	.61	1961	58	.12	.67
1962	60	.22	.57	1962	56	.12	.64
1963	57	.22	.54	1963	54	.12	.64
1964	54	.22	.51	1964	51	.12	.64
1965	52	.22	.51	1965	50	.12	.62
1966	49	.22	.53	1966	48	.12	.63
1967	46	.22	.54	1967	46	.12	.65
1968	43	.22	.54	1968	44	.12	.66
1969	40	.22	.62	1969	42	.12	.74
1970	37	.23	.66	1970	41	.13	.80
1971	34	.22	.59	1971	39	.12	.77
1972	32	.22	.56	1972	38	.12	.75
1973	29	.22	.56	1973	36	.12	.75
1974	26	.23	.55	1974	36	.13	.78
1975	25	.23	.57	1975	34	.13	.82
1976	23	.23	.58	1976	30	.13	.82
1977	22	.23	.59	1977	28	.14	.84
1978	20	.24	.60	1978	27	.14	.85

NOTES:
[1] The relative prices are the relevant capital goods deflator divided by the compensation of labor (index, 1950 = 100).
[2] The required yield is the relevant depreciation rate (.05 for structures, .15 for equipment) plus the sum of the dividend-price ratio on equity and a constant growth rate, .04.
[3] The corporate tax burden is defined in detail in the Technical Appendix. It represents the value of tax credits and depreciation allowance to businesses buying capital goods. When the values in this column decline, the tax law effectively offers business a greater "discount" or "rebate" for purchasing capital assets.

balance schedules. In 1962, the service lives of producers' durable equipment were generally reduced 30 or 40 percent, and equipment first became eligible for a 7 percent investment tax credit. The maximum corporate income tax rate was also reduced from 52 percent in the early 1950s to 50 percent in 1964 and 48 percent in 1965. By 1965 the contribution of income tax liabilities to the cost of capital services was 15 percent lower than it was in the mid-1950s.

Although equipment service lives were reduced another 20 percent in 1971 and the investment tax credit was raised to 10 percent in 1975, inflation has generally raised the tax burden on equipment since the late 1960s. In 1978 the contribution of income tax liabilities to capital costs was almost as high as it was in the mid-1950s.

Because nonresidential structures were generally ineligible for investment tax credits, the tabulated tax burden decreased less for these assets than it did for equipment from the 1950s to the 1960s.[10] Moreover, after 1969 structures were no longer eligible for accelerated depreciation allowances, so the rising inflation of the late 1960s and 1970s has pushed the tax burden on structures to new postwar peaks. In 1978 the contribution of income tax liabilities to the user cost of capital for structures was more than 30 percent higher than in the 1950s and early 1960s. Because the figures in the third column essentially use an average of past inflation rates in lieu of management forecasts, it is conceivable that recent tax burdens may even exceed the numbers shown in the table.

Summary

These estimates of the income tax burden on capital show that tax incentives generally encouraged capital formation, especially for equipment, until the end of the 1960s. These tax incentives, coupled with declining relative capital goods prices and falling discount rates, encouraged a rapid expansion of the capital stock. During the 1970s, however, rising inflation reduced business's after-tax return on investment, and frequent recessions made investors more cautious; consequently, the user cost of capital fell less rapidly after 1973 and the rate of growth of the capital stock declined. If higher rates of inflation had not raised the income tax burden on plant and equipment after 1965, the cost of capital services would have declined more than one-third during the last 13 years. Accordingly, the rapid expansion of the capital stock would have been encouraged, not arrested.

[10] Structures that do qualify for investment tax credits are typically owned by businesses in regulated industries, such as utilities. Regulatory commissions often take these tax incentives into account when allowing rate increases so that the after-tax rate of return on investment may not increase despite a more generous tax credit. In fact, some utilities use "flow through" accounting that passes these credits (and the benefits of accelerated depreciation allowances) on to the rate payers.

III. Potential Growth

If the relative cost of capital services were constant, potential output would expand as fast as the growth of hours plus technical change would permit. In this case, the estimates described in the Appendix suggest that "potential" growth for nonfarm business was 3 percent throughout the postwar period. From 1950 to 1965 hours worked increased 1.2 percent per year while the estimated annual technical change was 1.7 percent; after 1965, however, hours increased 1.8 percent per year, while annual technical change was only 1.2 percent.

The actual average annual expansion of nonfarm, nonresidential business output exceeded 3.6 percent from 1950 to 1965, more than .5 of a percentage point higher than the "potential" growth rate defined above. Because the relative cost of capital services fell substantially during this period, the ensuing aggressive investment in plant and equipment enabled production to expand faster than hours and technical change alone would have allowed. Since 1965, the more moderate accumulation of capital and other impediments to productivity growth, allowed nonfarm business product to grow, on average, only 3.2 percent per year. More recently, persistently high rates of inflation may have depressed this growth rate still further, to 3 percent or less.

The relative decline in the user cost of capital during the 1950s and 1960s helped push potential growth as high as 4 percent because capital services increased much faster than hours. Declining relative prices, discount rates, and tax liabilities all contributed to the lower capital costs that were responsible for the more rapid accumulation of capital that, in turn, could have boosted potential growth by .3 or .4 of a percentage point.[11]

Since the mid-1960s, however, income tax policy among other impediments to productivity growth allowed the potential growth rate of GNP to slump as low as 3 percent. During the 1970s rising inflation rates retarded the decline in the relative cost of capital services. Not only has inflation increased business tax burdens (the third column of Table 1), but it may have been the primary cause of the rising discount rates (the second column of Table 1). In any case, if the tax burdens had maintained the levels prevailing in the mid-1960s, the average annual growth of the capital stock could have been increased 1.6 percentage points from 1965 to 1978, and annual potential output growth could have been approximately .4 of a percentage point higher (see footnote 11).

[11] From 1950 to 1965, the tax burden on structures declined .9 percent annually while the burden on equipment fell 1.7 percent annually. From 1965 to 1978 the tax burden rose 2.3 percent and 1.3 percent respectively for structures and equipment. These figures imply that the weighted cost of capital services (the weights for structures and equipment are .33 and .67) before 1965 fell approximately 1.4 percent annually faster than it would have otherwise, and, afterward, capital costs rose approximately 1.6 percent faster than otherwise. The potential annual growth of the capital stock, therefore, was increased 1.4 percentage points before 1965 and was depressed 1.6 percentage points afterward. The actual growth of the capital stock may not have fulfilled its potential due to response lags and bottlenecks. In any case, the estimated production functions imply that a 1 percentage point increase in the growth of capital adds approximately .26 of a percentage point to the growth of potential output; consequently, the declining tax burden on capital may have added .3 or .4 of a percentage point to "normal" potential growth before 1965, and the rising tax burden may have subtracted .4 of a percentage point from "normal" potential growth afterward.

IV. Conclusion

Accelerated depreciation allowances, reduced corporate income tax rates and investment tax credits all combined to raise the demand for business capital from the mid-1950s to the mid-1960s, *temporarily* adding as much as .3 or .4 of a percentage point to the annual growth of potential output. Substantially higher inflation rates since then generally have reduced the demand for capital more than enough to offset the benefits of these tax incentives. This erosion of investment incentives not only rescinded the additional growth potential before the economy could fully exploit it but also *temporarily* reduced potential growth another .3 or .4 of a percentage point. So far, this reversal of incentives for investment spending has reduced the growth of output approximately .5 of a percentage point since 1965.

Although rising material prices may have been responsible for a considerable portion of the recent drop in potential growth, much of the slump can be attributed to the failure of the income tax codes to measure and tax business income accurately during periods of high inflation. In fact, rising energy prices may have indirectly depressed the demand for capital through the income tax codes to the extent these prices have been a cause of inflation. Economic policy may not be able to restore the relative price of energy to levels that prevailed in the 1960s, but it can measure and tax business income more realistically. If tax reforms had insulated the cost of capital services from today's high inflation rate, current estimates of potential GNP growth could have been as high as 3.5 percent. Of course, if the necessary tax reforms eventually are adopted or if the inflation rate falls dramatically, the ensuing rapid decline in capital costs would, once more, encourage rapid capital accumulation and *temporarily* lift the potential growth rate as high as 4 percent.

Measuring Productivity

GNP is a measure of the quantity of final goods and services produced by domestic businesses. From the GNP accounts, the product of a firm, by definition, is its value-added — the value that the firm *adds* to raw materials and intermediate goods as it transforms these inputs into output. Thus, the product of an automobile manufacturer is the quantity of autos manufactured by the firm less the quantity of steel, rubber, glass, oil, and other materials from which the autos are fabricated. This value-added is distributed among the factors of production that combine to produce GNP.

Value-added is the appropriate measure of product because it eliminates the "double-counting" associated with a gross output measure of production. For example, when a steel mill sells its product to an auto manufacturer, the value of this steel is counted in gross output. If the value of this steel were not then deducted from the output of the auto manufacturer, the product of the steel mill's labor and capital would be counted twice: once when the steel is sold to the auto company, and again when the steel embodied in the automobile is sold to the consumer. If, instead, the steel were produced by the auto manufacturer for itself, no such "double-counting" would occur, and gross output would be lower even though the total production of steel and automobiles had not changed. Therefore, value-added is the appropriate measure of the nation's product because gross output would overstate production, and changes in gross output would not necessarily reflect changes in total national product.

Accounting identities require that factor product must equal factor income. Because value-added is the difference between gross output and material input, it comprises the returns earned by the factors of production: part is paid to landowners as rent, part is paid to laborers and managers as wages and salaries, and the remainder is paid to those who own or finance inventories, machines and buildings — capital assets — as profits and interest.[1] Hence, GNP, or factor product, equals the compensation of labor, the returns to capital and the earnings of rentiers, factor income.

Some believe that energy is a factor of production, like labor and capital, because they believe energy prices influence the level of output and the productivity of labor and capital. A rising relative price of energy, according to this view, reduces business willingness to "employ" energy, thereby reducing the growth of potential value-added that a "unit" of labor and capital can produce because these factors of production have less energy with which to cooperate. Accordingly, much of the recent productivity slump may be attributed to rising energy prices.

[1] Though land is a factor of production, a lack of official, reliable estimates of the value of domestic land resources precludes its consideration here. Some useful, unofficial estimates are available, but they tend to tie the value of land mechanically to the value of structures. If these procedures are valid, then the consideration of structures alone entails little loss of generality because this component, structures, is essentially an index for total real estate.

Inventories are not a "factor" of production like equipment and structures. The efficient use of labor and capital often entails the creation of inventory stocks — goods in process, materials in warehouses, and final products depots — but, for the most part, inventories cannot technically substitute for machine tools or engineers in producing value-added. To the extent, however, that *innovations* in communications or data processing have enabled business to reduce inventory without depressing value-added, the production function in the technical Appendix underestimates technical progress.

Energy, however, is *not* a factor of production; it is a produced material input like iron ore, water, or wood. This does not imply that the growth of output and labor productivity are insulated from energy price changes, however. Material prices may have a considerable influence on GNP growth, but this influence does not arise from any material's role as a factor of production for GNP.

As defined in U.S. National Income and Product Accounts, GNP equals the compensation of labor, the return to capital, and the earnings of rentiers. The "returns to gasoline" are not part of national product or income; in fact, gasoline is itself produced by labor and capital and, as such, the contribution of labor and capital to gasoline is part of value-added. If gasoline and other material inputs, nevertheless, were considered factors of production, then business payments to these "factors" would have to be included both in income and output; otherwise, the accounting identity requiring that factor product equals factor income would be violated. In other words, if analysts insist that energy or other materials are factors of production, then for logical consistency they must no longer measure output by value-added; they must use gross output — the total value of the automobile, the steel, and the iron ore at each sale.

Yet, gross output, for reasons described above, is a questionable measure of output. Because of its "double-counting," not only does gross output overstate production, but changes in gross output do not necessarily represent changes in final output. Furthermore, defining product as gross output rather than value-added in order to introduce energy and other materials as factors of production creates unacceptable anomalies that violate the notion of "productivity." For example, if technical progress causes labor and capital to become more-efficient, so that they require less material input to produce the same value-added, the "productivity" of labor and capital would fall because gross output (value-added plus material input) would decline while these factor services do not. Ironically, then, because labor and capital become more efficient, the gross output measure of their "productivity" declines.[2] Therefore, this study, like the National Accounts, defines product as value-added and does not include energy and other material inputs among the factors of production.[3]

Because energy is not a factor of production for GNP, the quantity of gasoline used in a given production technique does not necessarily change the *potential* value-added labor *technically* can produce with each unit of material input any more than the quantity of iron ore, water, or wood consumed can change *potential* labor productivity. Value-added is the product of capital and labor as they transform gasoline and other materials into finished products. While a slower growth of gasoline supply (or any other material input) reduces *actual* output growth because labor and capital have less material input to transform into output, the growth of productivity for employed factors of production depends only on technological progress and factor prices.

[2] This problem is not rectified by defining product as value-added plus energy input only, instead of total gross product. If technical change allows labor and capital to produce the same value-added with less energy, once again measured factor productivity declines: the use of energy declines, so total "product" falls while labor and capital services do not.

[3] Robert Solow (in "Resources and Economic Growth," *American Economist*, vol. 22 (Fall 1978), pp. 5–11) reviews recent evidence to examine the effect of resource supplies on economic growth using a gross output production relationship. He reports that "nonrenewable resources have not been an 'important' input" so that "past economic growth would not have gained very much from cheaper or more abundant access to nonrenewable resources, nor lost very much from the opposite."

Although gasoline is not a factor of production for GNP, the price of gasoline and other material inputs can influence the growth of potential output and productivity. First, in the long run, the relative price of gasoline, iron ore, water, or wood can influence the choice of production technique or the pace of technical change. For example, one set of relative raw material prices may warrant the choice of a capital-biased technique to consume less of a relatively expensive material that is either produced by or used by labor: for a given ratio of labor compensation to the cost of capital services this technology warrants the hiring of more capital than labor. Another set of relative material prices may justify a labor-biased technique to consume less of a relatively expensive material that is either produced by or used by capital: for the same ratio of compensation to capital costs this second technology warrants the hiring of less capital than labor.[4] Accordingly, if relative material prices change, two coexisting technologies may temporarily determine value-added — one for established capital and laborers, another for new entrants.

Rising material prices may also encourage technical innovations that enable businesses to produce more value-added per unit of material input by employing more capital and labor. In this case, the rate of technical change and growth of the value-added produced by labor could rise. If domestic material prices rise, however, because resources become more difficult to extract from the earth, the pace of technical progress would decline.

The relative price of materials may also influence potential output and productivity by changing the relative costs of factors of production. For example, rising gasoline and heating oil prices will increase the cost of employing labor: not only will wages tend to increase but the expense of heating and cooling work spaces will rise. In a similar manner, rising material prices will increase the cost of buying and operating machinery. Rising energy prices could also raise the cost of using capital to the extent they are a cause of the currently high rate of inflation that has reduced the value of depreciation allowances for prospective investors. Businesses consider relative factor costs when choosing the mix of capital and labor they wish to employ. Therefore, even though material prices may not have changed production technology, rising material prices, for example, could raise the relative cost of capital, thereby depressing the growth of the capital stock, potential output, and labor productivity.

For these reasons, capital accumulation alone does not account for the entire productivity slump for nonfarm, nonresidential business. Rising energy prices, among other influences, have reduced the pace of technical progress recently. Furthermore, to the extent that a slower expansion of plant and equipment relative to hours worked does "explain" the productivity slump, rising energy prices are not necessarily absolved, for they may be responsible for lower capital-labor ratios.

This article, like many other studies, pre-

[4] In the context of a Cobb-Douglas production function, $\log(Q) = \alpha \log(H) + (1-\alpha)\log(K) + \log(\text{technology})$, changing resource prices may warrant the choice of a technique with a high value of α. Higher resource prices may also alter the pace of technical change and may warrant the substitution of, say, labor for capital by raising the relative cost of capital services.

sumes that changing material prices during the past three decades have not altered the *technical ability* to substitute capital for labor.[5] Unlike these other studies, however, this study does not assume that energy like labor and capital is a factor of production for GNP; rather, changes in the capital-labor ratio and, thereby, labor productivity are due entirely to changes in the cost of labor services relative to the cost of employing capital.[6]

[5] In other words, the α in footnote 4 has not changed. See the fitted equation in the technical Appendix. A future study will relax this assumption.

[6] Should relative energy prices rise, firms are *technically* able to produce the same value-added per unit of material input and factor input. Price incentives, however, may encourage technical innovations allowing more value-added per unit of material input by employing more factors of production, consequently, value-added per unit of factor input may either rise or fall. To the extent changes in energy prices have altered the course of technical progress, the estimated relationship in the technical appendix can detect changing trends. In any case, the technical ability to substitute labor for capital is not altered (α in footnote 4 is constant), so the capital intensity of production will not change unless relative factor costs change. Though this assumption is not unimpeachable (it will be relaxed in a future study), assuming that energy is a factor of production is no remedy. Energy prices may appear in the production function, but energy itself is not a factor of production. (Business regulation, according to common doctrine, influences productivity growth; yet no one has suggested that the "quantity of regulation" is a factor of production.) See the discussion of the production function in the Appendix.

Technical Appendix

The Data

The stock of equipment and nonresidential structures, E and S, are the net constant dollar estimates provided by the Department of Commerce, less pollution abatement capital and the capital of nonprofit business, multiplied by the Federal Reserve manufacturing capacity utilization rate, UCAP. UCAP is useful in this study because firms alter the length of the workweek for their plant and equipment (and labor) as they temporarily adjust production schedules to accommodate cyclical movements in demand.

The propriety of using UCAP in this manner is questionable to some analysts. UCAP is derived from the experience of manufacturing industries only, so its application to all nonfarm, nonresidential business introduces some error. More fundamentally, some believe that capacity utilization should not be a part of capital input measurement for any industry. Because I am using a production function, however, the role of UCAP is important. When demand for autos declines, the auto industry furloughs some laborers and reduces the workweek for others, and all analysts agree that we should consider only the actual number of hours worked, not the potential number of hours that the auto-workers could supply, in measuring productivity. In a sense, we consider the capacity utilization rate of the work force. Similarly, when capital is furloughed or operated at less than full capacity, consistency requires that we also consider the capacity utilization rate of plant and equipment in measuring productivity. If not, then if low demand caused auto firms to produce 75 percent of the autos that they now produce by furloughing 25 percent of their work force and "closing" 25 percent of their plants, we would erroneously believe that the capital labor ratio had risen by 25 percent in the auto industry. We would also erroneously believe that factor productivity had fallen because we would have overstated the capital services used by the auto industry. In fact, the productivity of employed factors has not changed at all.

Some labor and capital may be idle when the demand for output is depressed, but *potential* labor productivity or the actual productivity of employed labor depends on the willingness of business to employ capital relative to labor. Accordingly, the problem of fully employing both labor and capital resources may be considered separately from the problem of raising the employment of capital relative to labor. Although business cycles may temporarily influence measured labor productivity, the productivity growth for employed labor ultimately depends on investment incentives and the demand for capital services relative to labor services whatever the capacity utilization rate, whatever the demand for output.

Hours worked are the Bureau of Labor Statistics data; they are not adjusted for age, sex, or education. (See footnote 3 and the discussion of factor share equations under *Estimation of the Production Function*, below.)

Measures of output, prices and compensation are also published by the Department of Commerce and the Bureau of Labor Statistics. For nonfarm business, output does not include the value of housing services.

The cost of capital services, from Hall and Jorgenson, for example, equals

$$P_k/w \cdot (\delta + \rho) \cdot (1 - ITC - t\,Dep)$$

where P_k/w is the price of capital relative to the compensation of labor

δ is the depreciation rate of capital

ρ is the discount rate

ITC is the investment tax credit

t is the statutory corporate income tax rate

Dep is the present value of depreciation allowances.

The three factors above correspond to the three columns of Table 1. The familiar divisor $(1 - t)$ that usually appears in the third factor is omitted because corporate income taxes apply equally to the profits of labor or capital in production.

The discount rate in Table 1, column 2, equals the Standard and Poor's dividend-price ratio plus 4 percentage points. The 4 percentage points represent expected real growth of domestic business. The depreciation rate for equipment is 15 percent and for structures it is 5 percent. In column 3, the tax lifetime for equipment declines from 17.5 to 10.5 years over the postwar period, while for structures it drops from 28 to 23 years. The schedule of depreciation allowances for equipment and structures shifts from straight-line to sum-of-the-years' digits in 1954; and from 1966:4 to 1967:1 and from 1969:3 to the present the schedule of depreciation allowances for structures is 150 percent declining-balance. The discount rate for depreciation allowances equals 2 percent plus the average inflation rate for the previous five years.

ITC is the investment tax credit: zero before 1962; in 1962:1, .03 and increases by constant steps to equal .055 in 1963:3; constant at .055 until 1966:4; zero from 1966:4 to 1967:1; .055 from 1967:2 to 1969:1; zero from 1969:2 to 1971:1; .04 in 1971:2; .05 in 1971:3; .055 from 1971:4 to 1974:4; finally, .087 for 1974 and later.

The Production Function

The production function, or technical relationship defining the maximum net output, or value-added, that a given amount of capital and labor can produce, is translogarithmic:

$$\begin{aligned}(1)\ \ln(Q/H) = {} & \alpha_0 + \alpha_e \ln(E/H) + \alpha_s \ln(S/H) \\ & + \beta_{ee}\ln(E)^2 + \beta_{es}\ln(E)\ln(S) + \beta_{eh}\ln(E)\ln(H) \\ & + \beta_{es}\ln(E)\ln(S) + \beta_{ss}\ln(S)^2 + \beta_{sh}\ln(S)\ln(H) \\ & + \beta_{eh}\ln(E)\ln(H) + \beta_{sh}\ln(S)\ln(H) + \beta_{hh}\ln(H)^2 \\ & + \alpha(T),\end{aligned}$$

E: the stock of producers' durable equipment;

H: hours;

Q: value-added;

S: the stock of nonresidential structures;

$\alpha(T)$: productivity and technical change.

where: $\beta_{eh} = -\beta_{ee}-\beta_{es}$

$\beta_{sh} = -\beta_{es}-\beta_{ss}$

$\beta_{hh} = +\beta_{ee}+2\beta_{es}+\beta_{ss}$

The function, as defined above, has constant returns to scale, and the last term is intended to represent Hicks-neutral technical change and secular variations in total factor productivity.

Developing the argument of the text, energy is not a factor of production, it is a material input. First, according to the national accounts, the "returns to energy" are not a component of national income or value-added. Second, let Q denote value-added (output) and K, H, and E denote possible factor inputs; $Q = F(K, H, E)$. The optimal mix of "factors," given prevailing prices, is denoted K^*, H^*, E^*; thus, $Q^* = F(K^*, H^*, E^*)$ is the solution to the profit maximization problem:

$$\max P\,F(K, H, E) - rK - wH,$$

where P, r, and w are the price of output (value-added), the cost of capital services, and the wage rate.

In this context, if a rising relative price of energy warrants reducing E^* and increasing H^*, for example, then for this adjustment to not reduce profits "$\partial F/\partial E^*$" must be negative — the "marginal product of energy" is negative. If P (the price of *value-added*), r, and w do not change, the firm could earn the same profits after the cost of energy rises as it had before, if it does not alter its employment of K, H, and E. If the "marginal product of energy" is positive, then reducing energy "employment" to favor greater employment of labor reduces profits; therefore, the swapping of energy for either K or H is efficient only if energy's "marginal product" is negative.

If rising energy prices on the other hand, alter r/w or initiate macroeconomic policy which alters P/w, then a new mix of K and H is optimal. In time, changing material prices can also alter the course of technical change to permit a conservation of energy resources; the term $\alpha(T)$, therefore, should be able to represent changing secular trends in total factor productivity. These price incentives may encourage technical progress that allows more value-added per unit of input by employing more factors of production; consequently, it is not clear whether the reduction of energy consumption should raise or lower the rate of productivity growth.

(Though the quantity of energy, among other materials, does not belong in a production function defining value-added as the product of capital and labor, the price of these material inputs may appear. Equation (1), for example, could have expressed the αs and the βs as functions of the price of iron ore, wood, energy, etc. This step is deferred, however.)

A "production function" including energy should include other materials, and, in this context, the "output" should not be value-added but gross product, and products become both "outputs" and "inputs." This gross output "production function" must be interpreted with caution, however. If labor and capital become more efficient so that these factors require less material input to produce the same value-added, the gross output "productivity" of labor and capital would fall because gross output (value-added plus material input) would decline while factor services do not.

If the value-added production function embodies constant returns to scale in labor and capital, then value-added per unit of material input is $Q/M = F(K/M, H/M)$ and the gross output "production function" is $GQ = (Q/M + 1)M = (F(K/M, H/M) + 1)M = G(K, H, M)$. The "production function" G also exhibits constant returns to scale. A translogarithmic gross output "production function" for K, H, and M embodying constant returns to scale, however, implies that the value-added production function exhibits decreasing returns to scale in labor and capital. Such a function also implies that value-added is increased by altering the flow of material inputs even though the use of labor and capital services does not change and no technological innovations have occurred. These conclusions suggest that care must be taken when specifying gross output "production functions"; they are not necessarily simply analogous to the more familiar value-added production functions.

Estimation of the Production Function

Using a Bayesian technique, the parameters of the production function are estimated from postwar data, 1950:1 to 1978:4. The stochastic representation of (1) is:

$$\begin{aligned}(2)\ \ln(Q/H) = {} & \alpha_0 + \alpha_e \ln(E/H) + \alpha_s \ln(S/H) \\ & + \beta_{ee}(\ln(E)^2 + \ln(H)^2 - 2\ln(E)\ln(H)) \\ & + \beta_{es}(\ln(H)^2 + \ln(E)\ln(S) - \ln(H)\ln(E) \\ & \quad -\ln(H)\ln(S))2 \\ & + \beta_{eh}(\ln(S)^2 + \ln(H)^2 - 2\ln(S)\ln(H)) \\ & + \alpha_1(T) + \alpha_2(T)^2 + \alpha_3(T)^3 X + \epsilon,\end{aligned}$$

where T = 1 in 1950:1, . . . , 116 in 1978:4.

$$(3)\ \underline{y} = X\underline{\gamma} + \underline{\epsilon} \quad \epsilon_t = \rho\epsilon_{t-1} + \upsilon_t \quad \upsilon_t \sim N(0, \sigma^2),$$

where $\underline{y}$ is a vector of n observations on ln(Q/H), X is a matrix comprised of observations on the right-hand-side variables of (2), and $\underline{\gamma}$ contains the parameters of the production function. The errors, ϵ_t, may be represented by a first-order Markov process driven by a normal random variable, υ.

Rather than estimate the more common share equations, the production function is estimated directly. The share equations impose strong assumptions about the pricing policy of business, and, having imposed these assumptions, these share equations suffer from "simultaneous equations problems" at least as severe as the production function itself. For example, a rise in business tax rates will depress capital's share of after-tax value-added, ceteris paribus, while it raises the marginal user cost of capital. In response to this tax increase, the demand for capital will tend to fall and capital's share will tend to recover. The common share equations cannot describe this process: both observed factor shares and factor stocks are endogenous variables, and the share equations do not consistently represent any behavioral or technological relationships, unless one assumes: (a) firms are price takers, (b) average factor shares adjust "immediately" to equal required or marginal factor shares, and (c) firms are almost always on their production frontiers. Of course, if these assumptions obtain, the factor share equations should be expressed with the shares on the righthand side.

For well-known reasons dictated by the theory of contracts, the theories of decision-making under uncertainty (factors will be paid less than their marginal product by risk averse firms), intertemporal production planning, oligopoly/oligopsony behavior, the distortions of possible discrimination, etc, firms may seldom pay factors of production a return which corresponds to their prevailing marginal product, and firms may seldom be on their "efficient" production frontier. Furthermore disequilibrium conditions — for example, the market value of corporate capital seldom equals its replacement value — may also cause the "list prices" used in estimating factor returns to be misleading indicators of factor productivity. As suggested by Hall and Jorgenson, even if one is willing to accept competitive market theory, factor demands are functions of prevailing and of past marginal user costs. In any case the share equations succumb to at least as many statistical problems as does the production function itself, yet fitting the production function has the considerable attribute of being more direct.

The prior distribution for $\underline{\gamma}$ is normal with mean g_1 and precision matrix (inverse of the variance matrix) N_1. The conditional posterior distribution for $\underline{\gamma}$ is defined by the following statistics for each of ten discrete values for ρ ($\rho = .1i$, $i = 0, \ldots, 9$):

$$(4)\quad \text{let } R = \begin{bmatrix} \sqrt{1-\rho^2} & 0 & 0 & \ldots & 0 \\ -\rho & 1 & 0 & \ldots & 0 \\ 0 & -\rho & 1 & & 0 \\ & & & \ddots & \vdots \\ 0 & 0 & 0 & \ldots & 1 \end{bmatrix}$$

then $N_2 = (X^tR^tRX/\hat{\sigma}^2 + N_1)$

$\underline{g}_2 = N_2^{-1}(X^tR^tR\underline{y}/\hat{\sigma}^2 + N_1\underline{g}_1)$,

where $\hat{\sigma}^2$ is the mean squared residual from the normal projection of $R\underline{y}$ onto RX.

For a given value of ρ, then, the posterior is conditional on both ρ and $\hat{\sigma}^2$ [Zellner, pp. 70 ff. and p. 243], and our beliefs about $\underline{\gamma}$ are normally distributed with mean $\underline{g}_2$ and precision N_2.

The marginal posterior distribution for ρ is proportional to [Zellner, Chapter X.]:

$$(5)\ |\hat{\sigma}|^{-n}|N_2|^{.5}\exp[-.5(\underline{y}^tR^tR\underline{y}/\hat{\sigma}^2 - \underline{g}_2^tN_2\underline{g}_2)]f_1(\rho),$$

where $f_1(\rho)$ is the prior distribution for ρ. Therefore the "unconditional" posterior distribution for $\underline{\gamma}$ is a weighted sum of the normal distributions defined in (4), the weight for each distribution is proportional to the quantity defined by (5).

The posterior distribution, therefore, combines both prior beliefs and data information. The prior probability for each of the ten values of ρ equals .1. Because the data evidence overwhelmingly favors $\rho = 0.9$, Table A1 shows the prior distribution for $\underline{\gamma}$ and the posterior distribution given that $\rho = 0.9$.

According to the prior mean, the rate of Hicks-neutral technical change is 2 percent per year, and while the matrix of cross elasticities, β, is zero, the elasticity of output per hour with respect to both equipment and structures (α_e and α_s) is 15 percent.

The prior's convariances among the coefficients of (3) are zero, except for that between α_e and α_s and those among β_{ee}, β_{es}, and β_{ss}. The variances and covariances for these two groups of parameters were selected according to the following method. First a preliminary variance matrix for each of the sets of coefficients, (α_e, α_s, α_h) and (β_{ee}, β_{es}, β_{eh}, β_{ss}, β_{sh}, β_{hh}), is chosen. The sum of α_e, α_s and α_h is "known" to be unity, and the three restrictions shown in (1) are "known" to constrain the coefficients β. Denoting the set of coefficients, $\underline{\alpha}$ or $\underline{\beta}$, by $\underline{\delta}$, its preliminary variances by Σ, and the restriction on $\underline{\delta}$ by $R\underline{\delta} = \underline{c}$, then [Anderson, pp. 27–30]

$$\mathrm{Var}(\underline{\delta}\,|\,R\underline{\delta}=\underline{c}) = \Sigma - (R\Sigma)^t(R\Sigma R^t)^{-1}(R\Sigma).$$

In this manner the variance matrices for each of the two sets of coefficients have the appropriate singularities. The initial variances for (α_e, α_s, α_h) were (.0033, .0033, .0066) and for (β_{ee}, β_{es}, β_{eh}, β_{ss}, β_{sh}, β_{hh}) the initial variances were (.00097, .00019, .00019, .00097, .00019, .00097). The correlation coefficient among β_{ee}, β_{ss}, β_{hh} is .8 and the correlation coefficient between β_{eh} and β_{sh} is .5. The appropriate prior variances and covariances shown in Table A1 were taken from these constructed variance matrices.

The posterior mean for $\underline{\gamma}$ shown in Table A1 provides an estimate of the coefficients of (1):

(6) nonfarm business:

$$\begin{aligned}\ln(Q/H) = {} & 1.41 + .132\ln(E/H) + .139\ln(S/H) \\ & - 2.89\text{E-}3\ln(E)^2 + 5.61\text{E-}4\ln(E)\ln(S) \\ & + 2.33\text{E-}3\ln(E)\ln(H) \\ & + 5.61\text{E-}4\ln(E)\ln(S) - 2.81\text{E-}3\ln(S)^2 \\ & + 2.25\text{E-}3\ln(S)\ln(H) \\ & + 2.33\text{E-}3\ln(E)\ln(H) + 2.25\text{E-}3\ln(S)\ln(H) \\ & - 4.58\text{E-}3\ln(H)^2 \\ & + 4.46\text{E-}3\,T - 1.06\text{E-}6\,T^2 - 4.99\text{E-}8\,T^3\end{aligned}$$

(7) manufacturing:

$$\ln(Q/H) = -1.87 + .243\ln(E/H) + .300\ln(S/$$

Table A1
The Prior Mean, the Maximum-Likelihood Point and Posterior Mean for $\rho = 0.9$[1]

	Prior	Maximum-Likelihood[2]	Posterior
Nonfarm Business			
α_0	0.0 (1.00 E+3)	1.42 (3.08 E-1)	1.41 (4.26 E-2)
α_1	5.00 E-3 (1.52 E-3)	3.59 E-3 (3.48 E-3)	4.46 E-3 (1.22 E-3)
α_2	0.0 (5.00 E-5)	6.02 E-6 (6.91 E-5)	-1.06 E-6 (2.73 E-5)
α_3	0.0 (5.00 E-6)	3.14 E-8 (4.05 E-7)	-4.99 E-8 (1.81 E-7)
α_e	1.50 (5.00 E-2)	-1.19 (1.28)	1.32 E-1 (4.65 E-2)
α_s	1.50 E-1 (5.00 E-2)	1.18 (1.47)	1.39 E-1 (4.64 E-2)
β_{ee}	0.0 (1.67 E-2)	-4.60 (3.07)	-2.89 E-3 (1.63 E-2)
β_{es}	0.0 (1.08 E-2)	4.28 (2.88)	5.61 E-4 (1.07 E-2)
β_{ss}	0.0 (1.67 E-2)	-3.92 (2.72)	-2.81 E-3 (1.62 E-2)
Manufacturing			
α_0	0.0 (1.00 E+3)	3.04 E-1 (1.59 E-1)	-1.87 E-1 (2.88 E-2)
α_1	5.00 E-3 (1.52 E-3)	9.67 E-6 (2.35 E-3)	3.80 E-3 (1.02 E-3)
α_2	0.0 (5.00 E-5)	2.70 E-5 (3.64 E-5)	8.30 E-6 (2.09 E-5)
α_3	0.0 (5.00 E-6)	2.26 E-7 (2.23 E-7)	-3.51 E-8 (1.25 E-7)
α_e	1.50 E-1 (5.00 E-2)	-2.98 E-1 (2.77 E-1)	2.43 E-1 (4.46 E-2)
α_s	1.50 E-1 (5.00 E-2)	2.55 (9.75 E-1)	3.00 E-1 (4.55 E-2)
β_{ee}	0.0 (1.67 E-2)	-1.29 (5.30 E-1)	-9.08 E-3 (1.66 E-2)
β_{es}	0.0 (1.08 E-2)	5.98 E-1 (6.28 E-1)	2.67 E-3 (1.08 E-2)
β_{ss}	0.0 (1.67 E-2)	1.72 (1.69)	-1.07 E-2 (1.66 E-2)

NOTES:
[1] The figures in parentheses are standard deviations and standard errors.
[2] These statistics are approximate because $X'R^{-1}RX$ is "nearly singular."

$$- 9.08\text{E-}3\ \ln(E)^2 + 2.67\text{E-}3\ \ln(E)\ln(S) + 6.41\text{E-}3\ \ln(E)\ln(H)$$

$$+ 2.67\text{E-}3\ \ln(E)\ln(S) - 1.07\text{E-}2\ \ln(S)^2 + 8.03\text{E-}3\ \ln(S)\ln(H)$$

$$+ 6.41\text{E-}3\ \ln(E)\ln(H) + 8.03\text{E-}3\ \ln(S)\ln(H) - 1.44\text{E-}2\ \ln(H)^2$$

$$+ 3.80\text{E-}3\ T + 8.30\text{E-}6\ T^2 - 3.51\text{E-}8\ T^3.$$

Charts A1 and A2 show the observed values for ln(Q/H), the maximum likelihood estimates of ln(Q/H), as well as the estimates derived from equations (6) and (7). Even though the posterior mean and the maximum likelihood point estimate may differ considerably for several coefficients, because the data evidence is not tightly concentrated upon the maximum likelihood point the estimates of ln(Q/H) for both the maximum likelihood point and the posterior mean closely conform to the postwar pattern of output per hour for nonfarm business. The posterior mean, in a sense, shows the degree to which the data evidence can accommodate prior beliefs about the likely signs and magnitudes of the equation's coefficients. In this case, the data evidence can embrace many "reasonable" sets of estimates though the maximum likelihood point itself is rather "unacceptable."

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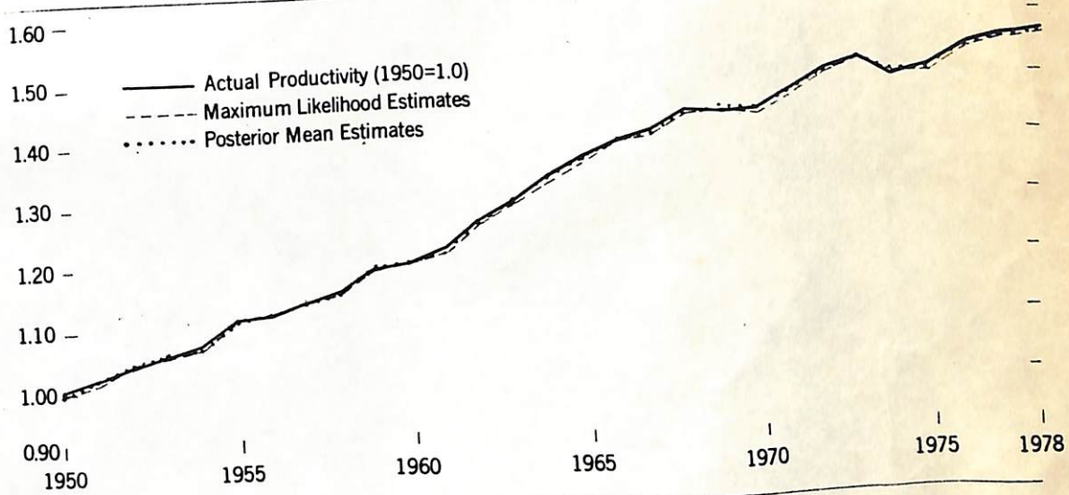
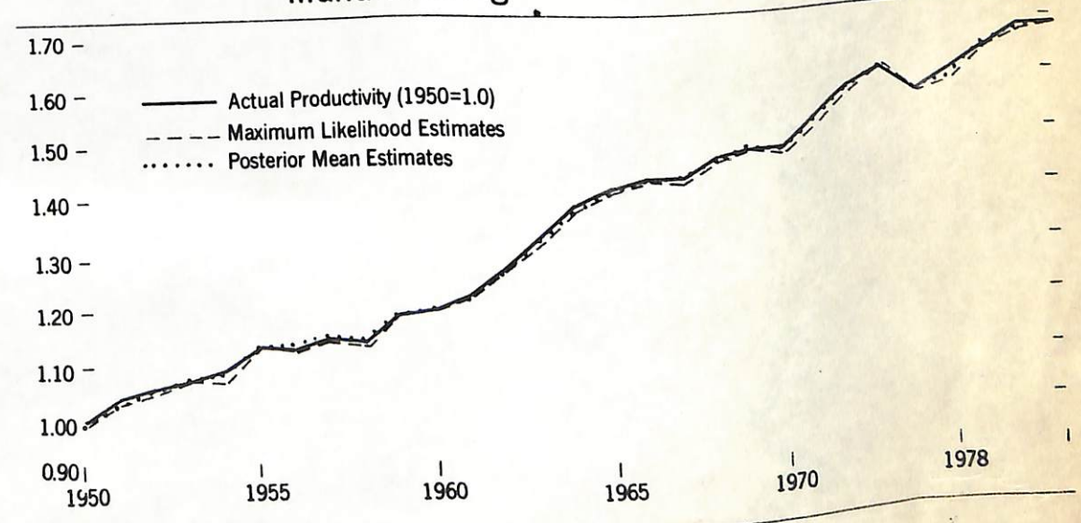
Appendix Chart 1 **Output Per Manhour: Actual and Estimated - Nonfarm Nonresidential Business**



Appendix Chart 2 **Output per Manhour: Actual and Estimated - Manufacturing**



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SHALL I COMPARE THEE TO A MINKOWSKI-RICARDO-LEONTIEF-METZLER MATRIX OF THE MOSAK-HICKS TYPE?

Or, Rhetoric, Mathematics, and the Nature of Neoclassical Economic Theory

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"They have indeavor'd, to separate the knowledge of Nature, from the colours of Rhetorick. . . ."

Thomas Sprat, *History of the Royal Society*

"The greatest thing by far is to have a command of metaphor."

Aristotle, *Poetics*

I. EASY RIDER

Is rhetoric just a new and trendy way to *épater les bourgeois*? Unfortunately, I think that the newfound interest of some economists in rhetoric, and particularly Donald McCloskey in his new book and subsequent

I would like to thank Arjo Klamer, Roy Weintraub, and Ken Dennis for their comments, as well as Warren Samuels, Daniel Hausman, and Bruce Caldwell for rescuing me from some errors. Undoubtedly, they all still believe I resist from being rescued from all error. I would also like to acknowledge the editors of the *Journal of Economic Literature* for demonstrating that the bounds of polite philosophical discourse are located at the perimeters of the defense of neoclassical theory. I am also aware that it is gauche to explain literary allusions, but I fear that the average economist has become so ignorant of the history of his discipline, and therefore claims to understand only the most literal of phrases, that I would direct those seeking the inner meaning of the title to consult Samuelson (1966 p. 1499). This paper was revised in August 1986 and then in September 1986.

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responses to critics (McCloskey, 1985a, 1985b), gives that impression. After economists have worked so hard for the past five decades to learn their sums, differential calculus, real analysis, and topology, it is a fair bet that one could easily hector them about their woeful ignorance of the conjugation of Latin verbs or Aristotle's Six Elements of Tragedy.[1] Moreover, it has certainly become an academic cliché that economists write as gracefully and felicitously as a hundred monkeys chained to broken typewriters. The fact that economists still trot out Keynes's prose in their defense is itself an index of the inarticulate desperation of an inarticulate profession.

There is nothing new in all of this: the average economist knows it in his or her bones. Hence the exasperation which must greet a passage such as that found in McCloskey (1985a, p. 29): "the overlapping conversations provide the standards. It is a market argument. There is no need for philosophical lawmaking or methodological regulation to keep the economy of the intellect running just fine." Isn't this just what the average neoclassical economist believed anyway? So what else is new?

I would like to argue that there is more to rhetoric than that. There is something in McCloskey's original 1983 *Journal of Economic Literature* article which touched a nerve, but is in danger of getting smothered amid all of the small-r rhetoric. McCloskey's "rhetoric" can only be fully understood in its dual historical contexts: the older context of the decline of classical rhetoric, and the more modern context of the ongoing methodological defense of neoclassical economic theory. Examination of these trends will lead us directly to a prosaic discussion of mathematical expression as a species of metaphor, and its dominant influence upon the rise of neoclassical theory. In a visceral way, "rhetoric" is often invidiously contrasted with mathematical expression among neoclassicals; this conviction is the most important clue in understanding the nature of neoclassical economic theory. Meditation upon this sequence of events shall redouble our curiosity concerning the philosophical implications of rhetorical analysis in the penultimate section of this paper.

II. WAR OF THE WORLDS

Don McCloskey has asserted that the canons of rhetoric provide a suitable set of concepts for understanding how arguments among economists fail or succeed. On a superficial reading, he appears to be concerned solely with "style." To be sure, this is one connotation of the term "rhetoric": It is *l'art de bien dire*, defined as the correct and agreeable

[1] For the curious, they are Plot, Character, Diction, Thought, Spectacle, and Song in Aristotle (1961, p. 62).

demeanor of address in conformity with the rules of communication in a civilized society. But there is another connotation of rhetoric, one which is also relevant: This is the art of persuasion. In a civilized society, it should be possible to change another person's mind without force or coercion. Hence rhetoric is also a form of a theory of social order, a prototype of morality, statecraft, and of philosophy itself. As the great philosopher himself said, "The perfection of style is to be clear without being mean" (Aristotle, 1961, p. 101).

Classical rhetoric was one of the pillars of education in the fifteenth through seventeenth centuries, the others being grammar and logic. Rhetoricians sought to instruct the student in the techniques of the arts of persuasion, beginning with drills in Greek and Latin and continuing on to translations of the ancient masters, such as Aristotle, Cicero, and Quintilian. Advanced exercises included practice in declamation and disputation, and instruction in the tropes appropriate to the three duties of the orator, which were to instruct, to please, and to move.

This situation began to change in the seventeenth century, when rhetoric came under severe attack by the partisans of the new sciences. In France, for instance, the primary antagonists of the rhetoricians were recruits from the Cartesian camp, who insisted that the conviction of certainty arose from introspective knowledge, mathematical expression, and the reduction of all the epiphenomena of the world to a few simple rules of matter in motion. Malebranche, for one, feared that audiences were too frequently swayed by what he termed nonrational considerations, and he denounced the appeal by rhetors to the senses, the imagination, and the passions (France, 1965, pp. 19 et seq.). The archetypical complaint of the new scientists was that the rhetor engaged in an irrelevant display of verbal or literary pyrotechnics; he aimed more to provoke applause and admiration than to get on with the real business of analysis and tutelage. Some critics went so far as to insist that all embellishment got in the way of communication, whereas others suspected that rhetorical refinements served to convince people against their wills. The Cartesian antidote to all of this puffery was immersion in the bracing environment of austere mathematics and rational mechanics. As Descartes wrote to Mersenne in 1629, "Order is what is needed: All the thoughts that can come into the human mind must be arranged in an order like the natural order of numbers." A goodly dose of that purgative would reveal a truth which was self-evident and independent of the authority and eloquence of others.

We are all aware that the Cartesian idea of a natural science has had its instrumental and tactical successes, and as a consequence it has displaced rhetoric. The rise of the modern university further encouraged a tendency toward professionalization more attune to the Cartesian ideal (Pyenson, 1983). One salient aspect of the process was the

cultivation of an arcane jargon in each little department, both for purposes of differentiation and to prevent the intrusion of outsiders. The *lingua franca* of the natural sciences became mathematics, and its influence became apparent in every discipline which pined for the status and legitimacy of the Cartesian natural sciences. Eventually, a mathematical and self-consciously scientistic style became conflated with the ideal of legitimate suasion, a format McCloskey calls "modernism," but given its genealogy, is more aptly called "the Cartesian Vice."

There now exist quite a few competent descriptions of the Cartesian Vice (Tiles, 1984; Rorty, 1979). In simple terms, for the Cartesian, the only reasoning is formal reasoning and the only thought is conscious thought. Reasoning is formal when knowledge of the subject matter is deemed irrelevant to the principles of formal demonstration, and therefore irrelevant in any acknowledgment of the validity of an argument. Indeed, it is claimed that the formal principles of reason are embodied in mathematics alone, a computational scheme which could ideally be programmed into an automaton which could then settle all disputes "objectively." Moreover, the Cartesian tradition is hostile to the idea that the social process of argumentation and persuasion should have any bearing upon rational knowledge, since only the individual mind can convince itself; it is also hostile to the idea that there is an inextricable social component to the growth of knowledge, suspicious of appeals to historical authority, and suspicious of the slippery connotations of words in the vernacular. In short, it is hostile to rhetoric. Assent of an audience of rational individuals is only to be expected upon the demonstration of the impersonal and self-evident truth of the mathematical syllogism (Gaukroger, 1980).

The irony of McCloskey's article on the rhetoric of economics was that he opted to champion the vanquished foe of Cartesianism as the best methodological defense of the social science most addicted to the Cartesian Vice, neoclassical economic theory. The neoclassical school of economics had only recently adopted all the trappings of the Cartesian world view – mathematical formalism, axiomatization, derogation of literary narrative, and mimesis of natural science terminology and attitudes – but had also endowed their mannequin of rational economic man with exclusively Cartesian powers and abilities: transparent individual self-knowledge, mechanical algorithms of decision-making, independence from all historical determination, and all social action ultimately explained by rational individual assent. In fact, one could easily make the argument (although I shall decline to do so here because of the necessity of the citation of much historical evidence) that in neoclassical economics ontogeny recapitulated epistemology, in the sense that the prior Cartesian conception of science dictated the model of man, and not vice versa (cf. Mirowski, 1985a, 1987, forthcoming). Suddenly, along

came McCloskey, insisting that neoclassical economists had been too long caught in the thrall of the Cartesian Vice. Irony was piled upon irony when he further asserted that addiction to the Cartesian Vice was nonlethal. If only economists would acknowledge that the persuasiveness of their arguments hinged upon rhetorical considerations, they would discover that orthodox theories now in the ascendant would be preserved, if not actually strengthened.

McCloskey's crusade could not help but sound dissonant and appear self-contradictory. One common reaction was to view it as just another installment in the continuing decline of the West, the dissolution and squandering of our rational heritage. Another common reaction was the American Admonition: If it ain't broke, don't fix it. Both reactions were really beside the point, although they did stoke the swirling fires of controversy. What was missing from the controversy was an appreciation of the historical determinants of this seemingly iconoclastic crusade.

Since the 1930s, neoclassical economic theory has increasingly allied itself with the natural sciences – or more exactly, an image of physics (a claim documented below) – in the process of inquiry, imitating both style and substance. Examination of neoclassical manifestos, from Robbins' *Essay* to Koopmans' *Three Essays*, from Friedman's *Essays* to Blaug's *Methodology*, reveals an escalation in the appeal to scientific legitimacy through citation of the practices which purportedly constitute the core of the scientific method, be they prediction, falsificationism, axiomatization, or the use of mathematical formalism. In deference to the Cartesian Vice, these practices were portrayed as self-sufficient abstract methods independent of any examination of what physicists actually did, or how they did it.

It was precisely this oblivion when it came to the actual practices of scientists which set neoclassical economics up for a fall in the 1970s. Physics itself had been going through a period of turmoil, trying to assimilate the dual disturbing implications of quantum mechanics and the proliferation of subatomic particles. The increasing politicization of science had fostered the growth of political movements skeptical of the claims of scientists (Krimsky, 1982). These first two trends led to a third, the revolution in the philosophy of science and the explosion of science studies in previously neglected areas such as the history and sociology of science. Everyone who was not intellectually moribund in the 1970s had at least heard of Thomas Kuhn's *Structure of Scientific Revolutions*; and many who were not professional philosophers took to reading the works of Paul Feyerabend, Steven Toulmin, Imre Lakatos, David Bloor, and others. It was the combined project of these and other authors to explode the myth of a single scientific method by means of detailed historical investigations into the origins and development of specific scientific theories.

In this context the neoclassical appeals to *the* scientific method appeared anachronistic and almost naively quaint (McCloskey, 1985a, p. 12). Testimonials of faith in the faultless rudder of falsificationism ran smack into the Duhem/Quine thesis, which states that every test is so inextricably imbedded in auxiliary hypotheses that rational adjustment of some subset can reverse the verdict of any adverse test (Harding, 1976). Proponents of austere axiomatic formalism were chastened by Gödel's Theorem and Wittgensteinian puzzles of interpretation (cf. Mirowski, 1986). Prophets of prediction were humbled by the appearance of ARIMA models as statistics with little or no *a priori* theory. And, to add insult to injury, physicists began to undermine some of the neoclassical economists' most cherished tenets of faith, such as the supposed impossibility of a free lunch. By the 1980s, some cosmologists were claiming that the entire universe was itself a free lunch, nothing more than a vacuum fluctuation.[2]

Eternal verities were crumbling; the barbarians were at the gates. From this one should not infer that most economists heard the rumblings from their posts on the barricades or even had their ear to the ground. Nevertheless, the rumblings on the frontier were just beginning to be audible to a few, however indistinct and jumbled, and neoclassical economists felt their force as part of the continuous lay litany that economists are charlatans and economics is not a science. Earlier defenses of neoclassical economics based on the progressively discredited conceptions of science were rendered ineffectual.

The genius of McCloskey's 1983 manifesto was that it promised an escape from this impasse. McCloskey's advocacy of a rhetorical defense was an exhortation to abjure all reliance upon "science" or the "scientific method." In criticizing scientism – what he called "modernism" and Hayek (1979, p. 24) called the "slavish imitation of the method and language of science" – he made use of many of the philosophical theses of Kuhn, Feyerabend, and Rorty on the radical underdetermination of scientific theories by data, the absence of a neutral observation language, and the importance of "external" considerations for the acceptance or rejection of scientific theories. Many historians of science – most notably, those associated with the Edinburgh school – had interpreted those external conditions as mediated by sociological forces, but McCloskey introduced his own innovation here, substituting classical rhetoric for sociological or anthropological theories. As he later admitted in the book-length version of his work, "The project here is to overturn the monopolistic authority of science in economics by questioning the usefulness of the demarcation of science from art" (McCloskey, 1985a, p.

2. I mean this literally, not figuratively. See Guth (1983, p. 215): "I have often heard it said that there is no such thing as a free lunch. It now appears possible that the universe is a free lunch."

57). The bottom line was that, while neoclassical economists were not the most artful of souls (or artful of dodgers?), they did manage to improve the tenor of their conversations over time: Hence, basically, I'm OK and you're OK.

This solution to the problem of the methodological justification of neoclassical economics was not destined to please everyone. Of course, some will cling to their outdated scientism, blind to both rhetoric and science.[3] Others will pronounce a plague on all methodological houses as long as their own career meets the market test – i.e., they get paid for doing economics. The remainder who do detect some valuable insights in McCloskey's work, however, will eventually find their curiosity frustrated and stymied by some deep contradictions inherent in his overall program. The first, already alluded to, is the painful incongruity of the assertion that a Cartesian model of economic man can be justified with an anti-Cartesian paradigm. This argument displays an antisymmetry which could easily be used against it: If people in general are neoclassical optimizers, and if economists are people, then should not economists also maximize over a set of personal objectives which might be contrary to the pursuit of open and honest conversations?[4] In other words, classical rhetoric embodies a specific theory of social order. Should not theory be consistent and congruent with the theory of social order in the theory it was intended to defend?

Second, there is an extreme incompatibility between the ideal of rhetoric as the study of all the various techniques of persuasion and McCloskey's own study of the rhetoric of particular arguments in economics. In one place, he insists that economics itself is "a historical rather than a predictive science" (McCloskey, 1985a, p. xix); yet elsewhere in the same volume he insists that the rhetorical analysis of economists' arguments, as well as the content of the arguments themselves, are necessarily ahistorical (McCloskey, 1985a, pp. 64–65, 93). The problem with this position is that rhetoric, by most accounts, is intrinsi-

3. A good example of the argument *"après moi, le deluge"* may be found in Hahn (1986, especially p. 834): "But the theory which Arrow and his coevals and successors have built is all that we now have of honest and powerful thinking on the subject. It is doubtful that politicians and intellectual speculators can act and speak sensibly without its help." It is also doubtful they can derive any guidance for action with its help, he neglects to add.

4. McCloskey (1985a, p. 126) admits this possibility, but does not seem to realize the extent to which it could cripple his entire thesis:

> ". . . the Announcement, the more bold, unargued and authoritarian the better, is the favored form of scholarly communication. . . . One wonders why unargued cases are accepted more readily than argued ones, even among professional arguers. . . . "

Others have already noticed the possible symmetry between the neoclassical theory of social behavior and a neoclassical theory of the behavior of scientists. See, for instance, Garner (1979).

cally and essentially an hermeneutic and historical form of inquiry; whereas it is neoclassical economics which is generally conceded to be an ahistorical explanation of social activity. Some of the very best examples of rhetorical analysis of economic arguments, such as Klamer (1983), are by their very nature historical inquiries: investigations into the "external" determinants of theory rejection or acceptance beyond the acknowledged arguments to be found in the economic literature.

I believe that McCloskey understood that the implicit theory of social order in classical rhetoric is diametrically opposed to the atemporal existence of the neoclassical *homo economicus*, and therefore a full rhetorical analysis would be congenitally critical of neoclassical economic theory. Of course, this would never do for his purposes, so in order to restrain and repress this tendency, McCloskey tried to restrict his definition of rhetoric to an atemporal consideration of the style of argumentation of economists independent of all historical context. Thus, in his chapter on the impact of Robert Fogel upon the discipline of economic history, he arbitrarily quarantines any discussion of the historical fact that Fogel and his cliometrics movement were the vanguard of the penetration of neoclassical economics into a stronghold of institutionalists, historicists, and other disgruntled types united by their distaste for the atemporal character of neoclassical economics. In his chapter on John Muth and rational expectations theory, he neglects entirely the running controversy over whether Keynesian economics was (or could be) consistent with the premises of neoclassical theory, as well as the relevant psychological literature which had suggested that the process of learning could not be adequately captured by neoclassical theory. It is not at all inconceivable that what starts out as a rhetorical immunization of neoclassical theory could rapidly become a poison pill, if all the directions on the label were followed. Perhaps this explains some of the disdain which greeted the appearance of McCloskey's original article.

I should like to take very seriously McCloskey's primary thesis – that "the scientific method" is inadequate to explain how economists choose to advocate the theories that they do – but to maintain that his subsidiary hypotheses are false. I would like to suggest some amendments to his manifesto:

i. Rhetorical analysis can provide valuable insights, but only when it is diachronic as well as synchronic;
ii. The style of economic arguments cannot be adequately understood independent of their content or context; and
iii. Rhetorical analysis is connately critical and will never constitute a satisfactory defense of neoclassical economic theory.

I am aware that the spirit of these assertions runs counter to contemporary deconstructionist credos in literary theory, but then, what would

you expect, coming from an economist? If economists, with their "pig philosophy" as Carlyle called it, do not insist on the existence of a world outside of the text, then who will?

Rather than shuffle a deck of methodological fiats and slap them down on the table one by one, it may be more edifying and instructive to focus attention on just one of McCloskey's rhetorical claims: that "mathematical theorizing in economics is metaphorical, and literary" (McCloskey, 1985a, p. 81). This assertion is almost certainly correct, but extended rhetorical analysis shall reveal it has implications undreamt of in McCloskey's market argument.

III. THE ABSENTMINDED PROFESSOR

The most subversive doctrine (from the vantage point of neoclassical economics) in the armory of McCloskey's rhetoric is the idea that mathematical expressions are "merely" metaphorical. In a discipline which has arrayed its pecking order largely on the basis of the appearance of mathematical sophistication, this must surely sound like the tic-tic-tic of the barbarians pecking at the gates. In order to drive home the inversion of conventional values, McCloskey has written that, "What is successful in economic metaphor is what is successful in poetry, and the success is analyzable in similar terms" (McCloskey, 1985a, p. 80). The average neoclassical economist might be willing to agree with Bentham that pushpin is as good as poetry, but would resist to the death the idea that poetry is as good as a polynomial.

It is important to realize that McCloskey himself does not think this is a disruptive doctrine, and indeed, thinks it a defense of the behavior of neoclassical economists in some of their most recent *contretemps*, most notably in the erstwhile Cambridge Capital Controversies.[5] These sometimes acrimonious controversies forced certain neoclassical theorists to admit that their Cambridge UK cousins' criticisms did possess some merit; however, it remains somewhat of an embarrassment that this has not curbed the ubiquitous appearance of neoclassical production functions in mathematical models. Whatever happened to the bracing discipline of the austere logic of mathematics? McCloskey would respond that, if one regards the production function (and, indeed, capital itself) as merely a metaphor, then there is little harm done. No metaphor is premised upon the precise identity between the object and the thing compared, or, as he put it,

5. The best blow-by-blow commentary is still Harcourt (1972) supplemented by Harcourt (1982). Does it say something about the tenor of American rhetoric that the most cogent defense of the Cambridge, Massachusetts, position also comes from the other side of the Atlantic (viz. Blaug, 1974)?

> The reason there was no decision reached was that the important questions were literary, not mathematical or statistical. The debate was equivalent to showing mathematically or statistically that a woman cannot be a summer's day. Yet no one noticed (McCloskey, 1985a, p. 82).

Such a cavalier summary of what was an extremely labyrinthine and subtle dispute cuts two ways. Superficially, it seems to say that the differences which divided the two Cambridges were *merely* metaphorical, and therefore inconsequential. Surely this cannot be McCloskey's message, because such an interpretation implies an invidious comparison between questions literary and questions mathematical contrary to the spirit of his rhetoric. On the other hand, neither can this be interpreted to suggest that the disputants be absolved of their respective pigheadedness merely because they neglected to subject the metaphorical content of their respective mathematical models to sustained analysis. Simply because Paul Samuelson (1966) insisted that J.B. Clark-style capital was a "parable" did not get him off the hook: He had made mathematical errors which were doubly grievous because so much of his authority derives from mathematical expertise. Surely the rhetor is not satisfied to mumble that "everyone has her own opinion, and there is nothing you can do to change it"? On the contrary, one would reasonably expect the proponent of rhetoric to plumb the depths of the metaphorical sources of apparently technical disagreements, with the eventual goal of clarifying the points of the dispute. There is no getting around it: Some parties are going to be criticized. Yet this is precisely the sort of analysis which McCloskey is not inclined to do.

The metaphorical character of mathematical analysis is not a novel idea. The great mathematician Henri Poincaré defined mathematics as the art of giving the same name to different things, a phrase more than adequate to do double duty as a definition of metaphor (Kline, 1980, p. 273). Wittgenstein, with his characteristic acuity, got to the crux of the matter:

> Mathematical conviction might be put in the form, "I recognise this as analogous to that." But here "recognise" is not used as in "I recognise him as Lewy" but as in "I recognise him as superior to myself" (Wittgenstein, 1976, p. 63).

The problem of what enforces the acknowledgment that one set of mathematical relationships is "the same" as another set is a major theme of Wittgenstein's later philosophy. One profoundly disturbing implication of this inquiry is that mathematics cannot be considered an independent mechanical decision procedure (as portrayed in the Cartesian tradition) because there are no self-enforcing rules concerning the sufficiency of mathematical analogy. Why is a geometric circle "the same" as the equation $(x-a)^2 + (y-b)^2 = r^2$? Does one still consider it the same if the y-coordinates are complex numbers, or if we are concerned with a non-Euclidean geometry? In what sense is matrix multiplication "the same" as the multiplication of integers or rational numbers? These types of questions led in the later nineteenth century to the concepts of "isomorphism" and "homeomorphism" as an attempt to codify some of the principles of "sameness" and to reveal the analogies between various branches of mathematics (Kline, 1972, p. 767). While this in turn led to very profound results in the theory of groups and semigroups, one should not conclude from it that the principles of metaphor and analogy in mathematics are formalized and settled for all time. The fact that Hesse (1966, pp. 64–77) tried to formalize the process of analogic reasoning in science using abstract algebra and failed should warn us that the latter has not sufficiently subsumed the former. There can be no more poignant illustration of this fact for economists than the case of the writings of William Stanley Jevons.

Although it is not common knowledge, Jevons was at least as famous as an expositor of the philosophy of science (such as it was in his day) as he was renowned as an economist. The second edition of his textbook *The Principles of Science* devotes an entire chapter to the role of analogy in science, and he specifically discusses the function of analogy in the development of mathematics. He admitted that "generalization passes insensibly into reasoning by analogy," but as a good Cartesian, he could not bring himself to express unrestrained enthusiasm over the method of reasoning by analogy. The stumbling block was the same as that indicated by Wittgenstein: When could one say metaphorical relationships were really "the same"? How does one decide that a resemblance or lack thereof is fundamental, and when incidental? Jevons chose to illustrate the problem of analogical reasoning with an example from mathematics:

> "analogical reasoning leads us to the conception of many things which, so far as we can ascertain, do not exist. In this way great perplexities have arisen in the use of language and mathematical symbols . . . mathematicians have needlessly puzzled themselves about the square root of a negative quantity, which in many applications of algebraic calculation, is simply a sign without any analogous meaning, there being a failure of analogy" (Jevons, 1905a, p. 643).

This passage was anachronistic when it was written; its error is glaringly apparent today. In the nineteenth century there were reasons to think that the square root of a negative number should not be accorded the same treatment as the square root of a positive number, but

these reasons were not written in stone, and in some cases the pure aesthetic appeal of the metaphor induced some mathematicians to persist in its development and elaboration. Quite unexpectedly, these "imaginary numbers" were then found to have applications in periodic functions, in probability theory, and in quantum mechanics. Jevons had suspected that analogy was pernicious, luring the unwary on to false paths. Instead, the analogy had become a sort of self-ratifying reality, with curious analytical constructs being developed for their own sake, and later further analogies being forged with physical phenomena.

The profound ramifications of the thesis that "mathematics is analogical reasoning" are being debated in the philosophical literature; a summary of those debates would carry us too far afield from our present concern, which is to analyze the rhetoric of mathematics in neoclassical economics. However, there is one fascinating thesis which we cannot pass by, and which may prove useful. Mary Tiles has recently argued that it is the metaphorical character of mathematics which can explain the uncanny feeling that the mathematician "discovers" platonic essences and grasps preexisting mathematical relationships independent of the process of inquiry – that, the widespread conviction that the mathematician is a discoverer, not an inventor (Wittgenstein, 1978, Part I, p. 99).

While the fact that two separate mathematicians arrive at the same solution for the problem $x = \sqrt{(56)(32)}$ may be traced either to a mechanical calculation procedure or to the heavy hand of authority, the discovery of new mathematical structures cannot be explained by the same means. Bachelard and Tiles claim that the new structures are a by-product of the drive of the mathematician to unify her discipline (Tiles, 1984, p. 87). The scheme for creating this unity is to apply the theory of one existing mathematical structure to the domain of another – that is, to reason by analogy. Because the two domains are never identical, there will be some ways in which the initial analogy appears to be a bad fit: The heterogeneity of domains produces "analogical interference." Tiles uses the example of a ratio of integers and the idea of a ratio between the diameter and the circumference of a circle, an analogy which induced cognitive dissonance and resulted in the discovery of π and other "irrational numbers" (Tiles, 1984, p. 93). She could have used the noncommutativity of the multiplication of quaternions, or any of a plethora of similar instances in the history of mathematics. The fact that the analogies are not perfect, and never can attain perfection, leads mathematicians to ask novel questions. The answers to these questions are curious, in that they do not seem to be predetermined by the previous corpus of mathematics, and yet produce answers which have the aura of objectivity, in the sense that the will of the mathematician to impose an analogy has been frustrated. Hence, the mathematics appears

to "resist" the original drive to unify the subject matter, fostering the impression that it exists independent of the objectives and choices of the researcher. In a rhetorical twist worthy of O. Henry, it is the metaphorical practices of mathematicians which conjure the impression of the cold objectivity of mathematics.

The practice of analogical reasoning is of course not restricted to the activities of mathematicians. This should appear self-evident to the neoclassical economist whose time and energy is spent constructing "models" of increasing levels of complexity and abstraction. What the neoclassical economist may not realize is that a substantial proportion of the activities of the physicist also consists of the transport of analogy from one domain of science to another. This has been recognized by numerous historians and philosophers of science from Duhem to Hesse to Pickering, including W.S. Jevons. Those forced to suffer through courses on electrical engineering will recall the light which dawns when one realizes that any mechanical or acoustical system can be reduced to an electrical network and the problem solved by circuit theory, or vice versa (Olson, 1958). The very success of the theory of energy in the nineteenth century was due to the newfound capacity to see analogies between phenomena which had previously appeared distinct and unrelated (Mirowski, forthcoming, Chapter 2). Now one could state that mass was "like" inductance and that velocity was "like" current, and hence use the mathematical formalisms developed in the sphere of rational mechanics to describe other phenomena in novel spheres, such as electricity and light.

Other analogies which were critical for the development of physics in the nineteenth century were comparisons between heat and electrostatics, and comparisons between light and the vibrations of an elastic medium. The physicist James Clerk Maxwell was so impressed with the fecundity of these analogies that he elevated the postulation of analogy to a principle of research method, a method he conceived as a middle way between the sterility of a strictly mathematical analysis and the excesses of pure speculation. His method paid off handsomely with the postulation of the famous Maxwell equations and the subsequent discovery of the electromagnetic nature of light (Nersessian, 1984). Examples of the role of analogy and metaphor in physics could be multiplied indefinitely.

The prevalence of metaphor and analogy in the history of the physical sciences is no accident. It is a corollary of another trend, the increasing use of mathematics as the preferred mode of communication within the disciplinary matrix. Mathematics, as we have observed, is the method *par excellence* for the transfer of metaphor. Once mathematical expertise has come to be the badge of the theorist in any science, then theory becomes isolated from that subset of the discipline responsible

for empirical implementation and experiment. The mathematical theorist is given *carte blanche* by her prestige and her separation from the nitty-gritty of everyday observation to prosecute any mathematical analogy or metaphor which captures her fancy. The negative component of any of these metaphors (for instance, the fact that light waves are not "really" like water waves because we cannot identify the substance which light waves move through) can be effortlessly set aside for the time being, or dismissed as irrelevant, impounded in *ceteris paribus* conditions or otherwise neutralized, because for the theorist, it is only the mathematics that matters (Colvin, 1977).

Many appeals to "beauty," "simplicity," "clarity" and suchlike by the mathematical community can be rendered comprehensible as comments upon the aesthetic qualities of analogies. Ironically, it is the existence of the closed community of those fluent in mathematics which permits the mathematical theorist to indulge in wilder flights of fanciful metaphor than might be condoned were they expressed in the vernacular. As it stands, the closed community of mathematical theorists can independently invest a metaphor with legitimacy, and leave it to the "applied scientists" to clean up the negative components of the analogy and make the messy bits fit with recalcitrant reality. It should go without saying that this constitutes an excellent sociological structure for the protection of a theory from its critics.

Before we get too carried away with the image of the cabal of mathematicians foisting off a whole load of rubbishy metaphors on a sheeplike and uncomprehending world, it will be prudent to recall that mathematical formalization is an ideal method of the transfer of metaphor, and that metaphor is an indispensable tool of human reasoning, "scientistic" or not. Metaphors are necessary because they provide us with ready-made linkages of concepts, and with ready-made reasons to justify those linkages. Metaphors differ from the "assumptions" which economists profess to hold with such cool agnosticism because they represent a web of propositions which have withstood testing, elaboration, and criticism in a different context. Knowledge is not an agglomeration of discrete and interchangeable propositions, like some tub of Lego blocks that can be indifferently snapped together and broken apart. If that were the case, then research would be a chaotic and anomic proposition, doomed to a random walk in a strange landscape. The lesson of philosophy in the age of Duhem, Quine, and Hesse is that propositions are networks of meaning (Hesse, 1974; Quine and Ullian, 1970). Metaphors gingerly extricate a web from one context and drape it over the phenomena in another context. Some aspects of the metaphor may not fit the new context; but when that inevitably happens, we do not necessarily abandon the entire theory, but rather use the metaphor to help us decide which conceptual aspects could be adjusted and which

are indispensable. There are some situations which would counsel abandonment of the entire theory; but there would be no way of knowing what they were without metaphors.

IV. DON'T LOOK BACK

Fortified with these observations, we now return to explicit consideration of neoclassical economics and McCloskey's thesis that mathematical models are metaphors. The preceding considerations suggest that there is substantial truth to this claim, simply because most extensions of mathematical formalism proceed by metaphor and analogy. Nevertheless, this simple observation has little cash value, because there are a potentially limitless number of possible metaphors which might have been proposed, and a myriad of mathematical metaphors which might have been deemed to warrant sustained elaboration. The questions which should concern the rhetor are: Which metaphor(s) were chosen? Why were they thought plausible when they were adopted? What happened to the negative components of the analogy? Are they still thought to be plausible? Why? Are the metaphors "dead" or "alive"? The very process of persuasion dangles without rational support in the absence of such an inquiry.

There already exists a metaphorical analysis of this format which can stand as an alternative to McCloskey's "Rhetoric" of neoclassical economic theory. This analysis claims that there is a coherence to neoclassical theory because it all has grown out of a single metaphor, a mathematical metaphor. It asserts an empirical hypothesis, that the progenitors of neoclassicism did what all mathematical theorists do: they appropriated a mathematical model lock, stock, and barrel from somewhere else, in the guise of a metaphor. In particular, the early neoclassicals took the model of "energy" from physics, changed the names of all the variables, postulated that "utility" acted like energy, and then flogged the package wholesale as economics. The author has filled many pages documenting this claim (Mirowski, 1984a, 1984b, 1985a, forthcoming) and will spare the reader a rehearsal of the prodigious parade of evidence here. In lieu of a sustained attempt to convince the skeptical reader, we shall merely sketch in the main outlines of the metaphor, restricting ourselves to what is needed to evaluate our later rhetorical theses.

At one point in his *Three Essays*, Tjalling Koopmans notes in passing, "A utility function of a consumer looks quite similar to a potential function in the theory of gravitation. . . " (Koopmans, 1957, p. 176). Although he opted not to elaborate the analogy, let us explore it further. Suppose we are to describe a mass point moving in a three-dimensional Euclidean space from point A to point B.

The conventional physical description, developed in the mid-nineteenth century, postulates a "force" decomposed into its orthogonal components, each multiplied by the spatial displacement, also suitably decomposed. In order to incorporate cases of nonlinear displacement and acceleration, the "work" done in the course of motion from A to B was defined as the summation of the infinitesimal forces F multiplied by their displacements:

$$T = \int_A^B (F_x dx + F_y dy + F_z dz) = (1/2)mv^2 \Big|_A^B$$

The writings of Lagrange and Hamilton insisted that the total energy of this system depended in a critical way upon the position of the mass point in a gravitational field. This was subsequently clarified in the following manner: Suppose that the expression $(F_x dx + F_y dy + F_z dz)$ was an exact differential equation. This would imply that there exists a function $U(x,y,z)$ such that:

$$F_x = \partial U/\partial x;\ F_y = \partial U/\partial y;\ \text{and}\ F_z = \partial U/\partial z.$$

The function $U(x,y,z)$ so defined was asserted to represent a gravitational field, which by the 1860s was also identified as the field of potential energy. The sum of the kinetic energy $(1/2mv^2) \equiv T$ and the potential energy U was understood as being conserved in the confines of a closed system. The law of the conservation of energy, in turn, clarified and encouraged the use of constrained maximization techniques (such as the Principle of Least Action, Lagrangean multipliers, and the Hamiltonian calculus of variations) in the description of the equilibrium motion of a mass point under the influence of impressed forces.

As Koopmans indicated, the similarity between this model and the conventional canonical neoclassical model is quite striking. Let the forces "F" be the prices of individual goods x,y,z, and the displacements be infinitesimal changes in the quantities of the goods dx, dy, dz. The rest of the metaphor falls into place: "Kinetic energy" is the sum of prices times quantities, and hence is the total expenditure or budget constraint; the potential field defined over the commodity space is clearly "utility."[6] Constrained maximization (or minimization) of an imponderable quantity over a conservative field leads directly to the equilibrium configurations of forces/prices.

Is this remarkable similarity merely an accident? Koopmans is prudently silent on this issue, but examination of the origins of neoclassical theory reveals that its progenitors consciously and willfully appropriated the physical metaphor in order to render economics a "mathematical science" (Mirowski, 1984a, forthcoming). Jevons (1905b, p. 50), Walras (1960), Edgeworth (1881), and nearly every other early neoclassical economist admitted this fact. Here the rhetor pricks up his ears; his blood starts to race; could this be a "rhetorical ploy"? And they all admitted it? Then why is it such news a century later? Could this be a "dead" metaphor – has it become so fully detached from its sources of inspiration that it is now effectively independent of the connotations and conditions of its genesis? Curiously enough, this was the position of that most pugnacious defender of economic mechanics (or mechanical economics?), Pareto:

> Let us go back to the equations which determine equilibrium. In seeing them somebody – and it might be the writer – made an observation of the kind above and said: "These equations do not seem new to me, I know them well, they are old friends. They are the equations of rational mechanics." This is why economics is a sort of mechanics or akin to mechanics . . . mechanics can be studied leaving aside the concept of forces. In reality all this does not matter much. If there is anyone who does not care to hear mechanics mentioned, very well, let us disregard the similarity and let us talk directly about our equations. We shall only have to face the drawback that in certain cases we shall have to labour greatly in order to deduce from those equations certain consequences that we would have perceived at once had we kept in mind the fact that mechanics has already deduced them from its own equations, which are similar to ours. All told this does not alter the consequences (Pareto, 1953, p. 185).

The rhetorical analyst, forewarned and forearmed by our previous discussion, smells the Cartesian Vice in the neighborhood. Here is the insistence that sources of inspiration are irrelevant; the actual process of inquiry is irrelevant; the composition of the audience is irrelevant. All that purportedly matters is the formal mathematical expression, which alone renders truth more transparent. The fact that the mathematics was appropriated wholesale from physics merely speeds up the research, and does not influence the content of the theory. However much Pareto wishes to appear a pragmatical and no-nonsense type of guy, the fact is that his prosopopoeia is eminently rhetorical, in that it is meant to persuade, and *not* to be a literal account of his activities, or the activities of other neoclassical economists.

I should like to argue that the physics metaphor in economics is not a dead metaphor, and that the attendant mathematics have not served as the simple heuristic device, *pace* Pareto. In the first place, neither Pareto nor any of his comrades in the marginalist revolution made explicit use of

6. Fisher (1926, pp. 85–86) presents a table which lists the correspondences between the physics and economics labels for the variables in the same mathematical formalism. For a detailed commentary, see Mirowski (forthcoming, Chapter 5).

the mathematical analogy for the purposes of speeding up the process of inference, or even to provide an independent check upon their analytical prognostications. This was not because the metaphor was dead on arrival; rather, it was because none of the neoclassicals understood the physics well enough to follow up on the detailed implications of the metaphor. This fact is illustrated by the numerous occasions when physicists, upon recognizing the physical equations, wrote letters to the neoclassicals to query them upon various points. The early neoclassicals – Walras, Fisher, Pareto – to a man replied with bombast, farrago, and finally a frustrated and sullen silence, simply because they did not understand what was being asked of them (Mirowski, 1985a, forthcoming).

In the second place, no neoclassical economist has ever seen fit to plumb the energetics metaphor for its "positive" versus "negative" components, weighing those parts of the metaphor which seemed relevant against those which appeared odd, strained, or even downright perverse. This could not be attributed to the possibility that the metaphor of utility as energy was so elegant, so felicitous, and so very right that it would be futile to look for its negative aspects. Yet, with only minor effort we can generate six profound disanalogies:

1. There is nothing obvious about the definition of human rationality as the maximization of an objective function over a conserved entity (Mirowski, 1985b). This elevation of the significance of extrema did not arise first in social theory, but rather in physics, as the principle of least action. The physics of constrained extrema were interpreted as evidence for the existence of a God who had constructed the world in the most efficacious and coherent manner. That maximization or minimization was global in the most comprehensive sense, and encouraged an attitude that "efficiency" could be defined in some absolute framework. In its evolution from Maupertuis to Euler to Hamilton, the principle of least (or varying) action shed its theological skin, but the notion of absolute efficiency persisted, and it was this connotation which was recruited to tame the multiform and unruly concept of rationality.

The predisposition of the modern neoclassical economist to "optimize" over someone's "objective function" is neither an empty tautology nor a harmless metaphor: It surreptitiously presumes an inordinately large amount of structure about the nature of desires and objectives, the role of time, the understanding of causality, the unimportance of process, the conservation of the domain of the objectives, the relative construction of the world of the actor vis-à-vis its reconstruction by the social analyst, the strict separation of the thing desired and the act of choice, and much, much more (Bausor, 1986; Mirowski, 1984b). And, of course, it resonates with this Western theological tradition without ever making reference to it.

classical economics was derived from the physics of a specific historical moment, namely, the years of the mid-nineteenth century just prior to the elaboration of the second law of thermodynamics. The mathematics of pre-entropic physics is now thought to have been the pinnacle of the development of static mechanism (Prigogine, 1980). In this vintage of physics, all physical phenomena are portrayed as being perfectly reversible in time; there was no room in theory for hysteresis. In other words, nineteenth-century physical law could have no history. This stubbornly anti-historical bias of neoclassical economics has frequently been excoriated by critics such as Joan Robinson, and bemoaned by such partisans as Hicks (1979), and Shackle (1967). What the latter have not realized is that it is futile to attempt to inject history into neoclassical stories without thoroughly wreaking havoc with the very physical metaphor which was its inspiration and the mathematical techniques which were responsible for its success. The mathematical metaphor of "equilibrium" is incoherent when a process exhibits a fundamental dependence upon its temporal location. In other words, economists misunderstand the dictates of their chosen metaphor of equilibrium.

3. In pre-entropic physics, all physical phenomena are variegated manifestations of a protean energy which can be fully and reversibly transformed from one state to another. When this metaphor was smuggled into the context of economic theory, it dictated that all economic goods be fully and reversibly convertible into utility, and thence into all other goods in the act of trade. Now, most economists would admit that the introduction of money into neoclassical economic theory has been an awkward marriage at best and a shotgun marriage at worst (Clower, 1967). The problem has been, curiously enough, metaphorical. In the mathematics, the analogue to money has not been some lubricant which greases the wheels of trade, but rather a superfluous intermediate crypto-energy which all other energies must become in transit to their final state. The mathematics say one thing; the accompanying commentary something else.

4. As a prerequisite for the application of techniques of constrained extrema, it has long been recognized that energy must be conserved as a mathematical rather than an empirical imperative (Theobald, 1966). If one takes the neoclassical metaphor literally, it would dictate that the sum of realized utility plus the money value of the budget constraint be equal to a constant, i.e., $T+U=k$ (Mirowski, 1984a, forthcoming, Chapter 5). Since this sum has no coherent interpretation from an economic point of view, the early neoclassicals avoided it. But there is no constrained optimization in the absence of a conservation principle, and neoclassicals discovered a mathematical imperative to impose various "unobtrusive postulates," such as the conservation of the utility field, the conservation of income, or the constancy of the marginal utility of money.

tended the liberation of neoclassical value theory from any dependence upon the utility concept. The motivations behind this self-denying ordinance were never openly discussed, although a rationally reconstructed history (Wong, 1978) can be organized by asking how our understanding of the folk-psychology of utility makes it dissimilar to energy. It can also explain why economists cannot bear to take psychology seriously. The failure of this abortive research program can be gauged by the extent to which axioms of revealed preference are isomorphic to those of a gravitational field.

6. Problems with the energetics metaphor can also assume less lofty and philosophical proportions. For example, the components of physical forces can assume negative values without disrupting the physical intuition; but negative prices really do seem beyond the pale (cf. Mirowski, 1986a).

The more one is willing to become embroiled in the history of physics and mathematics, the more one could expand this list. For our present purposes, I hope it proffers sufficient evidence to counter the claim that it makes no difference where the mathematical analogies come from, because once appropriated, they are freely amended to express only what was consciously intended. Mathematics is not a colorless and secure cloak into which the analyst can slip in order to shield himself from the vagaries of human discourse.

There is a vast rhetorical process going on here, and it cries out for analysis. It is not simply a matter of writing style, or conversational tactics, or an incident in which a single individual flashes into fleeting fame. It is not the saga of a John Muth, or a Robert Fogel. It is the narrative of the displacement of all other schools of economics (with the obvious exception of Marxism) by means of a single mathematical metaphor appropriated from nineteenth-century physics. It is the story of the persuasion of the majority of Western economists to pledge allegiance to a particular ideal construction of economic life by means of a single rhetorical technique.

This is where the idea of mathematics as metaphor takes us. It takes us to the historical origins of neoclassical theory, into its content. Inexorably, it also draws us into *critique*, into looking at the present with something far short of warm admiration and cozy satisfaction. This is where rhetorical analysis takes us; but it is a place where Don McCloskey does not want to go.

V. BLOW-UP

Don McCloskey claimed he rode into town on his Donald Davidson (McCloskey, 1985b). I suppose that this means he subscribes to David-

son's thesis that, "metaphors mean what the words, in their most literal interpretation, mean, and nothing more" (Davidson in Johnson, 1981, p. 201). Neoclassical economists have been trying to use this trick to get out of some of the nastier embranglements resulting from their physics metaphor since the beginning. Witness Pareto:

> [Social scientists] . . . can therefore derive no advantage from words. They can, however, incur great harm, whether because of the sentiments that words arouse, or because the existence of a word may lead one astray as to the reality of the thing it is supposed to represent, and so introduce into the experimental field imaginary entities such as the fictions of metaphysics or theology. . . . Literary economists . . . are to this day still dilly-dallying with speculations such as "What is *value?*" "What is *capital?*" They cannot get it into their heads that things are everything and words nothing. . . (Pareto, 1935, pp. 61–62).

This search for the perfect essence, the real stuff, has been frustrated for over a hundred years now. This tough-minded attitude about words and things is itself the last refuge of a scientistic scoundrel. The not-so-subtle innuendo that the common vernacular is fettered with clinging frivolous associations while the mathematics is, not, really will not wash either.

Neoclassical economic theory is founded upon a single mathematical metaphor which equates "utility" with the potential energy of mid-nineteenth-century physics. From Walras to Pareto to McCloskey the tendency has been to admit the metaphor in a coy and indirect manner, hedged about with the qualification that it is merely a matter of words, and therefore of no consequence to evaluations of the content and significance of the theory. If a "good metaphor depends, too, on the ability of its audience to suppress incongruities," and "What is successful in economic metaphor is what is successful in poetry, and the success is analyzable in similar terms" (McCloskey, 1985a, pp. 79[n, and 80), then the prognosis is clear. All that modern neoclassicals must do is to suppress all the uncomfortable or silly bits of the founding fathers' metaphor – and this they have done by their blinkered concentration upon the technical aspects of the mathematics, come hell or high water – and to evaluate the "artfulness" of the resulting product using their own internally generated criteria. This, of course, is nothing other than the "market test" in sheep's clothing. Just as the realpolitik version of great art is the art which still sells, the realpolitik version of great economics is the stuff which neoclassicals still flog in the classroom. If the metaphorical genesis of neoclassical theory is no longer mentioned in the classroom, well, then, it must have been expendable.

One of the virtues of the broader conception of rhetoric advocated here is its mandate to describe the *process* of persuasion in all its multiform splendor, from the literal reference of "mere words" to the social

construction of the object of discourse. In the more narrow case which concerns us here, the importance of metaphor (vernacular or mathematical) is that its role, contrary to Donald Davidson, is *never* limited to a literal representation of the concept of reference (Bicchieri, 1986). The use of metaphor sets up a field of secondary and tertiary resonances, contrasts, and comparisons which do not merely describe, but also reconstruct and transform the original metaphorical material. It is commonplace among philosophers that there are no rules for definitively identifying metaphors because the original thing compared and the object of comparison frequently undergo figure/ground reversal, and the forcefulness of a metaphor often derives from the unstated synergistic implications. This is not to say that the analysis of the efficacy of metaphoric reasoning is a hopeless project, trapped at the ineffectual level of aesthetic appreciation.

The foundational metaphor of mathematical neoclassical economic theory is palpably different from poetic metaphor, and therefore must be analyzed in a distinct manner. Mary Hesse, who has considered the role of metaphor in physics at great length, has described the fundamental distinctions between metaphors in science and metaphors in poetry (Hesse, 1966; 1974; 1980, pp. 118–23). It is a distinguishing characteristic of successful poetic metaphor that the images chosen be initially striking, unexpected, shocking, or even perverse. (One here might recall Baudelaire's comparison of his lover's body to a piece of carrion.[7]) A poetic metaphor is largely meant to be savored, to be entertained in the way one sips a wine, and not to be further analyzed in pedantic detail. (This most certainly explains the pariah status of literary critics in certain quarters.) The poetic metaphor sports a penumbra of further metaphors and implications which may themselves be contrary to conventional usage and the tacit knowledge of the reader, flagrantly contradictory with one another, and fly in the face of previous comparisons in the same text. Far from being considered an error, this is part of the calculated impact of poetic language. Finally, only the confused pedant takes a poetic metaphor to be a research program. A poem is intended to be self-contained; it is a rare occurrence for a poem to recruit missionaries who go out to remake the world in its image – at least, in the twentieth century.

Scientific metaphors clearly have different criteria of efficacy and success. Although a scientific metaphor may initially appear incongruous, this is not generally conceded to be a point in its favor, and much of scientific activity can be interpreted as an attempt to render unseemly metaphors intelligible and pedestrian. A distinguishing characteristic of

7. "Une Charogne" in Baudelaire's *Les Fleurs du Mal*. In the Pleiade *Oeuvres Completes* it can be found on pp. 29–31.

scientific metaphors is the fact that they are considered failures if they can only muster temporary impact and do not become the object of pedantic explication and elaboration. (Here one might cite examples of mathematicians rooting out the most obscure and arcane implications of the idea of a continuous function, or of the metaphor of "infinity," cf. Dauben, 1984.) Scientific metaphors should set in motion research programs which strive to make explicit all of the attendant submetaphors of the original. They should provoke inquiry as to whether the implications are consistent one with another, as well as consistent with the background tacit knowledge.

There is no such thing as a perfect scientific metaphor which has no negative aspects. It is the job of the scientist to reconcile these inconsistencies with the tacit knowledge of the profession as well as with the "facts." Scientific metaphors can fail, but this is not generally due to some mythical *experimentum crucis*, but rather due to an increasing realization on the part of the scientific participants that the metaphor is cumbersome, awkward, and throws up intractable inconsistencies with its penumbra of meanings. However tentative and nonteleological this process seems, metaphors are an indispensable component of the scientific vocabulary, because they are a means which permits the expansion and adaptation of theory to a changing world.

Thus a rhetorical analysis of scientific and mathematical metaphor will diverge from the rhetorical analysis of a poem in distinct and critical respects. The former must ask: Is the metaphor consistent with itself? Is it consistent with the rest of the science? What properties of the metaphor are essential, and which expandable? Which aspects are those of similarity, and which of causality? (Hesse, 1966, pp. 86–87). In these areas, McCloskey's version of rhetoric gets low marks, because it abdicates all responsibility for the tough questions. The probable cause of McCloskey's watered-down rhetoric is that neoclassical economic theory does not fare well under more intense cross-examination.

As already indicated, the progenitors of neoclassical theory did admit that they were asserting that something in economics was "like" energy in physics, but not one of them ventured beyond coy references to the examination of the consistency of the metaphor in any detail. When various physicists and mathematicians challenged the consistency and adequacy of the metaphor, particularly with respect to what they considered to be the most fundamental property of energy (i.e., its conservation), the neoclassicals responded with nonsense and incomprehension (cf. Mirowski, 1985a). This situation did not improve over time. Later neoclassicals wavered between affirming and denying that the metaphorical "utility" was required by the very structure of their economic theory, or quibbled about whether it only needed to be ordinal rather than cardinal, as if the denial of the metaphor as the very rock

upon which the theory was founded would somehow exorcize all of the negative components of the analogy with energy (Wong, 1978; Schoemaker, 1982; Mirowski, forthcoming, Chapters 6 and 7). Hence twentieth-century neoclassicals tried to suppress the negative components of the energetics metaphor by trying to suppress the metaphor itself, to the extent that contemporary neoclassicals are still surprised and a little shocked when confronted with the fact that their economic theory was unabashedly and directly appropriated from nineteenth-century physics. It was a curious sort of repression, basking in the warm sensation of being "scientific" because what twentieth-century neoclassicals did so resembled what physicists did, without evincing the least curiosity about how it all came to pass, or whether it all made a difference. This was not science; and it was not even passable poetry.

Because of this fact, critics of neoclassicism over the last century have been put in the unenviable position of having unwittingly to reinvent the wheel. When Veblen complained that man was not a lightning calculator of pleasures and pains who oscillates like a homogeneous globule of desire of happiness under the impulse of stimuli which leave the man intact, or when Schumpeter complained that the firm would not exist as a static maximizer, or when Sraffa complained that there are no increasing or decreasing returns, or even when the exceptional undergraduate frowns skeptically at the idea of a utility function, they are all unwittingly questioning the scientific propriety of the metaphor of utility as energy. The fact that the modern proponents of utility were innocent of the genealogy of the theory and its implications resulted in a palpable degeneration in the quality of discourse. The critics were testing the limits of the physics metaphor, whereas the defenders felt free to tender any response which was convenient, since they had no clear conception of what was necessary and what was superfluous in their adopted model. If care had been exerted in metaphorical reasoning, it would have eventually become apparent that once utility had been equated with potential energy, neoclassicals were not free to advocate anything they liked about production or psychology or equality – or even "justice" (Mirowski, forthcoming). If attention had been paid to the physics metaphor, then it would have become apparent that there are some attributes of the energy concept which are indispensable: that it be conserved in a closed system; that it is a variable of state, and therefore cannot be time dependent; that it posited a fundamental symmetry between the past and the future; that it was not a substance but a relation; that it was an integral, and therefore only determinate up to a constant of integration. Many acrimonious debates in the history of economics, including the Cambridge capital controversies, would have been clarified tremendously if these tenets had been kept in clear view. The purpose of Pareto's tough-guy sermon on words and things, as well

as McCloskey's more tender-minded rhetoric, was precisely to deny that metaphors have consequences.

VI. THE DISCREET CHARM OF THE BOURGEOISIE

Unhappily, neoclassical economists have not used their metaphor the way scientists generally use metaphors. But if this has been the case, the rhetor feels a duty to ask, then why has neoclassical economic theory been so persuasive over the course of the last century, to the extent of "marginalizing" all other schools of economic thought? The answer takes us outside the realm of McCloskey's rhetoric, but remains well within the bounds of our broader notion of rhetoric as the social construction of knowledge. This expanded rhetoric draws its theoretical inspiration from fields disparaged by the neoclassical economist because they have remained relatively impervious to the siren song of the Cartesian Vice: namely, anthropology and the sociology of knowledge.

Tracing their influence from Durkheim and Mauss on primitive classification, Mary Douglas and David Bloor have recently argued that the act of persuasion in any human culture is intrinsically metaphorical and social:

> I feel we should try to insert between the psychology of the individual and the public use of language a dimension of social behavior. . . . Persons are included in or excluded from a given class, classes are ranked, parts are related to wholes. It is argued here that the intuition of the logic of these social experiences is the basis for finding the *a priori* in nature. The pattern of social relations is fraught with emotional power; great stakes are invested in their permanence by some, in their overthrow by others. This is the level of experience at which the gut reaction of bewilderment at an unintelligible sentence is strengthened by potential fury, shock, and loathing. Apprehending a general pattern of what is right and necessary in social relations is the basis of society: this apprehension generates whatever *a priori* or set of necessary causes is going to be found in nature (Douglas, 1975, pp. 280–81).

In other words, *all* societies must appeal to their understanding of natural order for the purpose of legitimizing their social order. The works of Douglas (1973; 1975; 1982) describe how this process operates in non-Western societies; the fascinating work of Bloor (1982) and Barnes and Shapin (1979) applies the same sort of analysis to the history of Western physics, mathematics, and medicine. The relevance of this work to a revitalized theory of rhetoric is that it unites social theory with the original quest to understand how audiences are won over by certain general techniques of communication. The appeal to nature and to a natural order pervades our discourse in ways neither literal nor transpar-

ent; this submerged content accounts for many of those subversive and troublesome emotions which color any rational argument. The Cartesian plot to banish emotional discourse and to denigrate the process of argumentation was yet another instance of this general pattern of appeal to natural order.

Thus the appropriation of a mathematical metaphor from physics and its reification as neoclassical economic theory is rendered comprehensible as part of a much larger pattern, one that we share with such pre-capitalist societies as the Tiv and the Lele, as well as with our predecessors in earlier Western social formations. The success of neoclassical economic theory cannot be traced to the scientific criticism and elaboration of the positive and negative aspects of the original physics metaphor. Rather, it can be traced to the fact that the appropriation of a physics metaphor expresses a basic principle of human understanding, that social order must be understood as being rooted in and a reflection of natural order. Because this principle has been expressed in economics indirectly as a metaphor, it has proven profoundly more effective than if it had been stated baldly and prosaically, perhaps as a philosophical dogma, or a tenet of faith. The Cartesian predispositions and the scientific pretensions of economists would in that case have clashed with an explicit authoritarian fiat. It has proven more felicitous to allow the individual scientist through reflective contemplation to discover the implied metaphors of natural order inherent in the mathematical model appropriated from physics.

So what precisely is this metaphorical content of neoclassical economic theory which has proven so very successful in displacing all other schools of economic thought? Our expanded rhetorical analysis can only be adequately carried out in the detailed analysis of texts and conversations, but the architectonics can be briefly summarized. The physics metaphor implies that economics is a *science* and deserves all the legitimacy that is granted to physics itself, because there exists no great difference between the two modes of inquiry. The economy is portrayed as a self-contained and separable subset of social life, and as such has the character of a stable natural process. "Capitalism" as a natural entity is implied to be timeless: that is, it has always existed and will always continue to exist. Human beings within this sphere of social life behave as if they were automatons, in that their rationality is conflated with the existence of mechanical decision rules, most notably constrained maximization over a conserved vector field. Humans may behave differently in other spheres of social life, but since that behavior is "irrational" by definition, there is nothing left to be explained. Finally, the physics metaphor endows differential ontological validity upon sets of social phenomena: the "individual" is taken to be more real than any other social formation, be it the family, the firm, the nation-state, and so on.

VII. PORTRAIT OF A LADY

Let me tell you why I hate critics. Not for all the normal reasons: that they are failed creators (they usually aren't; they may be failed critics, but that's another matter); or that they're by nature carping, jealous and vain (they usually aren't; if anything, they might be accused of over-generosity, of upgrading the second-rate so that their own fine discriminations might thereby appear the rarer). No, the reason I hate critics – well, some of the time – is that they write sentences like this:

"Flaubert did not build up his characters, as did Balzac, by objective, external description; in fact, so careless is he of their outward appearance that on one occasion he gives Emma [Bovary] brown eyes (14); on another deep black eyes (15); and on another blue eyes (16)."

– Julian Barnes, *Flaubert's Parrot*, p. 74

Surely here is an opportunity to get rid of that great stick of a character *Homo economicus* and to replace him with somebody real, like Madame Bovary.

– Donald McCloskey, *The Rhetoric of Economics*, p. 66

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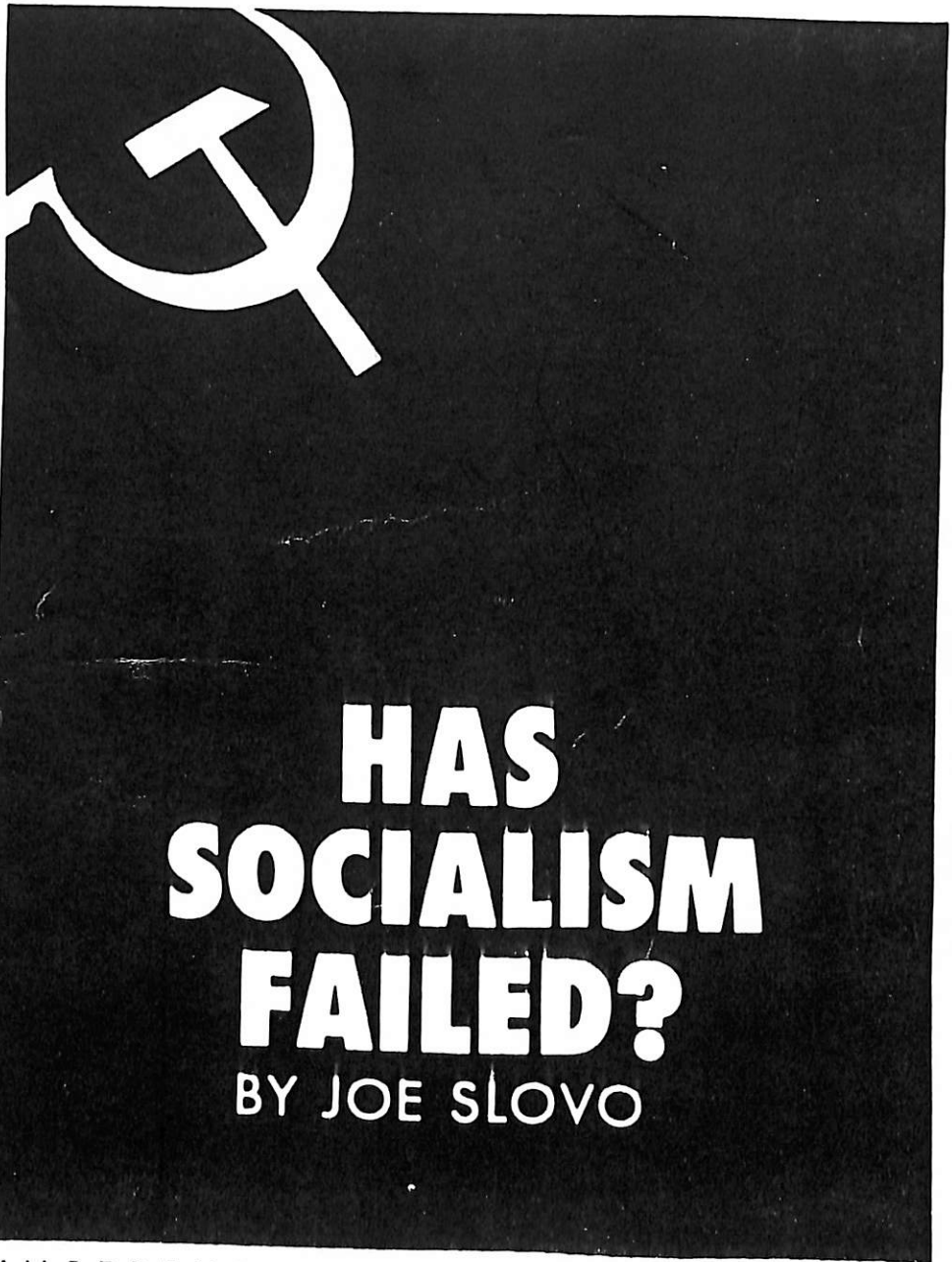

HAS SOCIALISM FAILED?

BY JOE SLOVO

UMSEBENZI DISCUSSION PAMPHLET

HAS SOCIALISM FAILED?

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CONTENTS

The subject matter of this discussion paper will no doubt be debated for years to come both inside and outside the ranks of communist and workers' parties. The publication of this draft has been authorised by our party's leadership, as a launching pad for further critical thought. Some colleagues have made extremely valuable suggestions, which have been incorporated. But, as a whole, it represents the first reflections of the author only.

January 1990

— ONE —
INTRODUCTION

Socialism is undoubtedly in the throes of a crisis greater than at any time since 1917. The last half of 1989 saw the dramatic collapse of most of the communist party governments of Eastern Europe. Their downfall was brought about through massive upsurges which had the support not only of the majority of the working class but also a large slice of the membership of the ruling parties themselves. **These were popular revolts against unpopular regimes; if socialists are unable to come to terms with this reality, the future of socialism is indeed bleak.**

The mounting chronicle of crimes and distortions in the history of existing socialism, its economic failures and the divide which developed between socialism and democracy, have raised doubts in the minds of many former supporters of the socialist cause as to whether socialism can work at all. Indeed, we must expect that, for a time, many in the affected countries will be easy targets for those aiming to achieve a reversion to capitalism, including an embrace of its external policies.[1]

Shock-waves of very necessary self-examination have also been triggered off among communists both inside and outside the socialist world. **For our part, we firmly believe in the future of socialism; nor do we dismiss its whole past as an unmitigated failure.**[2] Socialism certainly produced a Stalin and a Ceaucescu, but it also produced a Lenin and

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1. It is, for example, sad to record that among the early foreign policy initiatives of the new government in Hungary was to play host to South Africa's foreign minister. By doing this it has, without even the diplomatic niceties of consulting with the representatives of the repressed and dominated majority, moved away from one of the most humanitarian aspects of the policies of the socialist world, i.e. to be in the vanguard of those who shun apartheid.

2. Among other things, statistics recently published in *The Economist* (UK) show that in the Soviet Union — after only 70 years of socialist endeavour in what was one of the most backward countries in the capitalist world -- there are more graduate engineers than in the US, more graduate research scientists than in Japan and more medical doctors per head than in Western Europe. It also produces more steel, fuel and energy than any other country (The World in the 1990s; Economist publication). How many capitalist countries can match the achievements of most of the socialist world in the provision of social security, child care, the ending of cultural backwardness, and so on? There is certainly no country in the world which can beat Cuba's record in the sphere of health care

a Gorbachev. Despite the distortions at the top, the nobility of socialism's basic objectives inspired millions upon millions to devote themselves selflessly to building it on the ground. And, no one can doubt that if humanity is today poised to enter an unprecedented era of peace and civilised international relations, it is in the first place due to the efforts of the socialist world.

But it is more vital than ever to subject the past of existing socialism to an unsparing critique in order to draw the necessary lessons. To do so openly is an assertion of justified confidence in the future of socialism and its inherent moral superiority. And we should not allow ourselves to be inhibited merely because an exposure of failures will inevitably provide ammunition to the traditional enemies of socialism: our silence will, in any case, present them with even more powerful ammunition.

— TWO —
IDEOLOGICAL RESPONSES

The ideological responses to the crisis of existing socialism by constituents of what was previously known as the International Communist and Workers' movement (and among our own members) is still so varied and tentative that it is early days to attempt a neat categorisation. But at the risk of over-simplification, we identify a number of broad tendencies against which we must guard:

A. Finding excuses for Stalinism
B. Attributing the crisis to the pace of perestroika
C. Acting as if we have declared a moratorium on socialist criticism of capitalism and imperialism and, worst of all,
D. Concluding that socialist theory made the distortions inevitable.

A. Sticking to Stalinism

The term 'Stalinism' is used to denote the bureaucratic-authoritarian style of leadership (of parties both in and out of power) which denuded the party and the practice of socialism of most of its democratic content and concentrated power in the hands of a tiny, self-perpetuating élite.

While the mould for Stalinism was cast under Stalin's leadership it is not suggested that he bears sole responsibility for its negative practices. The essential content of Stalinism — socialism without democracy — was retained even after Stalin in the Soviet Union (until Gorbachev's intervention), albeit without some of the terror, brutality and judicial distortions associated with Stalin himself.

Among a diminishing minority there is still a reluctance to look squarely in the mirror of history and to concede that the socialism it reflects has, on balance, been so distorted that an appeal to its positive achievements (and of course there have been many) sounds hollow and very much like special pleading. It is surely now obvious that if the socialist world stands in tatters at this historic moment it is due to the Stalinist distortions.

We should have little patience with the plea in mitigation that, in the circumstances, the Stalinist excesses (such as forced collectivisation) brought about some positive economic achievements. Statistics showing high growth rates during Stalin's time prove only that methods of

primitive accumulation can stimulate purely quantitative growth in the early stages of capitalism or socialism — but at what human cost? In any case, more and more evidence is emerging daily that, in the long run, the excesses inhibited the economic potential of socialism.

Another familiar plea in mitigation is that the mobilising effect of the Stalin cult helped save socialism from military defeat. It is, however, now becoming clear that the virtual destruction of the command personnel of the Red Army, the lack of effective preparation against Hitler's onslaught and Stalin's dictatorial and damaging interventions in the conduct of the war could have cost the Soviet Union its victory.

Vigilance is clearly needed against the pre-perestroika styles of work and thinking which infected virtually every party (including ours) and moulded its members for so many decades. It is not enough merely to engage in the self-pitying cry: 'we were misled'; we should rather ask why so many communists allowed themselves to become so blinded for so long. And, more importantly, why they behaved like Stalinists towards those of their comrades who raised even the slightest doubt about the 'purity' of Stalin's brand of socialism.

In the socialist world there are still outposts which unashamedly mourn the retreat from Stalinism and use its dogmas to 'justify' undemocratic and tyrannical practices. It is clearly a matter of time before popular revulsion leads to a transformation. In general, those who still defend the Stalinist model -- even in a qualified way — are a dying breed; at the ideological level they will undoubtedly be left behind and they need not detain us here.

B. Blaming Gorbachev

Most communists, of course, concede that a great deal 'went wrong' and needs to be corrected. Some, however, fear that the corrective methods are so hasty and extreme that, in the end, they may do more harm than good. The enemies of socialism, so it is argued, are being given new powerful weapons with which to destroy socialism and to return to capitalism. The pace of Gorbachev's perestroika and glasnost are, either directly or indirectly, blamed for the 'collapse' of communist

1 Marx used the term 'primitive accumulation' to describe the **original** process of capitalist accumulation which, he maintained, was not the result of abstinence but rather of acts (including brigandage) such as the expropriation of the peasantry as happened during the British Enclosures (*Capital* Volume I, Part VII). Preobrazhensky in *The New Economics* (1926) talked about 'primitive socialist accumulation' involving the expropriation of resources from the better-off classes to generate capital for socialist industrial development. Here, the term is used to describe the arbitrary measures taken against the Soviet peasantry to forcibly 'enclose' them into collectives.

political hegemony in countries like Poland, Hungary, GDR and Czechoslovakia.

In the countries mentioned, despite the advantage of over 40 years of a monopoly of education, the media, etc., the parties in power could not find a significant section of the class they claimed to represent (or, for that matter, even a majority of their own membership) to defend them or their version of socialism. **To blame perestroika and glasnost for the ailments of socialism is like blaming the diagnosis and the prescription for the illness.** Indeed, the only way to ensure the future of socialism is to grasp the nettle with the political courage of a Gorbachev.

When things go badly wrong (whether it be in a movement or a country) it is inevitable that some who have ulterior motives jump on to the bandwagon. When a gap develops between the leadership and the led, it always provides openings for real enemies. But to deal with the gap in terms only of enemy conspiracies is an ancient and discredited device. Equally, to fail to tackle mistakes or crimes merely because their exposure will give comfort to our adversaries is both short-sighted and counter-productive.

In any case, a number of additional questions still go begging:

Firstly, have we the right to conclude that the enemies of a discredited party leadership are the same as the enemies of socialism? If the type of socialism which the people have experienced has been rubbished in their eyes and they begin to question it, are they necessarily questioning socialism or are they rejecting its perversion?

Secondly, what doctrine of pre-Stalinism and pre-Mao Marxism gives a communist party (or any other party for that matter) the moral or political right to impose its hegemony or to maintain it in the face of popular rejection?

Thirdly, who has appointed us to impose and defend at all costs **our version of socialism** even if the overwhelming majority have become disillusioned with it?

In general, it is our view that the fact that the processes of perestroika and glasnost came too slowly, too little and too late in Eastern Europe did more than anything else to endanger the socialist perspective there. **It is through these processes — and they must be implemented with all possible speed — that socialism has any hope of showing its essentially human face.** When socialism as a world system comes into its own again — as it undoubtedly will — the 'Gorbachev revolution' will have played a seminal role.

C. Abandoning the Ideological Contest

We are impressed with the contribution which crusading pro-perestroika journals (such as *Moscow News* and *New Times*) are making to the renovation of socialism. At the same time, we must not overlook the alarming tendency among many media partisans of perestroika to focus so exclusively on the blemishes of the socialist experience that the **socialist critique of capitalism and imperialism finds little, if any, place.**

In keeping with this excessive defensiveness, there is a tendency to underplay some of the most graphic pointers to the superior moral potential of socialist civilisation. For instance, it is a sad commentary on earlier socialist history that the Soviet people are now moved to erect monuments to the victims of the Stalin period. But the capitalist world is planning no monuments to those of its citizens ravaged by its cruelties nor to millions of victims of its colonial terror.

The transformations which have occurred in Poland, Hungary, the German Democratic Republic, Czechoslovakia and Bulgaria are revolutionary in scope. With the exception of Romania, is there another example in human history in which those in power have responded to the inevitable with such a civilised and pacific resignation?

We should remember De Gaulle's military response in 1968 when ten million workers and students filled the streets of Paris. It is not difficult to forecast how Bush or Thatcher would deal with millions in their streets supported by general strikes demanding the overthrow of their system of rule.

Some Soviet journals have become so exclusively focused on self-criticism that the social inequalities within capitalism and the continuing plunder by international capital of the resources of the developing world through neo-colonial manipulation, unequal trade and the debt burden, receive little emphasis. Middle class elements, including many journalists within socialist societies, seem **mesmerised by pure technocracy; the glitter of Western consumerism, and the quality of up-market goods, appear to overshadow the quality of life for society as a whole.**[2]

There is less visible than at any time a critique of imperialism's continuing human rights violations and its gross interference in the internal affairs of sovereign states through surrogates and direct aggression, and its continuing support for banditry and racist and military dictatorships.

The gloss which is put in some of these journals on social and political conditions inside the capitalist West itself has been described by Jonathan Steele in the British *Guardian* as little less than 'grotesque'. In some contributions capitalism is prettified in the same generalised and unscholarly way as it used to be condemned, i.e. without researched statistics and with dogma taking the place of information. The borderline between socialism and what is called welfare capitalism is increasingly blurred.

In contrast to all this, whatever else may be happening in international relations, **the ideological offensive by the representatives of capitalism against socialism is certainly at full blast.**

The Western media gloat repeatedly with headlines such as 'Communism — R.I.P.'. Professor Robert Heilbroner, a luminary of the New York New School, has already raised his champagne glass with a victory toast for capitalism. Asserting that the Soviet Union, China and Eastern Europe have proved that capitalism organises the material affairs of humankind more satisfactorily than socialism, he goes on to proclaim:

> 'Less than 75 years after it officially began, the contest between capitalism and socialism is over; capitalism has won ... the great question now seems how rapid will be the transformation of socialism into capitalism, and not the other way around.'[3]

Just in case more is needed to fulfil this prediction, some of capitalism's most powerful representatives are there to give history a helping hand. Reagan's final boast for his eight years in office was that he saw to it that not one more inch of territory in the world 'went communist'. Bush takes up the baton with: 'We can now move from containment to bring the socialist countries into the community of free nations'. The *Guardian* (2/6/89, United Kingdom) reports a multi-million pound initiative, endorsed by British ministers, to encourage change in Eastern Europe. And so on.

In the face of all this, it is no exaggeration to claim that, for the moment, the socialist critique of capitalism and the drive to win the hearts and minds of humanity for socialism have been virtually abandoned. **The unprecedented offensive by capitalist ideologues against socialism has indeed been met by a unilateral ideological disarmament.**

2. Socialism, as a transition phase to communism, is not based on full egalitarianism. But clearly the socialist maxim 'to each according to his contribution' is not applied absolutely in a socialist society which devotes a large slice of its resources to social services, subsidising basic necessities, and implementing the human right of guaranteed employment. **The middle strata in socialist society are inevitably worse off than their counterparts in the West. Access to the flesh-pots of consumer goods (which the West produces for the upper crust in almost mind-bending variations) is more restricted when society tries to use its surplus to achieve a more just distribution of wealth.**

3. The *New Yorker*, January 23, 1989

To the extent that this has come about through the need to concentrate on putting our own house in order it is, at least, understandable. But, in many cases, there is an inability to distinguish between socialism in general and the incorrect methods which were used to translate it on the ground. This has led to an unjustified flirtation with certain economic and political values of capitalism.

The perversion of democracy in the socialist experience is falsely contrasted to its practice in the capitalist West as if the latter gives adequate scope for the fulfilment of democratic ideals. The economic ravages caused by excessive centralisation and commandism under socialism seem also to have pushed into the background the basic socialist critique of capitalism that **a society cannot be democratic which is ruled by profit and social inequality and in which power over the most vital areas of life is outside public control.**

D: Losing Faith in the Socialist Objective

Some communists have been completely overwhelmed by the soiled image of socialism which they see in the mirror of history. They conclude that it reflects not only **what was** (and in the case of some countries, **what still is**), but, in addition, **what inevitably had to be** in the attempts to build a socialist society as understood by the founding fathers of socialist doctrine.

If, indeed, what happened in the socialist world **had to happen** because of some or all of our theoretical starting points, if the Stalin-type perversion is unavoidable, then there is no more to be said; we must clearly either seek an alternative to socialism or throw overboard, or at least qualify, some of its postulates.[4]

We believe, however, that the theory of Marxism, in all its essential respects, remains valid and provides an indispensable theoretical guide to achieve a society free of all forms of exploitation of person by person. The major weaknesses which have emerged in the practice of socialism are the results of distortions and misapplications. They do not flow naturally from the basic concepts of Marxism whose core is essentially humane and democratic and which project a social order with an economic potential vastly superior to that of capitalism.

4. In the recent period a number of European and African political parties have 'officially' abandoned Marxism-Leninism as a theoretical guide. In the case of FRELIMO, the decision appears to be the result of second thoughts on what may, in the circumstances, have been a premature transformation of the movement into a communist vanguard. But in the case of some Western parties the decision seems to be a response (with undoubted electoral implications) to the distortions of the socialist experience rather than a reasoned conclusion that Marxism is not a viable tool in the socialist endeavour. **A leading Soviet academic (reported in *Work in Progress* No.48, July 1987, p.7) has predicted that South Africa has no chance of becoming socialist for a century.**

— THREE —
MARXIST THEORY UNDER FIRE

Let us touch on some of the concepts which have come under fire in the post-perestroika polemics:

- Marxism maintains that the class struggle is the motor of human history.[1] Some commentators in the socialist media are showing a temptation to jettison this theory merely because Stalin and the bureaucracy around him distorted it to rationalise tyrannical practices. But **it remains valid both as an explanation of past social transformations and as a guide to the strategy and tactics of the struggle to win a socialist order;** a struggle in which the working class plays the dominant role.

- The economic stagnation of socialism and its poor technological performance as compared to the capitalist world sector cannot be attributed to the ineffectiveness of socialist relations of production but rather to their distortion. **Socialist relations of production provide the most effective framework for maximising humanity's productive capacity and using its products in the interests of the whole society.**

- Marxist ethical doctrine sees no conflict between the contention that all morality is class-related and the assertion that working class values are concerned, above all, with the supremacy of human values.[2] The separation of these inter-dependent concepts (in later theory and practice) provided the context in which crimes against the people were rationalised in the name of the class.

1. This must be understood as providing the **immediate** explanation of the way **major** social change manifests itself in a situation in which the relations of production have become obstacles to the development of productive forces.

2. This type of formulation is preferred to the one occasionally used by Gorbachev that there are certain universal human values which take priority over class values. This latter formulation tends to detract from the inter-dependence of working class and human morality. It also perhaps goes too far in separating morality from its class connection, even though it is clear that the assertion of certain values can be in the mutual interests of otherwise contending classes.

We continue to assert that it is only in a non-exploitative, communist, classless society that human values will find their ultimate expression and be freed of all class-related morality. In the meanwhile the socialist transition has the potential of progressively asserting the values of the whole people over those of classes.

- The great divide which developed between socialism and political democracy should not be treated as flowing naturally from key aspects of socialist doctrine. This approach is fuelled by the sullied human rights record and the barrack-room collectivism of some of the experiences of existing socialism. We believe that **Marxism clearly projects a system anchored in deep-seated political democracy and the rights of the individual which can only be truly attained when society as a whole assumes control and direction of all its riches and resources.**

- The crucial connection between socialism and internationalism and the importance of world working-class solidarity should not be underplayed as a result of the distortions which were experienced. These included excessive centralisation in the era of the Comintern, subordination of legitimate national aspirations to a distorted concept of 'internationalism', national rivalries between and within socialist states (including examples of armed confrontation). **Working class internationalism remains one of the most liberating concepts in Marxism and needs to find effective expression in the new world conditions.**

In summary, we believe that Marxism is a social science whose fundamental postulates and basic insights into the historical processes remain a powerful (because accurate) theoretical weapon. But this is not to say that every word of Marx, Engels and Lenin must be taken as gospel; they were not infallible and they were not always correct in their projections.

Lenin, for example, believed that capitalism was about to collapse worldwide in the post-October period.

It was a belief based on the incorrect premise that, as a system, capitalism had already reached the stage at which the capitalist relations of production constituted an obstacle to the further all-round development of the forces of production.

This was combined with a belief in the imminence of global socialist transformation, which undoubtedly infected much of the earlier thinking about the perspectives of socialist construction in the Soviet Union.

Also, it could well be argued that the classical description of bourgeois democracy[3] was an over-simplification and tended to underestimate the historic achievements of working class struggle in imposing and defending aspects of a real democratic culture on the capitalist state; a culture which should not disappear but rather needs to be expanded under true socialism.

But we emphasise again that the fundamental distortions which emerged in the practice of existing socialism cannot be traced to the essential tenets of Marxist revolutionary science.

If we are looking for culprits, we must look at ourselves and not at the founders of Marxism.

The Fault Lies with us, not with Socialism

In some cases, the deformations experienced by existing socialist states were the results of bureaucratic distortions which were rationalised at the ideological level by a mechanical and out-of-context invocation of Marxist dogma. In other cases they were the results of a genuinely-motivated but tragic mis-application of socialist theory in new realities which were not foreseen by the founders of Marxism.

The fact that socialist power was first won in the most backward outpost of European capitalism, without a democratic political tradition, played no small part in the way it was shaped. To this must be added the years of isolation, economic siege and armed intervention which, in the immediate post-October period, led to the virtual decimation of the Soviet Union's relatively small working class. In the course of time the party leadership was transformed into a command post with an overbearing centralism and very little democracy, even in relation to its own membership.

Most of the other socialist countries emerged 30 years later in the shadow of the cold war. Some of them owed a great deal to Soviet power for their very creation and survival, and the majority, for a great part of their history, followed the Stalinist economic and political model. Communists outside the socialist world and revolutionaries engaged in anti-colonial movements were the beneficiaries of generous aid and consistent acts of internationalist solidarity. They correctly saw in Soviet power a bulwark against their enemies and either did not believe, or did not want to believe, the way in which aspects of socialism were being debased.

All this helps to explain, but in no way to justify, the awful grip which Stalinism came to exercise in every sector of the socialist world and over

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3. See Lenin, State and Revolution, *Selected Works* pp 203-4.

the whole international communist movement. It was a grip which, if loosened by either parties (e.g. Yugoslavia) or individuals within parties, usually led to isolation and excommunication.

We make no attempt here to answer the complex question of why so many millions of genuine socialists and revolutionaries became such blind worshippers in the temple of the cult of the personality. Suffice it to say that the strength of this conformism lay, partly, in an ideological conviction that those whom history had appointed as the custodians of humankind's communist future seemed to be building on foundations prepared by the founding fathers of Marxism. And there was not enough in classical Marxist theory about the nature of the transition period to provide a detailed guide to the future.

This under-developed state of classical Marxist theory in relation to the form and structure of future socialist society lent itself easily to the elaboration of dogma which could claim general 'legitimacy' from a selection of quotes from the masters. But the founders of Marxism

> 'never invented specific forms and mechanisms for the development of the new society. They elaborated its socialist ideal ... they provided the historically transient character of capitalism and the historical need for transition to a new stage of social development. As for the **structure of the future society to replace capitalism, they discussed it in the most general terms** and mostly from the point of view of fundamental principles' (my emphasis)[4]

In particular, let us consider two issues:
a) socialism and democracy, and the related question
b) social and economic alienation under socialism.

4. M. Gorbachev in *Pravda* November 26th, 1989

— FOUR —
SOCIALISM AND DEMOCRACY

Marxist ideology saw the future state as 'a direct democracy in which the task of governing would not be the preserve of a state bureaucracy'[1] and as 'an association in which the free development of each is a condition for the free development of all'.[2] **How did it happen that, in the name of this most humane and liberating ideology, the bureaucracy became so all-powerful and the individual was so suffocated?**

To find, at least, the beginnings of an answer we need to look at four related areas:
a) The thesis of the 'Dictatorship of the Proletariat' which was used as the theoretical rationalisation for unbridled authoritarianism.
b) The steady erosion of people's power both at the level of government and mass social organisations.
c) The perversion of the concept of the party as a vanguard of the working class, and
d) Whether, at the end of the day, socialist democracy can find real expression in a single-party state.

A. Dictatorship of the Proletariat

The concept of the 'Dictatorship of the Proletariat' was dealt with rather thinly by Marx as 'a transition to a classless society' without much further definition.[3] For his part Engels, drawing on Marx's analysis of the Paris Commune, claimed that it indeed 'was the Dictatorship of the Proletariat'.[4] The Paris Commune of 1871 was an exceptional social experience which brought into being a kind of workers' city-state (by no means socialist-led) in which, for a brief moment, most functions of the state (both legislative and executive) were directly exercised by a popular democratic assembly.

1. Marx: *Civil War in France*
2. *Communist Manifesto*
3. Letter to J. Wademeyer, see also 'Critique of the Gotha Programme', *Selected Works, p.331*
4. *Introduction to Civil War in France*

The concept of the 'Dictatorship of the Proletariat' was elaborated by Lenin in *State and Revolution* in the very heat of the revolutionary transformation in 1917. Lenin quoted Engels approvingly when he said that 'the proletariat needs the state, not in the interests of freedom but in order to hold down its adversaries, and as soon as it becomes possible to speak of freedom the state as such ceases to exist' (Engels, Letter to Bebel). In the meanwhile, in contrast to capitalist democracy which is 'curtailed, wretched, false ... for the rich, for the minority ... the dictatorship of the proletariat, the period of transition to communism, will, for the first time, **create democracy ... for the majority** ... along with the necessary suppression of the exploiters, of the minority.'[5]

Lenin envisaged that working-class power would be based on the kind of democracy of the Commune, but he did not address, in any detail, the nature of **established socialist civil society**, including fundamental questions such as the relationship between the party, state, people's elected representatives, social organisations, etc. Understandably, the dominant preoccupation at the time was with the seizure of power, its protection in the face of the expected counter-revolutionary assault, the creation of 'democracy for the majority' and the 'suppression of the minority of exploiters'.

Rosa Luxemburg said, in a polemic with Lenin:

> 'Freedom only for the supporters of the government, only for the members of one party — however numerous they may be — is not freedom at all. Freedom is always and exclusively freedom for the one who thinks differently ... its effectiveness vanishes when "freedom" becomes a special privilege.'[6]

These words may not have been appropriate as policy (which is what Luxemburg argued for) in the special conditions of the phase immediately after the seizure of power in October 1917. **Without a limitation on democracy there was no way the revolution could have defended itself in the civil war and the direct intervention by the whole of the capitalist world.** But Luxemburg's concept of freedom is surely incontrovertible once a society has achieved stability.

Lenin clearly assumed that whatever repression may be necessary in the immediate aftermath of the revolution would be relatively mild and short-lived. The state and its traditional instruments of force would begin to 'wither away' almost as soon as socialist power had been won and the process of widening and deepening democracy would begin.

5. *Selected Works*, Volume Two, pp302-3
6. *The Russian Revolution*, p.79

Lenin was referring to the transitional socialist state (and not to the future communist society) when he emphasised that **there would be an extension of 'democracy to such an overwhelming majority of the population that the need for a special machine of suppression will begin to disappear** ... it is no longer a state in the proper sense of the word (because) the suppression of the minority of exploiters ... is easy, simple', entailing relatively little bloodshed, and hardly needing a machine or a special apparatus other than 'the simple organisation of the armed people (such as the Soviets) ...'[7]

We know that all this is a far cry from what happened in the decades which followed. The whole process was put in reverse. The complete 'suppression of the exploiters' was followed by the strengthening of the instruments of state suppression and **the narrowing of democracy for the majority of the population, including the working class.**

The anti-Leninist theory advanced (in the name of Lenin) to 'justify' this process was that the class struggle becomes more rather than less intense with the entrenchment of socialism. In some respects this became a self-fulfilling prophecy; a retreat from democratic norms intensified social contradictions which, in turn, became the excuse for an intensification of the 'class struggle'.

One of the key rationalisations for this thesis was the undoubted threat, even after the end of the civil war, posed by imperialism and fascism to the very survival of the Soviet Union and the continuing Western conspiracies to prevent the spread of socialist power after 1945. But events have demonstrated that if the survival of the Soviet Union was at risk from the fascist onslaught it was, among other reasons, also the result of damage wrought to the whole Soviet social fabric (including its army) by the authoritarian bureaucracy. And if Western 'conspiracies' have succeeded in threatening the very survival of socialism in places like Eastern Europe, it is the narrowing rather than the extension of democracy which has played into their hands.

The term 'Dictatorship of the Proletariat' reflected the historical truth that in class-divided social formations state power is ultimately exercised by, and in the interests of, the class which owns and controls the means of production. It is in this sense that capitalist formations were described as a 'dictatorship of the bourgeoisie' whose rule would be replaced by a 'dictatorship of the proletariat' during the socialist transition period. In the latter case power would, however, be exercised in the interests of the overwhelming majority of the people and should lead to an ever-expanding genuine democracy — both political and economic.

7. *Selected Works*, Volume Two, pp303-4

On reflection, the choice of the word 'dictatorship' to describe this type of society certainly opens the way to ambiguities and distortions.

The abandonment of the term by most communist parties, including ours, does not, in all cases. imply a rejection of the historical validity of its essential content. But, the way the term came to be abused bore little resemblance to Lenin's original concept. It was progressively denuded of its intrinsic democratic content and came to signify, in practice, a dictatorship of a party bureaucracy. For Lenin the repressive aspect of the concept had impending relevance in relation to the need for the revolution to defend itself against counter-revolutionary terror in the immediate post-revolution period.[8] He was defending, against the utopianism of the anarchists, the limited retention of repressive apparatus.

But, unfortunately, practices justified by the exigencies of the earlier phases became a permanent feature of the new society. As time went on the gap between socialism and democracy widened; the nature and role of the social institutions (such as the Soviets, the party and mass organisations) which had previously given substance to popular power and socialist democracy, were steadily eroded.

B. Elected Bodies and Mass Organisations

The steady erosion of the powers and representative character of **elected institutions** led to the alienation of a considerable portion of society from political life. The electorate had no effective right to choose its representatives. Gone were the days when the party had to engage in a political contest to win a majority in the Soviets. The legislative organs did not, in any case, have genuine control over legislation; by their nature they could only act as rubber stamps for decisions which had already been taken by party structures. The executive and judicial organs were, for all practical purposes, under the direct control of the party bureaucracy. **In practice the majority of the people had very few levers with which to determine the course of economic or social life.**

Democracy in the mass organisations was also more formal than real. The enormous membership figures told us very little about the extent to which the individual trade unionist, youth or woman was able to participate in the control or direction of their respective organisations. At the end of the day these organisations were turned into transmission belts for decisions taken elsewhere and the individual members were

8. It is instructive to note how Western anti-Marxists and liberals understood and even welcomed the imposition of the most blatant dictatorial methods to deal with the counter-revolutionaries in the immediate aftermath of the overthrow of the Ceaucescu regime.

little more than cogs of the vast bureaucratic machine.

The trade union movement became an adjunct of the state and party. Workers had no meaningful role in determining the composition of the top leadership which was, in substance, answerable to the party apparatus. For all practical purposes the right to strike did not exist. The extremely thin dividing line between management and the trade union collective on the factory floor detracted from the real autonomy of trade unions. Apart from certain welfare functions, they tended, more and more, to act like Western-style production councils, but without the advantage of having to answer for their role to an independent trade union under the democratic control of its membership.

Much of the above applied to the **women's and youth organisations.** Instead of being guided by the aspirations and interests of their constituencies, they were turned into support bases for the ongoing dictates of the state and party apparatus.[9]

The Party

In the immediate aftermath of the October revolution, the Bolshevik party shared power with other political and social tendencies, including Mensheviks and a section of the left Social Revolutionaries. In the elections for the constituent assembly in 1918, the Bolsheviks received less than a third of the popular vote.[10]

There may be moments in the life of a revolution which justify a postponement of full democratic processes. And we do not address the question of whether the Bolsheviks were justified in taking a monopoly of state power during the extraordinary period of both internal and external assault on the gains of the revolution. Suffice it to say that the single-party state and the guiding and leading role of the party subsequently became permanent features of socialist rule and were entrenched in the constitutions of most socialist states.[11] **Henceforth the parties were 'vanguards' by law and not necessarily by virtue of social endorsement.**

9. A stark illustration of this is the failure of any of the women's organisations in the socialist countries to mount agitation against the continuing inequalities between men and women in key social and political sectors. It is utterly inconceivable that the women's organisations could have failed to notice the continuing male-oriented structure of the family and the overwhelming male domination (more so than even in the capitalist West) of all structures of political power.

10. The total number of votes cast was 36.26 million. Of the major parties, the Social Revolutionaries received 20.9 million, the Bolsheviks 9.02 million, the Cadets 1.8 million, the Mensheviks 0.6 million and the rest was shared between 20 other parties.

11. Some of the socialist countries were ruled by a front but in substance the allies of the communist parties had little, if any, power or effective autonomy.

This was accompanied by negative transformations within the party itself. Under the guise of 'democratic centralism' inner-party democracy was almost completely suffocated by centralism. All effective power was concentrated in the hands of a Political Bureau or, in some cases, a single, all-powerful personality. The control of this 'leadership' by the party as a whole was purely formal. In most cases the composition of the highest organ — the congress which finalised policy and elected the leadership — was manipulated from the top.

The Central Committee (elected by variations of a 'list' system emanating from the top) had only the most tenuous jurisdiction over the Political Bureau. Within this latter body a change of leaders resembled a palace coup rather than a democratic process; invariably the changes were later unanimously endorsed.

The invigorating impact of the contest of ideas in Marxist culture was stifled. In practice, the basic party unit was there to explain, defend, exhort and support policies in whose formulation they rarely participated. The concept of consensus effectively stifled dissent and promoted the completely unnatural appearance of unanimity on everything. Fundamental differences were either suppressed or silenced by the self-imposed discipline of so-called democratic centralism. In these conditions the democratic development of party policy became a virtual impossibility.

D. The Single-Party State

Hegel coined the profound aphorism that truth is usually born as a heresy and dies as a superstition. With no real right to dissent by citizens or even by the mass of the party membership, truth became more and more inhibited by deadening dogma; a sort of catechism took the place of creative thought. And, within the confines of a single-party state, the alternative to active conformism was either silence or the risk of punishment as 'an enemy of the people'.

Is this suppression of the right to dissent inherent in the single-party state? Gorbachev recently made the point that:

> 'Developing the independent activities of the masses and prompting democratisation of all spheres of life under a one-party system is a noble but **very difficult mission** for the party. And a great deal will depend on how we deal with it'.[12]

Gorbachev's thought has special relevance to many parts of our own

12. *Pravda* November 26, 1989

continent where the one-party system abounds. It straddles both capitalist and socialist-oriented countries and in most of them it is used to prevent, among other things, the democratic organisation of the working people either politically or in trade unions.

This is not to say that all one-party states in our continent have in fact turned out to be authoritarian; indeed some of them are headed by the most humane leaders who passionately believe in democratic processes. Nor can we dismiss the role they have played in preventing tribal, ethnic and regional fragmentation, combating externally-inspired banditry, and correcting some of the grave distortions inherited from the colonial period.

In relation to the socialist perspective, it is sometimes forgotten that the concept of the single-party state is nowhere to be found in classical Marxist theory. **And we have had sufficient experience of one-party rule in various parts of the world to perhaps conclude that the 'mission' to promote real democracy under a one-party system is not just difficult but, in the long run, impossible.**

But, in any case, where a single-party state is in place and there is not even democracy and accountability within the party, it becomes a short-cut to a political tyranny over the whole of society. And at different points in time this is what happened in most socialist states.

The resulting sense of **political alienation** of the great majority of the people was not the only negative feature of existing socialism. Of equal importance was the failure to overcome the sense of **economic alienation** inherited from the capitalist past.

— FIVE —
SOCIALIST ECONOMIC ALIENATION

The concept of alienation expressed 'the objective transformation of the activity of man and of its results into an independent force, dominating him and inimical to him ...'[1] Alienation has its origins in class-dominated society based on private property. Under capitalism, in the course of the production process, the worker himself 'always produces objective wealth, in the form of capital, an alien power that dominates and exploits him'.[2] Thus, the exploited classes objectively create and recreate the conditions of their own domination and exploitation. Consciousness of this fuels the class struggle against capitalist relations of production.

The aim of communism is to achieve the complete mastery and control over social forces which humanity itself has generated but which, under capitalism, have become objectified as alien power which is seen to stand above society and exercises mastery over it. Communism, according to Marx, involves the creation of a society in which 'socialised humanity, the associated producers, regulate their interchange with nature rationally, **bringing it under their common control, instead of being ruled by it as by some blind power'.**[3]

The relevance of all this for our discussion is that only genuine socialist relations of production can begin the process which will lead to the **de-alienation** of society as a whole and generate the formation of a **new 'socialist person'**. The process of de-alienation — whose completion must await the stage of communism — cannot be advanced by education and ideology alone; conditions must be created which lead progressively to real **participation and control** by each individual (as part of 'socialised humanity') over social life in all its aspects.

The destruction of the political and economic power of capital are merely first steps in the direction of de-alienation. **The transfer of legal ownership of productive property from private capital to the state does not, on its own, create fully socialist relations of production, nor does it always significantly change the work-life of the producer.** The power to control the producers' work-life and to dispose of the products of labour is now in the hands of a 'committee' rather than a board of directors. And if the 'committee' separates itself from the producers by a bureaucratic wall without democratic accountability, its role is perceived no differently from that of the board of directors. It remains a force over which the producer has no real control and which (despite the absence of economic exploitation of the capitalist variety) dominates him as an alien power.

State property itself has to be transformed into social property. This involves reorganising social life as a whole so that the producers, at least as a collective, have a real say not only in the production of social wealth but also in its disposal. In the words of Gorbachev, what is required is **'not only formal but also real socialisation and the real turning of the working people into the masters of all socialised production'.**[4]

De-alienation requires that the separation between social wealth creation and social wealth appropriation and distribution is ended **and society as a whole is in control of all three processes.** A degree of self-management (at the level of individual enterprises) is only one ingredient in the process of de-alienation; conditions must be created making possible full popular control over **all society's institutions of power** not just as a 'constitutional right' but as a reality.

Alienation in Existing Socialism

The unavoidable inheritance from the past and the most serious distortions of socialist norms in most of the socialist countries combined to perpetuate alienation, albeit in a new form. **Private ownership** of the main means of production was replaced by **state ownership**. Private capital, as an alien power, no longer dominated or exploited the producer. But without real socialisation the key condition for de-alienation continued to be absent.

The immediate producers were given very little real control or participation in economic life beyond their own personal physical and/or mental exertions. In general, the over-centralised and commandist economies of the socialist world helped to entrench a form of 'socialist' alienation. **At the purely economic level this form of alienation often turned out to be the worst of both worlds.**

Under capitalism economic compulsion sanctified by the rule of capital (threatened unemployment, etc.) plays an important role in providing the 'incentive' for rising productivity despite alienation by

1 Marx, *Capital*, Volume 1, p.716, Penguin Books Edition
2 AP Ogurtsov, *Soviet Encyclopedia of Philosophy*
3 *Capital*, Volume 3, Chapter 48
4 *Pravda*, September 30, 1989

workers from the products of their labour. Capitalist economic levers based on the sanctity of private property are, at the end of the day, not over-concerned with the problems of alienation and more easily provide the incentive (in relation to the workers) that 'he who does not work, neither shall he eat'.

Under socialism guaranteed employment and the amount of remuneration did not always depend upon quality, productivity or efficiency, opening the way to parasitism at the point of production. Reward based on the socialist maxim of 'to each according to his contribution' can obviously play a part in increasing productivity. **But for socialist society as a whole to really come into its own requires an incentive based on the producer's real participation in the mechanisms of social control over the products of his/her labour; a feeling that the means of production and its products are his or hers as part of society.** This incentive was too often absent and stood in the way of the process of de-alienation.

Episodes of direct compulsion against producers, such as the forced collectivisation of the early 1930's and the extensive use of convict labour as a direct state and party exercise, made things worse. Like all forms of primitive accumulation, these episodes created a most profound sense of alienation whose negative consequences are still being felt. Pure exhortation and political 'mobilisation' did not, in the long run, prevent the onset of stagnation. Alienation, albeit in a different form, continued and inhibited the full potential of socialist economic advance.

There were, of course, other negative factors which require more extensive examination than is possible here. These include policies based on what has been called the 'big bang theory of socialism' which ignored the historical fact that many of the ingredients of social systems which succeed one another — and this includes the change from capitalism to socialism — cannot be separated by a Chinese Wall.

The economy of a country the day after the workers take over is exactly the same was it was the day before, and it cannot be transformed merely by proclamation. The neglect of this truism resulted, now and then, in a primitive egalitarianism which reached lunatic proportions under the Pol Pot regime, the absence of cost-accounting, a dismissive attitude to commodity production and the law of value during the transition period, the premature abandonment of any role for market forces, a doctrinaire approach to the question of collectivisation, etc.

But rectification of these areas alone would not establish the material and moral superiority of socialism as a way of life for humanity. Only the creation of real socialist relations of production will give birth to the socialist man and woman whose active participation in all the social processes will ensure that socialism reaches its full potential and moves

towards a classless communist society. Under existing socialism alienation has persisted because of a less than full control and participation by the people in these processes.

In short, the way forward is through thorough-going democratic socialism; a way which can only be charted by a party which wins its support through democratic persuasion and ideological contest and not, as has too often happened up to now, by a claim of right.

— SIX —
A LOOK AT OURSELVES

The commandist and bureaucratic approaches which took root during Stalin's time affected communist parties throughout the world, including our own. **We cannot disclaim our share of the responsibility for the spread of the personality cult and a mechanical embrace of Soviet domestic and foreign policies, some of which discredited the cause of socialism.** We kept silent for too long after the 1956 Khruschev revelations.

It would, of course, be naive to imagine that a movement can, at a stroke, shed all the mental baggage it has carried from the past. And our 7th Congress emphasised the need for on-going vigilance. It noted some isolated reversions to the past, including attempts to engage in intrigue and factional activity in fraternal organisations, sectarian attitudes towards some non-party colleagues, and sloganised dismissals of views which do not completely accord with ours.

The implications for socialism of the Stalinist distortions have not yet been evenly understood throughout our ranks. We need to continue the search for a better balance between advancing party policy as a collective and the toleration of on-going debate and even constructive dissent.

We do not pretend that our party's changing postures in the direction of democratic socialism are the results only of our own independent evolution. Our shift undoubtedly owes a prime debt to the process of perestroika and glasnost which was so courageously unleashed under Gorbachev's inspiration. Closer to home, the democratic spirit which dominated in the re-emerged trade union movement from the early 1970's onwards, also made its impact.

But we can legitimately claim that in certain fundamental respects our indigenous revolutionary practice long ago ceased to be guided by Stalinist concepts. This is the case particularly in relation to the way the party performed its role as a working class vanguard, its relations with fraternal organisations and representatives of other social forces and, above all, its approach to the question of democracy in the post-apartheid state and in a future socialist South Africa.

The Party as a Vanguard and Inner-Party Democracy

We have always believed (and we continue to do so) that it is indispensable for the working class to have an independent political instrument

which safeguards its role in the democratic revolution and which leads it towards an eventual classless society. But such leadership must be won rather than imposed. Our claim to represent the historic aspirations of the workers does not give us an absolute right to lead them or to exercise control over society as a whole in their name.

Our new programme asserts that a communist party does not earn the title of vanguard merely by proclaiming it. Nor does its claim to be the upholder of Marxism give it a monopoly of political wisdom or a natural right to exclusive control of the struggle. We can only earn our place as a vanguard force by superior efforts of leadership and devotion to the cause of liberation and socialism. And we can only win adherence to our ideology by demonstrating its superiority as a theoretical guide to revolutionary practice.

This approach to the vanguard concept has not, as we know, always been adhered to in world revolutionary practice and in an earlier period we too were infected by the distortion. **But, in our case, the shift which has taken place in our conception of 'vanguard' is by no means a post-Gorbachev phenomenon.** The wording on this question in our new programme is taken almost verbatim from our Central Committee's 1970 report on organisation.

The 1970 document reiterated the need to safeguard, both in the letter and the spirit, the independence of the political expressions of other social forces whether economic or national. It rejected the old purist and domineering concept that all those who do not agree with the party are necessarily enemies of the working class. And it saw no conflict between our understanding of the concept of vanguard and the acceptance of the African National Congress as the head of the liberation alliance.

Despite the inevitable limitations which illegality imposed on our inner-party democratic processes, the principles of accountability and elective of all higher organs were substantially adhered to. Seven underground Congresses of our party have been held since 1953. The delegates to Congress from the lower organs were elected without lists from above and always constituted a majority. The incoming Central Committees were elected by a secret ballot without any form of direct or indirect 'guidance' to the delegates. **In other words, the Leninist concept of democratic centralism has not been abused to entrench authoritarian leadership practices.**

Our structures, down to the lowest units, have been increasingly encouraged to assess and question leadership pronouncements in a critical spirit and the views of the membership are invariably canvassed before finalising basic policy documents. Our 7th Congress, which adopted our new programme, *The Path to Power*, was a model of democratic consultation and spirited debate.

Special procedures designed to exclude suspected enemy agents as delegates to Congress limited complete free choice. But, in practice, these limitations affected a negligible percentage. Overall, despite the security risks involved in the clandestine conditions, the will of our membership finds democratic expression. **This spirit of democracy also informs our relationship with fraternal political forces and our approach to the political framework of a post-liberation South Africa.**

Relations with Fraternal Organisations

As we have already noted, one of the most serious casualties in the divide which developed between democracy and socialism was in the one-sided relationship between the ruling parties and the mass organisations. In order to prevent such a distortion in a post-apartheid South Africa we have, for example, set out in our draft Workers' Charter that:

> 'Trade unions and their federation shall be completely independent and answerable only to the decisions of their members or affiliates, democratically arrived at. **No political party, state organ or enterprise, whether public, private or mixed, shall directly or indirectly interfere with such independence.'**

The substance of this approach is reflected in the way our party has in fact conducted itself for most of its underground existence.

Our 1970 extended Central Committee meeting reiterated the guidelines which inform our relations with fraternal organisations and other social forces. Special emphasis was once again given to the need to safeguard, both in the letter and in the spirit, the independence of the political expressions of other social forces, whether economic or national.

We do not regard the trade union or the national movement as mere conduits for our policies. Nor do we attempt to advance our policy positions through intrigue or manipulation. Our relationship with these organisations is based on complete respect for their independence, integrity and inner-democracy. In so far as our influence is felt, it is the result of open submissions of policy positions and the impact of individual communists who win respect as among the most loyal, the most devoted and ideologically clear members of these organisations.

Old habits die hard and among the most pernicious of these is the purist concept that all those who do not agree with the party are necessarily enemies of socialism. This leads to a substitution of name-calling and jargon for healthy debate with non-party activists. As already mentioned, our 7th Congress noted some isolated reversions along these lines and resolved to combat such tendencies.

But, in general, the long-established and appreciable move away from old-style commandism and sectarianism has won for our party the admiration and support of a growing number of non-communist revolutionary activists in the broad workers' and national movement. We also consider it appropriate to canvass the views of such activists in the formulation of certain aspects of our policy. For example, we submitted our preliminary conception of the contents of a Workers' Charter for critical discussion not only in our own ranks but throughout the national and trade union movements.

Democracy and the Future

Our party's programme holds firmly to a post-apartheid state which will guarantee all citizens the basic rights and freedoms of organisation, speech, thought, press, movement, residence, conscience and religion; full trade union rights for all workers including the right to strike, and one person one vote in free and democratic elections. **These freedoms constitute the very essence of our national liberation and socialist objectives and they clearly imply political pluralism.**

Both for these historical reasons and because experience has shown that an institutionalised one-party state has a strong propensity for authoritarianism; **a multi-party post-apartheid democracy, both in the national democratic and socialist phases, is desirable.**

We believe that post-apartheid state power must clearly vest in the elected representatives of the people and not, directly or indirectly, in the administrative command of a party. The relationship which evolves between political parties and state structures must not, in any way, undermine the sovereignty of elected bodies.

We also believe that if there is real democracy in the post-apartheid state, the way will be open for a peaceful progression towards our party's ultimate objective — a socialist South Africa. This approach is consistent with the Marxist view — not always adhered to in practice — that the working class must win the majority to its side: as long as no violence is used against the people there is no other road to power.[1]

It follows that, in truly democratic conditions, it is perfectly legitimate and desirable for a party claiming to be the political instrument of the working class to attempt to lead its constituency in **democratic contest for political power** against other parties and groups representing other social forces. And if it wins, it must be constitutionally required, from time to time, to go back to the people for a renewed mandate. The alternative to this is self-perpetuating power with all its implications for corruption and dictatorship.

1. Lenin, *Selected Works*, Volume 2, p36

Conclusion

We dare not underestimate the damage that has been wrought to the cause of socialism by the distortions we have touched upon. We, however, continue to have complete faith that socialism represents the most rational, just and democratic way for human beings to relate to one another.

- ***Humankind can never attain real freedom until a society has been built in which no person has the freedom to exploit another person.***
- ***The bulk of humanity's resources will never be used for the good of humanity until they are in public ownership and under democratic control.***
- ***The ultimate aim of socialism, to eliminate all class inequalities, occupies a prime place in the body of civilised ethics even before Marx.***
- ***The all-round development of the individual and the creation of opportunities for every person to express his or her talents to the full can only find ultimate expression in a society which dedicates itself to people rather than profit.***

The opponents of socialism are very vocal about what they call the failure of socialism in Africa.[2] But they say little, if anything, about Africa's real failure; the failures of capitalism. **Over 90 percent of our continent's people live out their wretched and repressed lives in stagnating and declining capitalist-oriented economies.** International capital, to whom most of these countries are mortgaged, virtually regards cheap bread, free education and full employment as economic crimes. Western outcries against violations of human rights are muted when they occur in countries with a capitalist orientation.

The way forward for the whole of humanity lies within a socialist framework guided by genuine socialist humanitarianism and not within a capitalist system which entrenches economic and social inequalities as a way of life. Socialism can undoubtedly be made to work without the negative practices which have distorted many of its key objectives.

But mere faith in the future of socialism is not enough. The lessons of past failures have to be learnt. Above all, we have to ensure that its fundamental tenet — socialist democracy — occupies a rightful place in all future practice.

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2. They conveniently ignore the fact that most of the countries which tried to create conditions for the building of socialism faced unending civil war, aggression and externally-inspired banditry; a situation in which it is hardly possible to build any kind of stable social formation — capitalist or socialist.

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1. Monomania about physics & eco. "Respect" for neoclassical eco. Attempt to sweep all sound theoretical & historical issues? Ideology? Politics? certainly eco, under the energy concept (symptomatic treatment of Marx)

2. Focus is on the scientific of the method (i.e. the formal self-representation) of neoclassical economics. Complains bitterly about its divorce from "empirical implementation & experiment" (1987, 80) Yet he himself never addresses the practical content of neoclassical (or Keynesian) eco. (He knows everything about the philosophy of surgery, & the concept of the scalpel. But...) 2/20/90

(1)

1. Is the objection that neoclassical economics imitated physics, or that it imitated the wrong physics ("nineteenth century physics")?
   — E.G. appropriation of "stochastic concepts" by Mirowski himself, of catastrophe theory of nonlinear dynamics, etc., by others, of entropy by Georgescu-Roegen

2. His own predelictions are for game theory, stochastic concepts, and Georgescu-Roegen (Mirowski, More Heat than Light, CUP, 1989:10) as discussed in ch 8 of the text.

3. Conservation and Energy

   (I) "our best provisional def. of a 'conservation principle' is the rule that some particular aspect of a phenomenon remains invariant or unaltered while the greater phenomenon undergoes certain specified transformations" (13)

   (II) The energetics movement, of the late nineteenth century aimed to "deduce the whole of physical theory" from three basic concepts (space, time, and energy) and two principles (conservation of energy, irreversibility between 'actual energy' and 'potential energy') (50, 53). The program rapidly fell out of favor within physics in the early 20th century. (1865) Clausius formalized these two principles as the First and Second laws of Thermodynamics (energy of the universe as a constant, and entropy of the universe increased to a max) (61). To make the irreversibility of Thermodynamics (Second Law) consistent with the apparent reversibility of "all other physical laws", the "second law as reinterpreted to mean that things go in one direction on time, not because they CANNOT go back the reverse way, but rather because it is just extremely unlikely that they do

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Backward in time" (63) [From Maxwell's Demon to Prigogine]
This opened the door to probability, randomness, and ~~only~~ statistical determinacy only in the large into physics (63-64)
[But this is more at a conceptual & philosophical level, rather than practical, since "it has been estimated that 90% of all engineering systems cannot be treated by currently available methods of statistical mechanics, and are instead resolved by resort to classical thermodynamics or phenomenological procedures" (66)]

[He sees "chaos theory" as telling "us that deterministic differential systems may exhibit indeterminate and seemingly stochastic evolution of dependent variables" (76), although whether "this was the final break from determinism remains to be seen" (74)]

(III) In the Special Theory, Einstein revises the "conservation of energy into the conservation of mass and energy $E = mc^2$. Thus in a sense confirms the 'energetics movement's' earlier claim that "matter must be ultimately reduced to energy" (79)
But in the General Theory, gravitation makes space-time irregular, and these irregularities mean that "in the presence of gravitation, energy and momentum are no longer conserved" (80)
In "General" Relativity, no general conservation principle has yet been found (81-82).

(IV) "Quantum mechanics attacked the last bastion of the energy concept, the

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assertion of continuity", and in the process throw out "all commonsense notions of causality, persistence, & identity" (88-89)

(v) He ends by quoting Guth [1983] on the possibility that "the universe may be completely devoid of all conserved quantum numbers, ... [so that] our observed universe emerged from nothing or from almost nothing. I have often heard that there is no such thing as a free lunch. It now appears possible that the universe is a free lunch" [Guth, 1983, quoted on pp 97-98]

To this Mirowski adds "No doubt about it; this has got to be bad news for an economist" (98)

(vi) Summary & connection to economics: The energy concept, in all its guises and attempted guises, is based on "the conviction that nature is economical" (100)

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STAGNATION AND UNDERCONSUMPTION IN SWEEZY AND STRACHEY*

Manuel Roman

*Anwar Shaikh taught me the critical stance taken in this paper. I also owe to him the idea of comparing Sweezy and Strachey's economics. Any mistakes outstanding are my responsibility.

Stagnation and Underconsumption in Sweezy and Strachey

Introduction

Strachey's book The Nature of Capitalist Crisis and Sweezy's The Theory of Capitalist Development are today classic texts in Marxist economics. In my view, we can learn from these books far more about the fallacies of orthodox Marxism than we can about the crisis of capitalism itself. Both texts treat capitalism as a system mired in a swamp of chronic stagnation and appeal to external contingencies to explain its vigorous growth in the twentieth century [Commerce Dept. 1973].Both identify underconsumption as the chief cause of the stagnation, with Strachey managing nonetheless to place the Falling Rate of Profit argument at the very center of his claim in favor of the underconsumption tendency, a rather remarkable feat of eclectic misconstruction. Even in his fully Keynesian incarnation of A Program for Progress (1940), a book in which Strachey broke grounds towards his final repudiation of Marxism, Strachey held on to his Falling Rate of Profit argument and used it once more to make a case for underconsumption as being the crucial problem of the day. Sweezy on the other hand never had much use for the Falling Rate of Profit theory and did his best to challenge its worth while favoring underconsumption as the correct diagnosis for Capitalism's crisis tendencies. In his book The Theory of Capitalist Development (1942), Sweezy wished to construct a logically tight and historically validated theory of underconsumption that could be traced in some fashion to the (admittedly) fragmentary textual evidence found in Marx's own work.

Sweezy and Strachey share a view of the structure of production that conceives of the output of means of production as only the first stage in the production of consumer goods, which is their final destination. Strachey justified this notion of a vertically integrated structure of production in connection with the 'rational needs' of society, and Sweezy did it by means of an alleged 'technical' relation linking the production of means of production to the production of consumer goods. Finally they noted the growth of monopoly as constituting a fundamental structural change in late capitalism, one that leads to the conscious regulation of the 'anarchy of capitalist production'. For Strachey Monopoly Capital strengthens the underconsumption tendency but makes possible the introduction of progressive measures of control, chiefly controls over the financial heights of capitalism with the expressed purpose of providing cheap credit to private firms and the wherewithal for the expansion of public enterprises. Political action can sustain full employment if Monopoly Capital cannot do so. Sweezy expressed approval for the economic arguments standing behind Strachey's advocacy of reforms, but felt skeptical about their political acceptance by the ruling class [Sweezy 1970:348]

Structure of the Paper

First I show how Sweezy and Strachey conflate the presence of Cycles with recurrent Crises. Then I bring up Hayek's theory of how a credit induced expansion ultimately leads to depression in order to highlight a connection that totally bypassed Strachey's final judgement. I go on to analyze Sweezy's own theory of underconsumption so crucially dependent on the alleged existence of

a *technical* linkage between Department I and II. Next I discuss how Strachey's reliance on the underconsumption argument and his embrace of the Keynesian theory of effective demand, prepared the grounds for his program of reforms. I sum up my argument laying out the Classical perspective on accumulation, now completed by Shaikh's formulation of a dynamical approach to effective demand. My purpose being to contrast this classical approach with that of Sweezy and Strachey. In the Appendix I present Sweezy's model with some critical remarks. Finally I show a dynamic simulation of the underconsumption model.

Crises and Cycles

Sweezy and Strachey believe that the study of the cyclical fluctuations that punctuate capital accumulation is the proper domain for a theory of crisis. While Strachey briefly acknowledged the existence of a "General Crisis" (introduced by Palme Dutt in Fascism and Social Revolution), his main concern centers in the study of cycles, for he says, "It would be false, however, to separate the study of this general crisis from the study of the cyclical crisis. For the cyclical crises are the main economic phenomena in which the general and continuing crisis manifests itself" [Strachey 1935:13-14]

It is clear that the concept of a "General Crisis" simply provides Strachey with the setting for long-run stagnation within which his fluctuations occur. But one of the most interesting aspects of Strachey's work concerns his understanding that credit is at the root of the cyclical nature of accumulation: credit allows firms to increase their spending beyond the limit established by their sales. In conjunction with his Falling Rate of Profit argument, Strachey reasons that without credit the growth path of accumulation would enter a declining phase, but there would be no cyclical oscillations. Then, he says, "If we can imagine a creditless capitalism in which every transaction was mediated by hard cash, then it is true that the oscillatory form of the crisis, but not the crisis itself might be abolished. We should get a slow, steady decline in the rate of profit" [Strachey 1935:313]. What makes Strachey's view of credit so remarkable, aside of its truth content, is that by the time he is ready to present his program of economic reforms five years later, he settles for cheap credit as a panacea.

In spite of the fact that Strachey himself failed to undertake any sustained analysis of credit and its effects, he was well aware of Hayek's work on credit inflation and knew that while credit allows capital to reach beyond the limits of its realized profits, "then and to the same extent, it pulls production in within those limits". Strachey's oscillations are a manifestation of his deep-seated belief that Capitalism faced an insurmountable dilemma: "profits or plenty". In the early stages of any upswing, capitalists have managed to contain wages, have raised the rate of surplus value and restored a measure of acceptable profitability. This restoration in turn induces an increase in the rate of accumulation and the mass of produced profits expands. But simultaneously, Strachey reasons, the decline in wages relative to profits narrows the consumption capacity of the market, and the boom crashes in a realization crisis that drags profitability down with it. Faced with this collapse in profitability capitalists seek to lower their production costs by means of mechanization and larger economies of scale. Their aims of lowering costs and expanding sales

ultimately clash with each other. For while their expenditures on new fixed capital cause a new upturn, in due course the bust will come again: when the enlarged production capacity is not matched by a proportionately enlarged consumption demand. As a consequence, the stagnation tendencies, progressively strengthened by monopoly will gain the upper hand, showing themselves in the guise of a growing excess capacity. This outline of the cycle is, of course, radically at odds with Marx's own formulation in Volume I, Chapter 25.

For his part, Sweezy ignores Marx's specific distinction between his cycle theory of Volume I and the concept of General Crisis linked to Absolute Overaccumulation and culminating in depression of Volume III. This happens because for Sweezy also, late Capitalism's dominant tendency is stagnation and not growth. Hence since accumulation cannot be sustained, it cannot drive the system to a General Crisis. Instead, Sweezy argues, "an accelerated rate of accumulation brings a reaction in the form of a crisis; the crisis turns into depression; the depression through filling up the reserve army and depreciating Capital values, restores the profitability of production and thereby sets the stage for a resumption of accumulation" [Sweezy 1970:153]. But let there be no question of this resurgence in accumulation setting a discernible trend, for Sweezy sees only cycles: "this is, then, really more than a theory of crisis; it is essentially a theory of what modern economists call the business cycle as a whole" [Sweezy 1970:153] and he drives the point home, "Marx regarded the business cycle as the specific form of Capitalist development and the crisis as one phase of the cycle" [Sweezy 1970:154]. Thus we have persistent cycles, and therefore, persistent crises, but no sustained accumulation.

The setting for these cycles and crises is the state of chronic stagnation characteristic of twentieth century Capitalism. Strachey accepted the onset of the General Crisis dating to 1914 (as suggested by Palme Dutt) and Sweezy located the theoretical origin of his chronic stagnation in Kautsky's review essays dealing with Tugan-Baranovsky's book Theory and History of Commercial Crises in England, published in Russia in 1894 and Germany in 1901 [Coletti 1978:237-283]. Kautsky's review essays appeared in *Die Neue Zeit* in 1902 [Coletti 1978:187-236]. In his review Kautsky noted that "Capitalism necessarily imposes a limit to capitalist consumption and conversely it fosters the continuous expansion of the means of production and the productivity of labor. In turn this sets the grounds for the ever increasing output of means of consumption. But the underconsumption of the exploited is no longer balanced by the consumption of the exploiters. This is the root cause of the permanent tendency to underconsumption" [Coletti 1978:209]. Kautsky is careful to add that "the continued existence of capitalist production remains possible, of course, even in such a state of chronic depression".[1]

In Sweezy's view, the dynamics of accumulation are bound by this persistent stagnation and therefore there is no rising trend building up the pressures for a General Crisis caused by Absolute Accumulation. Instead there are cyclical fluctuations with recurring episodes of recessions. According to Sweezy, Marx's extended treatment of the General Crisis in Volume III, Chapter 15 is merely an extension of Volume I's cycles outline, where the downturn is caused by the rise in wages, itself brought about by the rise in accumulation. Sweezy argues that Marx's analysis in Volume III "clearly continues the Volume

I line of thought on crisis" [Sweezy 1970:152] and therefore "we should be on sounder ground to search for causes of the falling tendency of the rate of profit in the process of capital accumulation with its inherent tendency to raise the demand for labor power and hence the level of wages" [Sweezy 1970:149].

Now in Volume I, Chapter 25, Marx posits the rate of accumulation as the independent variable of the dynamical system and, in combination with the rising composition of capital, he is intent to show the effects on the employment of the labor force. But first he abstracts from technical change to demonstrate that under the most favorable circumstances, accumulation could proceed on average without the exhaustion of the Reserve Army. A limit cycle is outlined in which a rise in the rate of accumulation raises the demand for labor proportionately and reduces the Reserve Army. Wages are pushed up and the rate of surplus value lowered, thus blunting the stimulus to accumulate as profitability falls. But a lower accumulation rate reduces the demand for labor and lowers wages. With the restoration of the rate of surplus value and profitability the rate of accumulation rises and the cycle starts all over again. R.M. Goodwin has formalized this non-linear dynamics and laid the grounds for fruitful developments [Goodwin 1967]. But the tendency intrinsic in the social relations of production to subsume the labor process under the goals of capitalist production leads to mechanization. Shaikh has shown that if the organic composition of capital rises, Goodwin's dynamics ceases to be stable. Competitive pressures mandate the use of mechanized methods for individual capital to survive and grow. These methods displace labor power from production, while accumulation absorbs it. All the while labor productivity is rising, the value of labor power falling and the rate of surplus value increasing. Fixed capital costs increase with the scale of production and the degree of mechanization: capital deepening gives rise to a growing organic composition. Thus the accumulation of capital sets into motion two systemic tendencies which are organically linked: the rise in the rate of surplus value is bound up with the growing organic composition of capital. Shaikh has shown that, contrary to Sweezy's argument, [Sweezy 1970:100] the growth in the organic composition becomes the dominant tendency [Shaikh 1987]. Steindl understood the structure of the Falling Rate of Profit much better than Sweezy, even though he also favors underconsumption as the root cause of stagnation [Steindl 1976:240]. Steindl's rejection of the Falling Rate of Profit argument can be justified in light of the fact that he lacked a theory of Marxian competition and he knew of no coercive force imposing behavior upon individual capitals that would lower their rate of profit.[2]

The Falling Rate of Profit manifests the joint dynamics of a rising rate of surplus value and a growing organic composition. Now as accumulation proceeds in a rising trend, the contraction of the necessary labor time must necessarily reach such dimensions that the growth of surplus value significantly slows down. Then any increase in wages would trigger the collapse of accumulation. For at this stage of the long-term accumulation wave, the valorization needs of capital have grown in measures that cannot be fulfilled, since the untapped source of surplus value is so low. That is why any increase in wages, shifting the system in reverse, would not just precipitate a cyclical downturn, but also a General Crisis. Of course it is not necessary that wages rise for the outbreak of a General Crisis caused by Absolute Accumulation. The point is that Sweezy's argument that the Volume III treatment of the General

Crisis is merely an extension of the cycles theory in Volume I is off the mark. Sweezy persistently ignores the difference between the dynamics of short-term inventory cycles regulating the adjustment between aggregate Supply and Demand; medium-term cycles regulating the adjustment between Supply and Capacity; and accumulation waves tracing the dynamics of profitability over long periods of time and setting the gravitational center around which the shorter cycles occur. The shorter cycles manifest the actual dynamics of accumulation and effective demand but the trend must be theoretically located as the gravitational center of the whole dynamics. Because General Crisis episodes do not happen frequently, they are serious affairs that cannot be conflated with the experience of business cycles. Marx's comment in this regard is apposite here: "The contradictions inherent in the movement of capitalist society impress themselves upon the practical bourgeois most strikingly in the changes of the periodic cycle, through which modern industry runs, and whose crowning point is the universal crisis. That crisis is once again approaching, although as yet but in its preliminary stage" [Marx 1986:29].

Credit Inflation and Hayek's Depression

Strachey believed that Hayek's analysis of how a credit induced accumulation boom led to inflation and then to depression, confirmed Marx's view of cyclical dynamics. Strachey's understanding of the relationship between accumulation and the Falling Rate of Profit is that the only way to prevent the mass of profits from falling is raising the accumulation rate as much as possible. But to do so in the context of growing fixed costs requires containing any increases in wages, hence repressing the growth of consumption. That was the message that Joan Robinson read in The Nature of Capitalist Crisis. As she put it: "the rate of profit tends to decline as capital accumulates, and an ever greater rate of accumulation is necessary to maintain production. As soon as the rate of accumulation is checked the crisis is upon us. The only way to cure the crisis is to increase accumulation. But this can only be done by reducing consumption" [Strachey 1940:265] and Joan Robinson could have added that Strachey's only option was the contraction, absolute or relative, of workers' consumption. Strachey never considered, even as a theoretical possibility, a change in the disposal of surplus value, with a greater share made available for accumulation rather than capitalist consumption. His ever present assumption is that the only way to increase the rate of accumulation is to raise the rate of surplus value, and generally speaking Strachey meant cutting wages, not merely allowing wages to rise by less than the increase in labor productivity. Strachey was stung, without a doubt, by Joan Robinson's review of his book (which he reproduces in one of the Appendixes of his 1940 book A Program for Progress), and sought to redeem his argument from this obvious flaw. Joan Robinson had concluded that in a nutshell "the pivot of the whole argument is that investment cannot increase unless consumption declines" [Strachey 1940:265]

Now Strachey came out in A Program for Progress to defend Marx's analysis from such undeserved criticism. But the point was moot, for it was not Marx but Strachey who had indeed presented the dilemma of profits or plenty and the Law of the Falling Rate of Profit as a raw choice: either accumulation increases and wages are cut, or the Falling Rate of Profit precipitates a collapse in the mass of profits and depression follows. Strachey responded to Joan Robinson that Marx's analysis was more sophisticated than all that. For Marx,

he said, the crucial relationship was between the increase in labor productivity and the increase in wages. With a Falling Rate of Profit the only way to forestall the decline in the mass of profits was "to maximize accumulation" and this required that the rise in wages fall behind the rise in productivity. This requirement, prepared the ground, according to Strachey, for a realization crisis because "the demand for the services of capital goods does not rise rapidly enough to offset the growth in their supply" [Strachey 1940:266], an argument which will be taken up by Sweezy at a latter date.

In 1935 Strachey was impressed by Hayek's dynamics of credit inflation as a temporary substitute for a contraction in consumption demand [a rise in savings]. Hayek's argument was that without a voluntary decline in consumption, depression was the inevitable outcome of any increase in investment. And Hayek saw the likelihood of such an event as a consequence of technical change and its effects on costs and prices. As late as 1940 Strachey also considered that technical change was at the center of accumulation and took it to be the major force behind the Falling Rate of Profit: while new methods lower labor costs, they raise fixed capital per unit of output and require a larger scale of production, fostering accumulation and a larger mass of profits but a lower profitability [Strachey 1940:266-267]. In Hayek's analysis technical change lowers the unit cost of output and competition lowers prices. The fall in prices erodes profitability and industrial capitalists lose the urge to accumulate. But bankers profit from extending credit and therefore favor making loans rather than face stagnation. So they make overtures for new loans to finance investment. Hayek wishes to trace the consequences of this credit inflation in a situation where the propensity to consume does not decline. Entrepreneurs carry on with their investment plans, now funded by the banks. Monetary authorities contribute to this expansion by increasing bank reserves if necessary. Sooner or later the rise in investment demand will push up the prices of producers' goods, and profits will follow suit. The rise in profitability in Department I sustains its expansion. Factors of production currently located in the activities of Department II will shift to Department I. The increase in spending of Department I has raised incomes for its factors. Now they are ready to make good their consumption needs: a rise in the demand for consumption goods follows. This increased demand, coupled with the earlier shift of productive resources away from Department II, results in price hikes of consumption goods. The profitability of Department II will rise and so the profit differential in favor of Department I is lost. As a counterflow productive resources begin to shift back to Department II activities. In the absence of a voluntary increase in the propensity to save, this means an absolute increase in consumption without the corresponding rise in savings being forthcoming to sustain the investment boom.

The reasoning is as follows. There are two basic types of productive resources: specific and non-specific. The non-specific type of factors are highly mobile (the equivalent of working capital), whereas the specific type (basically fixed capital goods) are anchored to the activities for which they were designed. The non-specific type factors are able to move with ease into the expanding consumption sectors leaving shortages in their wake within Department I. In some cases, Hayek suggests that the effects of this reallocation of factors are not found just in the rise of costs within Department I, but the downright cessation of some production activities due to the lack of complementary resources

(working capital). What the contraction eventually reveals is that the structure of production (the capital deepening) had been extended beyond the bounds allowed by the consumption base. This is what the credit inflation was meant to accomplish. Ending the inflationary spiral sets off the crisis. The ensuing depression simply confirms to Strachey that his reading of Marx was correct:"a credit system allows the capitalists to postpone adjusting their system to the real situation. Naturally, therefore, it makes the necessary adjustments more violent and powerful, makes them into crisis when in the end they have to be made" [Strachey 1935:309]. I believe that this position is analogous to Minsky's view of the role of credit and recession. [Minsky 1986:Part III]

It is evident that, for Hayek, money mattered a great deal. The supply of money was understood to be endogenous, that is, flexible depending on the demands of trade. The banks increase liquidity when they create money of account. The depression does not happen because there is not enough money but rather because there is too much of it. But the supply of money grows because its demand increases, since it is necessary to fund new investment plans. The banks are all too ready to comply. Hayek made it plain that "no analysis of actual economic phenomena is complete if the role played by money is neglected. This means that we have definitely to give up the opinion which is still widely prevalent, that, in the words of John Stuart Mill...'there cannot, in short, be intrinsically a more insignificant thing, in the economy of society, than money' which 'like many other kinds of machinery only exerts a distinction and independent influence of its own when it gets out of order" [Hayek 1931:110] [Rogers 1989:281].

In Hayek's argument, the collapse of the structure of production may be forestalled by a new dose of credit. Each time around, however, the marginal dose must be larger than the previous one in order to prove effective in raising the prices and profits of Department I. As the stock of money in the system rises with every additional injection, ever larger injections are required to sustain the desired pull on prices. But the rise in investment demand, leading to higher spending on consumption, will lower the profit differential initially enjoyed by Department I. In the course of these dynamical changes Supply is not equal to Demand. There are sequential adjustments between the Supply and Demand in both sectors brought about by price changes. This is a crucial difference between Hayek's dynamics and Keynes' model. In Hayek the growth of Department I takes place by draining resources away from Department II. In turn, the expansion of Department II takes place at the expense of Department I. Hayek's distinction between specific and non-specific type resources allows for a non-linear dynamics to govern the final outcome: not enough savings is available because income in the aggregate does not increase but instead contracts. For Hayek the depression results from insufficient savings, while in the case of Strachey and Sweezy stagnation results from insufficient investment and excessive savings. The Keynesian influence is obviously on the side of Sweezy and Strachey.

Thus, money matters because the provision of new credit launches the inflationary expansion, which in turn funds the growth of consumption demand. Underlying these monetary flows, however, lies the structure of production which sets the ultimate bounds for the monetary expansion. Hayek's argument points out that the creation of new money stretches the structure of production

[increases the capital intensity of production] to an extent which is not compatible with the structure of final demand revealed by consumption spending. This happens because the structure of effective demand only grows in volume without changing its original proportions: since the propensity to consume did not decline, new productive resources were not permanently released by Department II in order to sustain the desired deepening of capital. Hayek's argument persuaded Strachey that the sound analysis of capitalist accumulation by all schools of thought, from Marx to Hayek, highlighted the need for consumption to fall if accumulation is to rise. Strachey noted that not the lack of money, but the lack of sufficient savings (because of the expansion in consumption), caused the depression. Therefore, in Strachey's translation of the arguments made by Hayek and Marx, the increase in the rate of surplus value necessary to compensate for the growth of the organic composition, required the suppression of any long-term tendency for wages to rise. Hayek's argument proved to Strachey in 1934, writing his own account of the nature of capitalist crisis, that a depression was the inevitable outcome of a loose money policy by bankers and monetary authorities. Conversely, he understood that credit inflation was no viable alternative to the contraction of consumption. Strachey saw Capitalism trapped in the throes of its great dilemma: either the rate of surplus value rises and accumulation can be sustained, or wages rise, realization problems are solved, but accumulation is not possible, stagnation sets in instead. Of course Marx had shown differently in Volume II, where expanded reproduction takes place without realization barriers.

The point here is that Strachey on the left (as well as Sweezy) and Hayek on the right shared the belief that the structure of production is so vertically integrated, that accumulation is driven by the dynamics of consumption demand. Strachey could imagine an ideal Capitalism in which the dynamics of accumulation were free from such demand constraints, but he dismissed the thought as being beyond the pale of human reason. The tension between an ideal system and its real setting in society reappears in 1940, when Strachey advances his program of reforms, only this time Strachey believes that his ideal can replace the actually existing Capitalism. Says Strachey:"this remarkable system would, if it could be operated in its purest essence, perform one function, and one function alone. It would develop, gigantically and unendingly, the capacity to produce" [Strachey 1935:109].

Providing the counterpoint to Sweezy and Strachey on underconsumption, Tugan-Baranovsky stressed the need to approach the study of Capitalism in its own terms, as a system guided by the pursuit of profit and not happiness. Tugan was intent to show that Capitalism could accomplish its goals while failing to serve the welfare of its working class: "Marxists have always thought too highly of Capitalism; they have imagined that Capitalism was bound to set as one of its concerns the standard of living of the working class, and failing to do so, it would collapse in a realization crisis. But this notion is based on a total misunderstanding of the true nature of the system. A declining standard of living and a simultaneous expansion of production are not contradictory from the Capitalist standpoint. Capitalism is not set up to cater to social needs but to promote the accumulation of capital. Capital needs men as the basic source for its growth, not as a rational foundation" [Tugan-Baranovsky, 1978:257]

The principal reason why Strachey failed to unravel the nature of

Capitalist crisis is that he posited an ideal image of Capitalism which he thought congruent with Marx's schemes of expanded reproduction. But then instead of asking how such a path of expanded reproduction could be located within the actual dynamics of accumulation, Strachey chose the effortless route and denied its existence. The challenge proved to be beyond Strachey's eloquence and talent. He rejected the possibility of expanded reproduction because he was not able to explain its attendant turbulence. It was either growth or cycles, but Strachey proved unable to explain their joint dynamics. All he could do was to imagine a path of extended reproduction without the turbulence of effective demand intruding. Sweezy on the other hand was never caught up in such plight. He assumed from the start that since consumption demand is not the guiding force behind accumulation, although consumption is the final goal of capitalist production, accumulation in late capitalism could only be the result of external contingencies. The structure of production established by the dynamics of accumulation would clash, sooner or later, with the structure of effective demand. The difference between Sweezy's and Hayek's arguments being that in Hayek's case consumption demand grows in excess, relative to the capital deepening previously experienced, and in Sweezy's case consumption demand does not grow sufficiently to validate the growth of capacity. Strachey contrasts his ideal model with his truncated view of capitalist reproduction:"if it were rational never to use our ever increasing productive capacity to provide us with any increase in consumers' goods; if it were possible to confine all our new investment to the upper reaches of the structure of production; if it were possible to absorb the whole increase of the production of commodities within the structure of production, so that no increased supply ever emerged from that structure; if it were possible so to compress demand at the consumers'end, and so to expand it at the producers end, that the sides of the Hayekian triangle were infinitely prolonged; if it were not insane to propose to occupy the human race, kept for ever on subsistence rations, in perpetuity with the task of making machines to make machines to make machines; then Capitalism might be immune from crisis" [Strachey 1935:300].

But would it be so immune? This quotation shows how thin Strachey's understanding of the Falling Rate of Profit theory of crisis was, even though he kept it at the center of his books from 1935 to 1940. It is clear that an increase in the organic composition of capital of the magnitude depicted in Strachey's words would have so depressed the rate of profit as to drive the system to Absolute Overaccumulation. Of course Strachey ignored the consequences of a steadily falling rate of profit on the mass and chose instead to focus on the partial "cyclical crisis".

It is remarkable indeed that while Strachey built his analysis of the nature of capitalist crisis around Marx's theory of the falling rate of profit; while Strachey used Hayek's dynamical model of credit inflation to argue against the view that capitalist crises break out due to a lack of money; and finally while Strachey knew that "Capitalism, because it is both nationally and internationally competitive, must also continually develop the productive powers of society" [Strachey 1935:301], his ideological stance led him to portray a world rent by the underconsumption of the masses; the advocacy of cheap credit as a panacea against stagnation; and the ubiquitous presence of monopoly, calling for measures of control to curb its dominance.

Clearly these inconsistencies between different phases of Strachey's ideological development highlight the weakness of his orthodox Marxism. His early insight into the connection between credit and cycles was not elaborated upon and so the linkage between credit and debt and the consequences for accumulation were missed altogether. His concern with the effects of mechanization on the rate of profit was not pursued into the field of competitive behavior. Competition appears only sporadically in the overall argument, hence the general laws lie unhinged without a microeconomic foundation. Monopoly was interpreted to be the consequence of the systemic movement towards greater concentration and centralization. Strachey's ideology stood in the way of science.

Sweezy's Theory of Underconsumption

It is an explicit assumption of Sweezy's theory of crisis that the output and growth of Department I is part of a vertically integrated structure of production whose final output consists of consumer goods. In other words, Department I is only an input of Department II and its growth adds a corresponding capacity to Department II, by way of a technically imposed articulation between the two. The notion of the "accelerator" establishes a relationship between changes in output (income) and the technically given change in investment. But Sweezy posits a technically given connection between the rate of investment that enlarges the system's capacity and the rate of growth in consumption goods. The 'existence' of this technical coefficient was first announced by Otto Bauer [Bauer 1936:351-53], and as Howard and King put it succintly "Paul Sweezy .. took over Bauer's model in its entirety" [Howard and King 1990:98]. Sweezy's single piece of evidence for this claim refers to a study made by Carl Snyder in 1936. In point of fact Snyder's work does not concern the alleged capital/consumption but rather the capital/output(income) ratio. Domar has commented that "this error of thinking in terms of a ratio between capital and consumption rather than between capital and total output or income is very frequent in economic literature. It probably goes back to the idea that consumption is the final aim of production and that therefore all capital is used for the production of consumer goods. This is true only in a stationary state" [Domar 1957:123] It is interesting to note that Sweezy's approach leads him to deny the possibility of internal accumulation and thus to validate his choice of technical relationship.

When Sweezy turns his technical relationship between the growth of Departments I and II into the linchpin of his underconsumption argument it is clear that he is thinking of it in its material and not its value form [Schlesinger 1950:183-184]. Recently John Bellamy Foster has sought to rescue this relationship from criticism by insisting that the "natural-technical" relationship is "imposed by the use-value structure of the system" [Foster 1986:77] and argued that in spite of the difference between a capital/output(income) and a capital/consumption relationship, "the relationship that Sweezy specified between investment and consumption was not without considerable backing in the economic literature, since it was equivalent to the original form of the accelerator principle, as developed especially by John Maurice Clark" [Foster 1986:242]. Bellamy Foster took exception to Shaikh's discovery of Sweezy's "fundamental error" [Shaikh 1978:229] charging that "Shaikh's method was simply to set up a 'straw man' version of the general underconsumption approach

to be knocked down with the argument of Tugan-Baranowski" [Foster 1986:82].

Incidentally, I have quoted Tugan earlier in order to suggest that this revisionist's understanding was in many respects sharper than that of his orthodox opponents. At any rate Bellamy Foster conceded that "it is quite true that 1) Department I (the investment goods sector) cannot be *entirely* reduced to an 'input' into Department II (the consumption goods sector); 2) producer goods may be used to make producer goods" [Foster 1986:82]. Bellamy Foster appeared to accept Shaikh's point that "it is perfectly possible to have a rising ratio of machines and materials per worker and proportional growth of both Departments, while still have expanded reproduction" [Shaikh 1978:229], but the appearance was deceptive, for according to Bellamy Foster "all of this merely indicates that the smooth expansion of Capitalism is always possible on paper (where the realization problem is concerned)" [Foster 1986:83]. Of course Shaikh's response to this would be that the accumulation process is anything but "smooth". Turbulence and local disequilibria are the ever present characteristics of accumulation and yet an implicit order exists which allows expanded reproduction to proceed. Bellamy Foster presses a group of underconsumptionists into service as favoring his view: "as Luxemburg, Lenin, Bukharin, Sweezy, Kalecki, Coonts and others have argued...sooner or later investment is brought up short by the fact that it must satisfy final demand, and hence it cannot be expected to expand for long periods of time independently from consumption" [Foster 1986:83].

Adding Lenin to his list of underconsumptionists seems like an oversight, for we have explicit testimony that Lenin's views on this matter were exactly the opposite of those imputed to him by Bellamy Foster. In his comprehensive study of The Development of Capitalism in Russia, Lenin writes: "the Department of social production which produces means of production has, consequently, to grow faster than that producing articles of consumption" [Lenin 1967:54]. The point is driven home repeatedly: "compared with means of production, articles of consumption play a minor role in the formation of the home market", and finally, "Nothing could be more senseless than to conclude from the passages in Capital that Marx did not admit the possibility of surplus value being realized in Capitalist society, that he attributed crisis to underconsumption and so forth" [Lenin 1967:58].

The problem is, according to Bellamy Foster's interpretation of Sweezy's underconsumption argument, that the aim of capitalist production is to expand exchange value, and the pursuit of this goal requires the unlimited growth of the stock of means of production. On the other hand, it follows that the growth rate in consumption spending must be lower than the growth in the mass of surplus value. Hence the systemic goal of capital accumulation clashes with the natural-technical condition inherent in material production: "Herein lies the fundamental contradiction of Capitalist production, from which all others are ultimately derived" [Foster 1986:83]. In Bellamy Foster's version of the argument, it is clear that for the underconsumptionist, the central question is located at the connection point between capital considered from the perspective of self-expanding value and the technically integrated structure of production; as if this technical structure were externally imposed to the capitalist goal of unlimited valorization. It follows from this interpretation, that the limit to the

development of capital no longer issues from the development of capital itself as a social relation, but is rather found outside of it, in the barriers thrown-up by the technical structure of production to the fulfillment of capital's systemic goal.

Bellamy Foster assumes that the technical structure is not subsumed under the dominance of capitalist production: that while the labor process is so subsumed, the technical structure evades it. Indeed Rosa Luxemburg reproached Marx's efforts to work out the conditions necessary for expanded reproduction to proceed, in much the same vein as Bellamy Foster used against Shaikh: "it is not merely because mathematical equations are easily put on paper that accumulation will continue ad infinitum without any friction. In other words: the time has come to look for the concrete social conditions of accumulation" [Luxemburg 1964:119].

Sweezy's own version of the underconsumption argument consists of the following building blocks: 1) accumulation tends to rise as a proportion of surplus value; 2) investment in means of production tends to rise as a proportion of accumulation; 3) capitalist consumption is a declining portion of surplus value; 4) advances in variable capital (wages) tend to decline relative to accumulation; 5) there is a technical relationship linking the growth in the output of means of production to the growth in the output of consumers' goods. Hence the growth rate of output in consumption goods will tend to exceed the growth rate in demand for such goods. As a consequence of this widening gap, Capitalism will either suffer from chronic stagnation and growing unutilized capacity or will experience recurrent episodes of underconsumption crises. This tendency towards stagnation becomes more pronounced as a result of the movement of concentration and centralization of capitals leading to the growth of Monopoly. Monopolies naturally raise prices in order to increase profit margins. They do not experience the pressures to accumulate that were present under free competition, for they wish to prevent an increase in supply lowering prices and profits. Their monopoly position allows them a range of options which were not previously available. In a competitive regime, Seeezy argues, capitalists are always free to choose between reinvesting their money capital in the purchase of productive resources or financial assets of greater liquidity. Any fall in the rate of profit below its "usual" level, Sweezy says, will prompt capitalists to move out of the production circuit and into financial assets. But the growth of Monopoly expands the options available. Monopolists can set up barriers to entry and effectively exclude hostile intruders. Then Capitalism is split into two spheres, one monopolistic and the other competitive. The competitive sphere harbors the smaller, financially weaker capitals, engaged in activities that require lower capital advance and free entry. Monopolists then are not obliged to invest in their own business because they do not wish to expand capacity and experience lower prices and profit rates. Instead they can penetrate the competitive sectors and settle there, even though the profit rates in those sectors will be lower than in the Monopoly sphere. Why would they prefer investing in activities with lower profit rates? Sweezy is satisfied that the monopolist concern is with marginal and not average profit rates, hence their choice for lower marginal rates in the competitive sectors allows them to maintain higher average rates of profit in the Monopoly sphere. This is not an easy argument to accept.

Now the problem with this argument is that if Monopoly capital's new investments are concentrated in the competitive sectors, the capacity and output would be growing faster and also the prices and profit rates falling faster in those sectors relative to the long term trend. In that case the profit rate differential between the monopoly and the competitive sectors would widen, and as the gap increased it is hard to see how any new investment could be attracted there. Sweezy sees this closing of investment outlets in the competitive sphere as another factor adding strength to the stagnation tendency in late capitalism. In response to the gradual decline in incentives for new investments, capitalists will try every means to spread monopoly throughout the system. If they succeed in achieving their objectives, profit margins would rise, but the growth of excess capacity would once again reinforce the stagnation tendency. Moreover, since monopolists are able to select not only their field of investment, but also the composition of that investment, the decline in competitive activities intensifies monopoly's search for cost-cutting technology. Monopoly's choice of techniques would be more labor-displacing than those selected by smaller competitive firms. This would consolidate Monopoly positions in large scale, capital-intensive activities that effectively close entry to others. Labor-saving technical change as practiced by monopolists would deepen the underconsumption tendency. As a result of the entrenchment of Monopoly capital, the gap between Capitalism's capacity output and the growth of effective demand would increase. Then the system will experience either recurrent oscillations between its potential capacity and its lower path of effective demand, or stagnation manifested by the growth of excess capacity.[3]

Ironically enough, it is quite possible to use all the evidence for Monopoly marshalled by Sweezy, to construct a theory of competition based on classical/Marxian canons [not "perfect competition", of course] which would obviate the need for Monopoly concepts. In addition, the Falling Rate of Profit argument can be linked to a theory of General Crisis which produces *results* (and not causes) similar in nature to Sweezy's underconsumption. Shaikh has advanced further than anyone else in these developments, managing to reconstruct the structure of classical Political Economy while exposing the inadequacy of orthodox Marxism.

Strachey's Program of Reforms

Throughout his transformation into a full-fledged Keynesian, Strachey insisted that his theory of the Falling Rate of Profit was the one single most fruitful insight into capitalist dynamics yet available. In his 1940 book A Program for Progress, where he enthusiastically embraced the Keynesian remedies for Capitalism's ills, Strachey still found himself defending his own version of Marx's famous law. Moreover, he now contended that *all* worthy schools of thought in economics had a place for it in their midst, and this was particularly so with the Keynesian economics. The only difference between their position and that of Marxists like himself, Strachey argued, was that bourgeois economics thought of this law as a mere tendency, which could become actual only if other factors were not at play. But of course other factors were always present. Hence bourgeois economics considered the falling rate of profit as "a mere empty abstraction" [Strachey 1940:8]. It was Strachey's intent to rescue the falling rate of profit from the realm of metaphysics and show its material

effects: the law, says Strachey, is a frightening reality to all concerned, workers and capitalists. Strachey's argument consists in showing how the factors that previously held the falling rate of profit in check were now losing power or fast disappearing. He then recounts the nature of the forces counteracting the decline in profitability: technical change; opening of new markets, population growth. It may be noted, in passing, that while technical change appears as a countertendency in Strachey, in Marx it is the main force behind the falling rate of profit, as it leads to a rising organic composition of capital which dominates the dynamics of profitability.

But we may also compare Strachey's array of counteracting forces to the falling rate of profit with Sweezy's list of forces counteracting the underconsumption tendency. Sweezy's list is longer than Strachey's. His countertendencies are divided into two groups: those which raise the level of consumption relative to the growth rate in means of production, and those which directly weaken the stagnation tendency, should accumulation be induced by some external contingency. Sweezy identifies population growth; commercial unproductive expenditures; and state expenditures on social welfare, as forces that raise consumption and narrow the gap between accumulation and effective demand. Sweezy believed that, by 1942, commercial unproductive expenditures were growing faster than productive ones, as a result of the pressures to sell derived from the presence of excess capacity in industry. In addition, state expenditures transfer surplus value via taxation from accumulation into different forms of social consumption, lowering investment growth and therefore narrowing the underconsumption gap. Among the factors which weaken the stagnation tendency directly, Sweezy counts the industrialization of new regions; technical change; misguided investments. Industrialization and technical change absorb large doses of capital for long periods, without being ready to enlarge the capacity to produce consumption goods until the last stages are completed. In order to prevent stagnation, then, it would be necessary for the industrialization of new regions, or technical change, to happen much too fast. The assumption being that in reality they will not be available as needed. At any rate all investments eventually enlarge the underconsumption gap, while misguided investment is likely to diminish in size. In Sweezy's opinion this is due to the growth of Monopoly and the renewed ability on the part of the monopolist to weigh investment options with greater care for the possible outcomes, free from competitive pressures. All in all, it would be Sweezy's judgement (to no one's surprise) that the forces counteracting the underconsumption and stagnation tendencies were weakening as Capitalism developed.

In Strachey's case, his three countertendencies were meant to increase the demand for capital over its supply and thus check the falling rate of profit. Strachey believed that this is what Keynes had in mind when he wrote "if capital becomes less scarce the excess yield will diminish" [Strachey 1940:9]. Strachey was as concerned as Sweezy with the consequences of falling profitability creating a society mired in "chronic stagnation" and an economy subject to "the periodic, and more or less rhythmical, oscillation of boom and slump" [Strachey 1940:11]. But Strachey's countertendencies, like Sweezy's, were weakening: the falling rate of profit was a real, actual tendency. The ultimate consequence of this weakening for Strachey was the same as it was for Sweezy, namely stagnation and underconsumption. Now it must be made clear that this outcome must be distinguished from the argument that as a consequence of the

falling rate of profit, in the stage of Absolute Overaccumulation, effective demand for consumption is insufficient to realize capacity output in Department II because capitalist outlays have been sharply reduced. Strachey's view, as well as Sweezy's, is that any time that the accumulation rate rises to counter the effect of a falling rate upon the mass of profits, the underconsumption gap will emerge. This is because the rise in accumulation and the organic composition will be simultaneously accompanied by an increase in the rate of surplus value. But then the decline in wages relative to profits reduces the effective demand necessary to realize the profits produced in Department II and hence the capital goods outlays in this sector. Strachey thus believes that he has found in Keynes a kindred spirit: he interprets Keynes as saying that a decline in wages, contrary to classical theory, narrows the market and blocks the expansion.

Strachey was intent to show that a program of reforms could raise mass consumption and improve the performance of Monopoly Capital in favor of the working class. Since capitalist costs in industry are made up not only of outlays for materials, machinery and the wages of labor power, but also of interest and rents, Strachey proposed the introduction of measures designed to control and reduce interest and rents. Accepting Keynes' analysis of the rate of interest, Strachey was confident that monetary policy could go a long way to make credit plentiful and cheap. According to Keynes, the rate of interest determines liquidity preference and not savings. Therefore a progressive policy of money management would seek to lower the rate of interest without the fear of lowering total savings. Lower interest rates would stimulate the financing of new investments and would compensate capitalists for not reducing wages in the bargain. The more credit issued by the banks, the greater their liquidity position, for Keynes had taught that finance was really a revolving fund: it all returned to the banks. The role of the monetary authority would be simply to ensure that an ample supply of reserves was available to the banks in order to fund all forthcoming investment plans. Then if private businesses were not bold enough with expansion projects, and full employment was not achieved by their spending, public enterprises could be equally funded with newly created cheap credit. Moreover public enterprises would boost the demand for the output of private firms through multiplier effects, a matter so central to Keynesian economics.

Strachey's Program was predicated on the assumption that Capitalism had entered a new stage in which Monopoly controls had replaced the "anarchy of capitalist production" [Strachey 1936:90]. On the one hand, monopoly intensified the stagnation tendency, as prices were pushed up and higher profit margins blunted the stimulus to accumulation. Besides, monopoly prices cut into wages and reinforced underconsumption. The unemployed masses required income, and Keynes showed that higher income was obtained through higher investment. Now Strachey followed Keynes [and abandoned Hayek's earlier warnings] in the advocacy of cheap credit as a panacea for the cure of Capitalism's ills. The means to this end were available, and only the political will was needed. Strachey knew, of course, that a full employment situation, if sustained, would change the bargaining position of the labor force. His Program was addressed to the need for recovery out of the Depression without an increase in capitalist costs, particularly wage costs. But full employment would lead to higher wages "imposing a lower general rate of profit and interest on the class which owns the means of production". He was confident, overly confident perhaps, that

resistance to his reforms would be overcome, because "social reforms by widening the market and so making it possible for the capitalists to use all their capital, would actually increase the total amount of profit and interest which the Capitalists would receive, in spite of lowering the rate" [Strachey 1938:312]. Having posited an ideal Capitalism free from crisis in his earlier book, Strachey now sought to make the actually existing Capitalism conform to the ideal with the assistance of his reforms.

Accumulation and Effective Demand

For Classical economics accumulation was the normal manifestation of Capital's intrinsic drive to expand profits. Marx formalized the structure of expanded reproduction showing the necessary conditions for the accumulation of surplus value. The schemes abstract from technical change in order to show how in each period accumulation is possible by simply expanding the capital advanced out of the surplus value previously extracted. Marx did not formalize a theory of effective demand as an adjunct to his reproduction schemes. Nonetheless in Volume II the elements for the elaboration of such a theory were present. They are found in Marx's extended treatment of the complex web of money flows that link up the capital and revenue circuits. The task of formulating such a dynamical theory of effective demand in the context of accumulation has been recently completed by Shaikh [Shaikh 1985,1988,1989]. The circuits of commodity production involve outlays of money by capitalist firms: purchases of labor power, materials, etc, with a money reflux presumed at the end when capital changes from the commodity to the money form as the sale is realized. Of course the turbulence characteristic of actual reproduction precludes any assumption that individual firms will indeed find their produced profits equal to their realized profits. In fact no assurance is possible that individual firms will realize any sales and thus find validation for their previous outlays. Yet expanded reproduction in the aggregate proceeds, and consequently the question of effective demand involves reconciling the emergence of a cyclical tendency towards aggregate balance of Supply and Demand with the absence of any prior assumption regarding equilibrium. In other words, the challenge so successfully met by Shaikh's formulation of the dynamical theory of effective demand, calls for the location of intrinsic forces that will contain the aggregate deviations within a certain range, preventing them from becoming explosive. What Marx made clear was first that Capital's own outlays are the source of the effective demand that validates the accumulation drive, and secondly, expanded reproduction is possible because the internally produced funds are sufficient to fuel it.

Now Ricardo abstracted from the question of effective demand and accepted Say's principle that every sale implies an immediate purchase. Ricardo overlooked the intertemporal nature of purchases and sales in the circuits of commodity production: the linkage between buying and selling is subject to time lags and ordered sequences. Today firms purchase materials, labor power, etc in order to engage in the production of goods that will be ready for sale only at a later date. Today's sales validate the investment outlays made in the past. Marx is intent to show that neither Supply or Demand as such are the driving force behind the tendential adjustment of purchases and sales. Instead, profitability is identified as the dynamic force behind accumulation as well as the regulating power behind the movements of Supply and Demand. The rise and fall of Supply and Demand responds to profitability changes in the various industries of the

system. While accumulation proceeds in all industries (in the crisis-free stage), the average profit rate is higher in some and lower in others. Higher than average profit rates reveal the presence of capacity utilization above normal caused by excess Demand. Inflows of capital into those industries will raise their growth rate above the average, Supply will expand, prices will fall and profitability levels will come down, possibly even below the average. It is explicitly understood that within the context of "anarchic" capitalist production, nothing prevents the movement of capital from overshooting its targets and the reversal of the initial conditions. At any time, aggregate Demand will not equal Supply and yet the deviations are contained by the fluctuations in capacity utilization and profitability.

Underconsumptionists like Malthus, on the other hand, have argued that the conditions for balanced growth could not be satisfied in real life: sectoral imbalances would prevent the attainment of an aggregate fit between Supply and Demand. Observing the anarchy of Capitalist production, they failed to appreciate the implicit order buried in the turbulence of actual reproduction. Shaikh has shown that aggregate Demand will balance with Supply over a fast cycle, with excess Demand canceling out on average. The center of gravity for this "inventory" cycle turns out to be another, though slower, cycle regulating the dynamical adjustment between capacity output and actual Supply. This medium-term cycle traces the reaction of investment outlays to capacity utilization. In Harrod's approach once the system's capacity growth is off the warranted path (Marx's path of extended reproduction), the deviation becomes explosive as the accelerator does its work. Shaikh has shown how disaggregating the investment outlay into a fixed and circulating component, and setting capacity utilization as the variable controlling investment, Harrod's "knife-edge" problem can be solved. Instead of explosive deviations, a limit cycle traces the tendential adjustment, with the path of extended reproduction acting as its gravitational center.

In contrast, Strachey could only envision an "ideal" Capitalism able to experience accumulation as long as the question of effective demand did not intrude. Once the matter of effective demand was raised, Strachey was helpless to explain accumulation. Hence he could deal with accumulation, but only in the unreal world, and totally failed to account for the dynamics of effective demand and accumulation. Since the dynamical relationship escaped his comprehension, Strachey chose to reject the possibility of sustained accumulation. He lived in a world shattered by Depression and the question of effective demand overwhelmed his other concerns. He thus was ready to embrace the Keynesian formulation of effective demand precisely because Keynes eschewed accumulation and made effective demand the driver behind short-run income equilibrium. Orthodox Marxism, preceding the publication and knowledge of Marx's own thinking on the matter, had rejected the intrinsic dynamics of capital accumulation and raised stagnation to the level of organic characteristic of twentieth century Capitalism. In the event, as Keynesian economics provided a formal account of the alleged absence of any intrinsic tendency to expanded reproduction, Marxists were deeply moved by it and added it to their other theoretical appropriations (like perfect competition, the theory of Monopoly, Schumpeter's theory of technical change, etc).

Thus while Keynes sees "animal spirits" behind entrepreneurial decisions

involving long-term investment, Sweezy observes a capitalist urge "to get rich" (Sweezy 1970:181). Sweezy's capitalists decide how much to invest, if anything al all, depending on their expectations of future conditions and whether or not they view the marginal rate of profit lower or higher than its "usual" level. As in Keynesian economics, Sweezy's capitalists can opt for liquidity preference regardless of competitive pressures or past commitments. This freedom of action is especially highlighted under conditions of Monopoly capital.

For the accumulation urge to be satisfied, Sweezy's capitalists need to extract as much surplus value per worker as they possibly can. Now in order to prevent accumulation from pulling up wages and lower profitability, the most effective strategy involves mechanization. Capital-intensive methods are costly investments that would absorb all the available surplus value not consumed by capitalists. Sweezy does not introduce the question of credit in any systematic way [Sweezy 1970:157]. The effective demand for the output flowing out of this growing capacity is driven by the growth of final demand in consumer goods. This growth is necessarily limited by the use of the largest share of surplus value in accumulation of capacity expanding fixed capital. In addition Sweezy imposed a technical linkage between the growth in capacity and the growth in the output of *consumer goods*. But only that capacity needed to produce consumer goods directly will prove to be a profitable undertaking. Hence the capitalist urge to accumulate and expand productive capacity clashes with the lagging growth of effective demand. Therefore the potential rate of accumulation can be reached only if extraordinary contingencies are present. If not, the underconsumption gap will lead to a collapse of the structure of production. The only alternative to prevent this collapse is to reject accumulation. Stagnation emerges as the alternative to the collapse in late Capitalism.

In Sweezy and Strachey, episodic bouts of accumulation are likely to degenerate into sharp fluctuations between a potential path which cannot be sustained and simple reproduction. The growth rate of effective demand will drag the actual growth rate of accumulation down because while the share of capitalist consumption in surplus value remains constant, the share of workers' consumption in total output falls. The problem then is located in the discrepancy between the amount of surplus value used for investment in fixed capital, and the reflux of money returning to capitalists via final sales of consumption goods, plus the sales of those capital goods acting as inputs for their production. It is a kind of "oversaving" theory of underconsumption. Now introducing Sweezy's alleged technical relationship between the growth of capacity and the growth of consumption goods output [akin but not identical to the accelerator], Sweezy's underconsumption problem reveals a family nexus with Harrod's "knife-edge".

A Harrodian Interpretation of Sweezy's Instability

In Sweezy's view any time the system reaches towards its potential output path, the lagging effective demand will pull it down, causing the contraction in investment to lower capacity utilization; a new contraction of effective demand will further intensify the accelerated decline.

In Harrod's dynamics, investment enlarges the stock of means of

production and output capacity,

$$I \Rightarrow \Delta K \Rightarrow \Delta N$$

The capital/capacity ratio,

$$v = \frac{K}{N} \Rightarrow constant$$

Therefore, the change in capacity,

$$\Delta N = \frac{\Delta K}{v} = \frac{I}{v}$$

And since the growth rate of the means of production is given by,

$$g_k = \frac{I}{K} = \frac{v\Delta N}{K} = \frac{v\Delta N}{vN} = \frac{\Delta N}{N} = g_n$$

We learn that the growth rate of the stock in means of productions equals the growth rate in capacity. Now capacity utilization, u is the ratio of actual to capacity output,

$$u = \frac{Y_t}{N} \geq 1 \Rightarrow \leq 1$$

Okishio has established a direct relationship between capacity utilization and accumulation in fixed capital [Okishio 1964]. If u < 1 fixed capital investment declines, effective demand declines and capacity utilization falls again. Harrod relied on the accelerator to reach the same results, and Sweezy leaned heavily on his alleged technical relationship between capacity and consumption output. Now Okishio based his conclusions on the static short-term equilibrium between investment and savings,

$$sY_t = I_t$$
$$Y_t = \frac{I_t}{s}$$

Next the capital/output ratio,

$$c = \frac{K_t^*}{Y_t^*} \Rightarrow constant$$

The asterisks indicate both potential capacity output and the potential stock of fixed capital required to produce it. Now the degree of capacity utilization can be expressed as,

$$u_t = \frac{Y_t}{Y_t^*} = \frac{\textit{actual output}}{\textit{potential output}} = \frac{\frac{I_t}{s}}{\frac{K_t^*}{c}} = \frac{I_t/K_t^*}{s/c} = \frac{g_{kt}}{s/c}$$

And this expression says that the growth rate of the fixed capital stock,

$$g_{kt} = u_t \frac{s}{c}$$

Only when actual output is equal to potential capacity output will u = 1 and the growth rate of capacity output equal,

$$g_{kt}^w = \frac{s}{c}$$

This would be the growth rate necessary to make output and effective demand grow as fast as capacity. Capacity utilization is then the ratio of the two growth rates, the growth rate in actual effective demand and the growth rate in potential effective demand,

$$u_t = \frac{g_{kt}}{g_{kt}^w}$$

When $g_{kt} < g_{kt}^w$, as Sweezy claims to be normally the case, capitalists will reduce their fixed capital spending, further reducing capacity utilization and dragging the system down to the only sustainable path of simple reproduction.

Shaikh has now demonstrated that this is all wrong. The fluctuations in capacity utilization can regulate the cyclical adjustment between actual output and capacity. When investment outlays are disaggregated into fixed and circulating components, reductions in the fixed share in response to a decline in capacity utilization free up funds for use in circulating capital with a direct effect on output and effective demand. This dynamical adjustment cushions the effects of a decline in fixed capital spending and contains the contraction within the bounds of a medium-term cycle.

None of this implies that accumulation can proceed for ever crisis-free. Contrary to Sweezy and Strachey, technical change leads to a rising organic composition which inevitably expresses itself in a falling rate of profit. The mass of profits will rise to a peak and over a long wave stagnate. In Marx the trend of expanded reproduction is thus modified and at the stage of Absolute

Overaccumulation accumulation is halted. In the absence of growth, the cyclical adjustments between aggregate Demand and Supply, actual output and capacity output break out into sharper oscillations. Excess capacity and overproduction become endemic features of the crisis, as firms cease to expand and pump funds into the system. The complex web of money outlays and refluxes comes unravelled. The contraction in business spending causes a rise in the average level of unemployment. Sweezy and Strachey confuse the effects of the accumulation crisis for its ever present cause.

Notes

1. In their informative History of Marxist economics, Howard and King point out that "Kautsky's discussion of crisis reveals the dominance of underconsumptionist ideas in Marxist thought before 1914, together with the marginality of the falling rate of profit" [Howard and King 1989:84]. But it would be wrong to presume that the situation has changed since 1914. In a recent study of the Marxist system, Robert Freedman faithfully reproduces the underconsumptionist interpretation of Kautsky, Sweezy and Strachey, without acknowledgment of the tradition [Freedman 1990:100-101].

2. Steindl comments:"It is time to say that a decline of the rate of profit on this account may easily prevent him from adopting such methods. This is firstly, because he will not invest at all at a rate of profit below a certain level. And, secondly, because there may be other possibilities for investment which do not involve a decline in the profit rate" [Steindl 1976:242].

3. For Bleany, "Sweezy seems to assume that the problem can only be temporarily solved by a high rate of investment, and that if any interruption of the growth should occur, the economy will be faced with an immediate collapse back into stagnation. The possibility of oscillation around a consistently high rate of growth is dismissed as impossible, although a little reflection shows that such a possibility is perfectly possible" [Bleany 1976:118]. Characteristically, Sweezy's whole theoretical construction is held together by very thin strings. There are quite a number of strings, but they are very thin indeed. It boggles the mind to consider that one of the major interpretations of orthodox Marxism has so little behind it.

Appendix: Sweezy's model of Underconsumption

Sweezy's argument has been summarized by Georgescu-Roegen as follows: "Capitalists' behavior can lead only to a decreasing ratio between the rate of consumption and the rate of capital investment, whereas the technical conditions require this ratio to be constant" [Georgescu-Roegen 1966:409].

Sweezy begins by defining the national income as the sum of three flow rates per unit of time: workers' consumption, w = dW/dt; capitalist consumption, l = dConR/dt; and net investment, k = dK/dt. Next Sweezy posits as the "fundamental feature of Capitalism" that accumulation tends to take an increasing share of surplus value, and investment in means of production an increasing share of accumulation. Hence the growth rate of consumption for both workers and capitalists will be lower than the growth rate of investment. Thus, Sweezy's national income will be,

$$(1)\quad \frac{dY}{dt} = \frac{dW}{dt} + \frac{dL}{dt} + \frac{dK}{dt}$$

and from the "fundamental feature of Capitalism" Sweezy derives,

$$(2)\quad w = \alpha(k);\quad 0 < \alpha'(k) < 1;\quad \alpha''(k) < 0$$
$$(3)\quad l = \beta(k);\quad 0 < \beta'(k) < 1;\quad \beta''(k) < 0$$

Now it is central to the model to distinguish between the growth rate of investment k determined by Sweezy's "fundamental feature of Capitalism", and the growth rate of investment warranted by the growth rate of consumption c. For Sweezy took from Otto Bauer the assumption that there is a technical articulation between the growth of the stock of means of production and the growth of the capacity to produce consumer goods. The whole point of Sweezy's efforts hinges on the alleged contradiction between the technical relationship and the social relations underlying the "fundamental feature of Capitalism".

Differentiating (1) we obtain the growth rate of income

$$(4)\quad \frac{d^2Y}{dt^2} = \frac{d^2w}{dt^2} + \frac{d^2l}{dt^2} + \frac{d^2k}{dt^2}$$

The model establishes the warranted rate of growth of the stock of means of production as being determined by the growth rate of total consumption and the capital/output coefficient,

$$(5)\quad \frac{dc}{dt} = \lambda\left[\frac{d^2w}{dt^2} + \frac{d^2l}{dt^2}\right]$$

Now rearranging (5) and substituting,

$$\frac{1}{\lambda}\frac{dc}{dt} = \frac{d^2Y}{dt^2} - \frac{d^2k}{dt^2}$$

$$\frac{d^2Y}{dt^2} = \frac{1}{\lambda}\frac{dc}{dt} + \frac{d^2k}{dt^2}$$

$$(6)\quad \frac{d^2Y}{dt^2} = \frac{d^2k}{dt^2} + \frac{\lambda}{\lambda}\left[\frac{d^2w}{dt^2} + \frac{d^2l}{dt^2}\right]$$

From (2) we derive

$$\frac{dw}{dt} = \alpha'(k)\,\frac{dk}{dt}$$

And from (3),

$$\frac{dl}{dt} = \beta'(k)\frac{dk}{dt}$$

Differentiating these expressions we have,

$$(7)\quad \frac{d^2w}{dt^2} = \alpha'(k)\frac{d^2k}{dt} + \frac{dk}{dt}\alpha''(k)\frac{dk}{dt}$$

$$(8)\quad \frac{d^2l}{dt^2} = \beta'(k)\frac{d^2k}{dt} + \frac{dk}{dt}\beta''(k)\frac{dk}{dt}$$

Substituting (7) and (8) into (4) we have,

$$(9)\quad \frac{d^2Y}{dt^2} = \frac{d^2k}{dt^2} + \left[\alpha'(k)\frac{d^2k}{dt} + \frac{dk}{dt}\alpha''(k)\frac{dk}{dt}\right] + \left[\beta'(k)\frac{d^2k}{dt} + \frac{dk}{dt}\beta''(k)\frac{dk}{dt}\right]$$

$$(10)\quad \frac{d^2Y}{dt^2} = [\alpha'(k) + \beta'(k) + 1]\frac{d^2k}{dt^2} + [\alpha''(k) + \beta''(k)]\frac{dk^2}{dt^2}$$

If the national income is assumed to grow at a constant or declining rate,

$$\frac{d^2Y}{dt^2} \leq 0$$

Since the behavioral assumptions of the "fundamental feature" require the acceleration of investment,

$$\frac{d^2k}{dt^2} > 0$$

It follows from (10) that

$$\frac{d^2Y}{dt^2} - \frac{d^2k}{dt^2} < 0$$

Therefore the warranted rate of growth in means of production imposed by the growth rate in consumption (5) will be negative,

$$\frac{dc}{dt} = \lambda\left[\frac{d^2Y}{dt^2} - \frac{d^2k}{dt^2}\right] < 0$$

But the actual growth rate of the means of production determined by the "fundamental feature" principle would be,

$$\frac{dY}{dt} = \frac{dw}{dt} + \frac{dl}{dt} + \frac{dk}{dt}$$

Thus substituting and rearranging we have,

$$(11)\quad \frac{dY}{dt} = \alpha'(k)\frac{dk}{dt} + \beta'(k)\frac{dk}{dt} + \frac{dk}{dt}$$

$$(12)\quad \frac{dY}{dt} = \frac{dk}{dt}[\alpha'(k) + \beta'(k) + 1]$$

$$(13)\quad \frac{dk}{dt} = \frac{\frac{dY}{dt}}{\alpha'(k) + \beta'(k) + 1} > 0$$

Hence, according to Sweezy, the underconsumption gap will widen through time leading to sharp fluctuations or the stagnation of Capitalism. But what does the conclusion really mean? That $dc/dt < 0$ means that the share of means of production required to produce consumer goods declines, while the rising dk/dt shows that the total output of means of production increases. This only means that the share of means of production required to produce means of production tends to rise. It is a plausible outcome of Capitalist accumulation.

Domar's Correction: a family dispute

With respect to Sweezy's technical articulation, Domar has remarked that "a case can perhaps be made for the usefulness and possible stability of the ratio between the stock of capital and the volume of its (annual) output, but what is the meaning of the ratio between the stock of capital and that part of its output which is sold to consumers?" Domar simply comments that "not an insignificant part of investment is made in order to produce further investment goods" [Domar 1957:123].

Domar finds that Sweezy's argument in favor of stagnation and underconsumption is not as powerful as it could be. Sweezy's model shows that in order to avoid excess capacity, aggregate income must grow at an increasing absolute rate to match an increasing ratio of investment in means of production to income. Sweezy did not believe that national income was likely to grow at such a rate in late Capitalism. Domar is intent to show that even if investment

in means of production did not rise in relation to income, income must grow nonetheless at an increasing absolute rate to avoid stagnation. Domar did not think that this rate of growth was likely to occur in mature Capitalism.

Domar pointed out that Sweezy's behavioral assumptions require that income grow at an increasing *absolute* rate if,

$$(14)\quad \frac{d\left(\frac{k}{Y}\right)}{dt} \geq 0$$

In Domar's own formulation, the equilibrium condition for 'full capacity' growth is that the level of savings, sY = k, the level of investment. Given the propensity to save s, and the income/investment ratio v, we can write,

$$(15)\quad \frac{dY}{dt} = kv$$

Substituting the equilibrium condition sY = k,

$$\frac{dY}{dt} = svY$$

And therefore the warranted growth rate in income,

$$(16)\quad \frac{dY}{Y} = sv$$

Now differentiating (14) we have,

$$Y\frac{dk}{dt} - k\frac{dY}{dt} \geq 0$$

And this means that,

$$(17)\quad Y\frac{dk}{dt} \geq k\frac{dY}{dt}$$

Differentiating (15) and substituting into (17),

$$(18)\quad \frac{d^2Y}{dt^2} = v\frac{dk}{dt}$$

Rearranging (18) we have,

$$\frac{dk}{dt} = \frac{\frac{d^2Y}{dt^2}}{v}$$

And substituting into (17),

$$Y\left[\frac{\frac{d^2Y}{dt^2}}{v}\right] \geq k\frac{dY}{dt}$$

Hence,

$$Y\left(\frac{d^2Y}{dt^2}\right) \geq kv\frac{dY}{dt}$$

We know from (15) that,

$$\frac{dY}{dt} = kv$$

Therefore,

$$Y\left(\frac{d^2Y}{dt^2}\right) \geq \left(\frac{dY}{dt}\right)^2$$

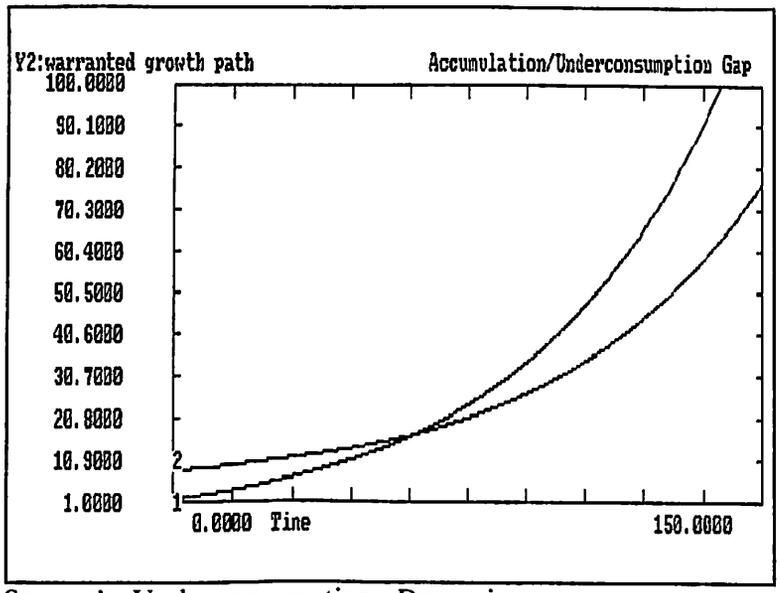
We thus confirm (14) and the premise that the absolute growth rate of national income must be rising to satisfy the equilibrium condition. Domar did not believe (and assumed that Sweezy would agree) that Capitalism was capable of such dynamism.

Dynamical Simulation of Sweezy's Model

My simulation model takes the national income to be = 10. Workers' consumption, V amounts to 60% at the starting point, with capitalist consumption, Cr adding another 20% to total consumption. Hence the disposable surplus value for accumulation, S = 20%. 80% of that surplus value will be invested in means of production.

The share of workers' consumption falls continuously at the rate of 2%. Hence the disposable surplus value, S will grow, and since 80% of that growing surplus value is reinvested in means of production, the time growth rate of capitalist consumption is the difference. The total growth rate of consumption is the sum of dV/dt and dCr/dt. Finally the simulation model assumes that the national income grows at the same rate as the share of workers' consumption falls = 2%.

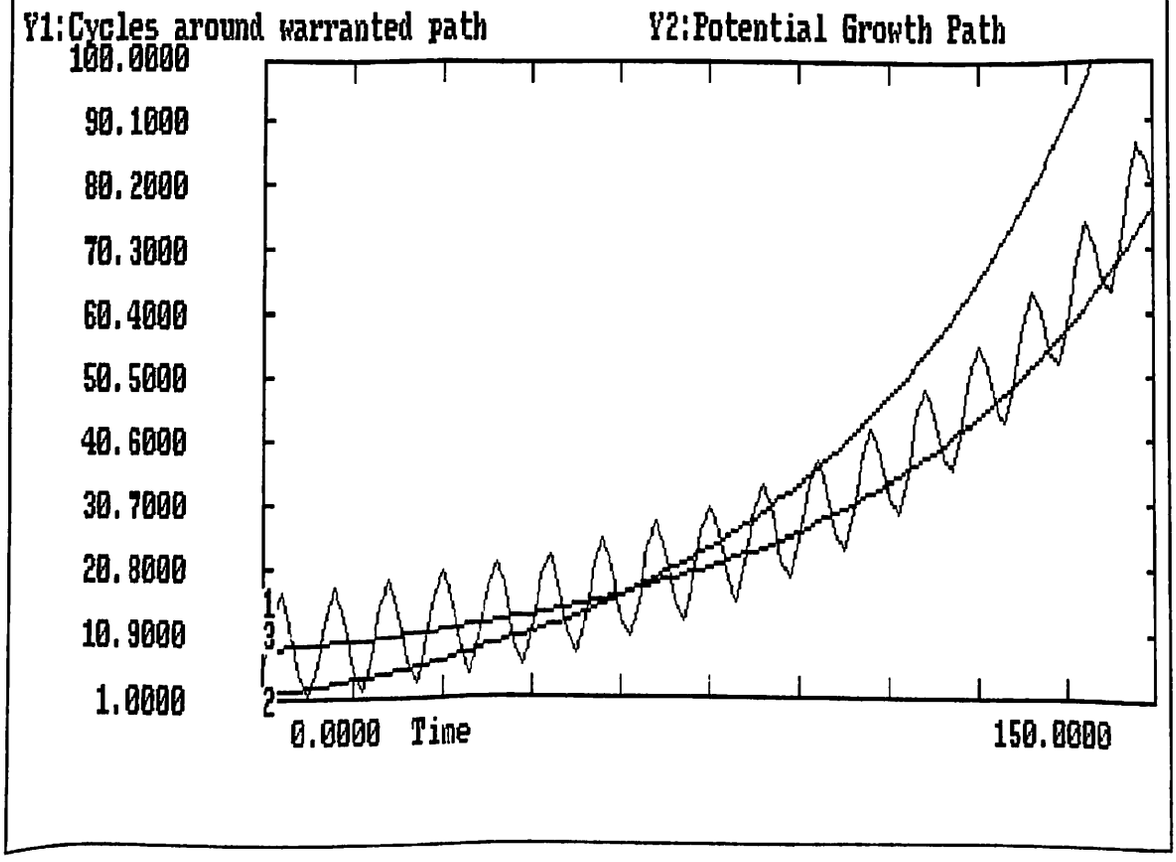
The simulation shows that while accumulation starts at a lower level than consumption, it will rise above the warranted path traced by the growth in total consumption. The growth in capitalist consumption is insufficient to match the



Sweezy's Underconsumption Dynamics

decline in workers' consumption and hence from Sweezy's point of view the under consumption gap will grow larger through time. The consequence of this will be either the collapse of accumulation or the persistence of sharp fluctuations around the warranted path traced by the growth in consumption.

Sweezy's Underconsumption Cycles



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MARX AND ENGELS ON FRENCH SOCIAL DEMOCRACY: HISTORIANS OR REVOLUTIONARIES?

By Bernard H. Moss

To Anne
With appreciation
Bernie Moss

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MARX AND ENGELS ON FRENCH SOCIAL DEMOCRACY: HISTORIANS OR REVOLUTIONARIES?

By Bernard H. Moss

Marx first applied his materialist method to the study of contemporary history in essays on the French Second Republic. *The Class Struggles in France, 1848 to 1850* and *The Eighteenth Brumaire of Louis Bonaparte* stand as landmarks in Western historiography because they combine a subtle and brilliantly dialectical account of political personalities, ideas, and movements with a class analysis rooted in production relations.[1] Recent commentators have seen in the latter work nothing less than the epistemological break with economic reductionism that disclosed the specificity and relative autonomy of political life.[2] Such Althusserian readings of Marx are questionable,[3] but they point to the solid reputation these essays énjoy among Marxists and non-Marxists alike. Despite differences in method and approach, recent historical work tends to confirm the substance of Marx's analysis with respect to the nature of the ruling elites,[4] the impact of the mid-century economic crisis,[5] the leading role of workers, the radicalization of peasants and lower middle classes, and the repressive authoritarian nature of Napoleonic rule.[6]

Yet, for all the subtlety and complexity of Marx's histories, they

[1] See Leonard Krieger, "Marx and Engels as Historians," *Journal of the History of Ideas,* **14** (1953), 381-403.

[2] David Fernbach, ed., *The Revolutions of 1848 by Karl Marx* (London, 1968), 57; Stuart Hall, "The 'Political' and the 'Economic' in Marx's Theory of Classes," *Class and Class Structure,* ed. Alan Hunt (London, 1977), 39-40; and Gwyn Williams, "Interpretations of the French Revolution: Karl Marx and Alexis de Tocqueville," in *France: 1848-1851* (Milton Keynes: The Open University, 1976), 111-16.

[3] Marx's concern for the specificity of the political is evident in his earliest critique of Hegel's philosophy of law, K. Marx and F. Engels, *Collected Works* (London, 1975), III, 3-129. A good antidote to Althusser though extreme in its essentialism is Shlomo Avineri, *The Social and Political Thought of Karl Marx* (London, 1968).

[4] See C. H. Johnson, "The Revolution of 1830 in French Economic History," *1830 in France,* ed. J. Merriman (New York, 1975), 139-89.

[5] See *Theory and Society,* 12, no. 4 (July 1983).

[6] The best surveys are by Roger Price, *The French Second Republic* (Ithaca, 1972), and *idem,* ed., *Revolution and Reaction: 1848 and the Second French Republic* (London, 1975), 1-72. See also T. Margadant, *French Peasants in Revolt: The Insurrection of 1851* (Princeton, 1979); J. Merriman, *The Agony of the Republic: The Repression of the Left in Revolutionary France, 1848-1851* (New Haven, 1978); Thomas R. Forstenzer, *French Provincial Police and the Fall of the Second Republic: Social Fear and Counterrevolution* (Princeton, N.J., 1981); Ronald Aminzade, *Class, Politics and Early Industrial Capitalism: A Study of Mid-Nineteenth-Century Toulouse, France* (Albany, N.Y., 1981); and my *Origins of the French Labor Movement: The Socialism of Skilled Workers, 1830-1914* (Berkeley, 1976).

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demands.[16] The danger was that a maximalist policy such as that advocated by the True Socialists would frighten the bourgeoisie into the protective arms of the monarchy, thus reproducing the classic German syndrome of restoration *en permanence.*[17]

Whether the transition from a social democracy based on a broad coalition of classes to a socialist regime in which the working class would lead required a separate revolution remained a matter of circumstance.[18] Where the working class constituted a majority, as in England, a democratic constitution would lead directly to proletarian rule. But where workers could build a majority only in coalition with the petty bourgeoisie, as in France and Germany, a second revolution might be necessary. Marx and Engels apparently feared that in less industrialized countries where the middle class was still strong and independent, it would be able to exploit the parliamentary system for its own purposes in order to stabilize capitalist relations and halt progress towards socialism.[19] If parliament were a forum which favored middle-class over working-class democrats, armed struggle was the preferred medium of the proletariat. The proletariat had a better chance of assuming leadership of a popular coalition in the course of revolutionary struggle than through electoral contests and parliamentary debate. But if armed struggle appeared to offer the most direct path to proletarian rule, Marx and Engels did not exclude—at least before 1850—the possibility of a parliamentary transition even in France and Germany.

In France where, according to Marx, the bourgeoisie, or at least its financial fraction, held power under a liberal monarchy, the revolution would be directed toward achieving political and social democracy. For this purpose Marx and Engels fully endorsed the program of the radical newspaper *La Réforme,* which called for the nationalization of large-scale industry and gradual collectivization of small-scale enterprise through producers' cooperatives.[20] Because of their exclusion from suffrage and access to credit under the monarchy, the French petty bourgeoisie, in contrast to the British, had forged a social democratic bloc with workers and peasants. Marx and Engels regarded the middle-class leaders of this bloc—Ferdinand Flocon, Louis Blanc, and Alexandre Ledru-Rollin—as champions of the working classes. They treated them as friends and allies and were regarded by them as social democrats.[21] The February days were greeted by Engels as the revolt of the working class

[16] Engels feared strikes and the distribution of the Communist program would frighten the German bourgeoisie in 1848, *Works,* XXXVIII, 173.
[17] *Ibid.,* III, 184-86.
[18] *Ibid.,* VI, 350.
[19] Engels's reasoning in this October 1847 draft must be imputed from earlier and later writings, *ibid.,* V, 52-53, X, 30-32.
[20] *Ibid.,* VI, 299, 375-82, 393-401, 438-44.
[21] *Ibid.,* VI, 518, XXXVIII, 133-39, 152, 155-57.

against the bourgeoisie. The outcome, he believed, would be decided in the struggle between Ledru-Rollin and the *Réforme* faction, supported by the working class, who were "communists without knowing it,"[22] and the moderate socialists of the *National,* representing the petty bourgeoisie, who were reluctant to carry out the anti-capitalist expropriations that were necessary for the fulfillment of their program (*ibid.,* 166-69).

Marx and Engels as yet had only theoretical differences with social democracy. As they had declared in the *Manifesto,* the Communists did not constitute a political party with a separate program; they were rather a leadership group that held an advantage over other democrats in possessing a materialist understanding of history and its movement toward communism (*ibid.,* VI, 497-98). The Communist League was more a propaganda and discussion circle than an activist party. Organized as a secret society in the absence of political freedom in Germany, it could be dissolved after the 1848 revolution.[23] Just as Marx and Engels did not prejudge the case for a separate proletarian revolution, so they did not insist on the immediate formation of a working class party out of the loosely organized and socially heterogeneous elements comprising social democracy.

Nevertheless, they criticized the French social democrats for their historical idealism, their chauvinism, and their attachment to "the phrases and illusions . . . handed down from the great Revolution."[24] Ignoring the rise of industrial capitalism, which pitted workers against employers, the social democrats still shared the Saint-Simonian vision of a society divided between parasitic elites—landowners and financiers—and producers—including both industrialists and workers.[25] They conceived of socialism as the final goal, a system of distributive justice, rather than as the transition to communism made possible by the growth of productive forces. They expected to achieve it within the national boundaries of France, whereas Marx and Engels believed that it could not survive in one country until it had conquered Britain, the most industrialized nation then dominating the world market.[26]

The first sign of a split with social democracy appeared after Marx's return to Germany and the news of the June Days in Paris. Marx and Engels were surprised by the depth of popular unrest in Germany and by the wide gulf separating workers and peasants from middle-class democrats (*ibid.,* XXXVIII, 170-74). German democrats were pale imitations who cast shadows on the French original. Even on purely political issues, they lacked boldness and resolution, harbored illusions about the

[22] *Ibid.,* XXXVIII, 168.
[23] Hunt, *Political Ideas,* 169-74.
[24] *Works,* VI, 518; also 335-56, 398-99, and XXXVIII, 152, 155-57.
[25] See my "Parisian Workers," esp. 207-08.
[26] *Works,* V, 49, X, 56.

bourgeoisie, and refused to break with the aristocratic ideal of a federal Germany.[27] The June Days had a tremendous impact on German society. Marx was not alone among Germans in interpreting the events in Paris as a class struggle between workers and bourgeoisie. Based on false hopes and misinformation, Engels reported a degree of planning and offensive strategy among the insurgents that suggested political direction and emerging class consciousness (*ibid.*, 133, 157-64). Marx hailed the June Days as the beginning of the class war which had smashed the fraternal illusions of February and broken the bonds uniting working-class and middle-class democrats (*ibid.*, 128, 148-49).

After June 1848, Marx and Engels would interpret social democracy through a prism that fractionated it into proletarian and petty bourgeois components. This interpretation was based partly on information they received from friends in Paris who shared their outlook as well as on the hope that a second revolution in France, led by the proletariat, would save the faltering German revolution. The June Days demonstrated for them the futility of relying solely on parliamentary democracy and highlighted the need for a workers' party capable of leading revolutionary struggle.

Theoretical differences with the *Réforme* now assumed practical significance. Marx reproved the newspaper for its lukewarm, embarrassed support of the June insurgents (*ibid.*, 478-79). It was guilty of historical idealism when it attributed popular setbacks to errors of judgment, i.e., accidental causes, rather than to antagonistic class interests and invoked patriotism and morality as the motivation for socialism rather than material class interest (*ibid.*, 493-95). The rival presidential campaigns of Ledru-Rollin and François Raspail, run on identical platforms, were interpreted by Engels as a sign of class division in social democracy. As the candidate of the Mountain, the social democratic caucus in parliament, Ledru-Rollin displayed the rhetorical devotion and indecision of the class he represented—the petty bourgeoisie. Without the armed might of the proletariat pushing him forward, he would likely use an electoral victory to acquire capital for his own class. Raspail, by contrast, the leader of the armed workers in February, was truly revolutionary because as candidate of local Parisian committees he was a direct representative of the working class (*ibid.*, VIII, 123-28).

When Marx and Engels assessed the reasons for the failure of the revolution in Germany at the end of 1848, they looked to the French proletariat to spark off a second revolutionary round in Europe (*ibid.*, 213-15). The accession to power of Louis Napoleon and the Party of Order polarized the social classes, recreating a coalition of middle classes around the increasing revolutionary working class. Marx and Engels waited for insurrections to break out on January 29 and March 21 when

[27] *Ibid.*, VII, 27-29, 48-52, 75, 77.

the government introduced and finally passed a bill outlawing the popular democratic clubs.[28] As German democrats were being crushed by the Prussian army in June, Marx journeyed to Paris where a revolutionary response to the French military assault on the Roman Republic was being prepared.

Marx's first-hand newspaper account of the events of June 13 stood out from those written by other participants—German Communists and social democrats alike—by the distinction he drew between the parliamentary party of the Mountain and the "party of the people" organized in clubs, secret societies, and electoral committees.[29] The Mountain had been forced to invoke the force of arms to defend the constitution by the "party of the people" that had urged a surprise attack on the night of the 11th and the establishment of a veritable Paris Commune on June 13. But due to hesitation, over-confidence, and lack of military preparation, the Mountain had been outwitted by government troops under the command of General Changarnier, who dispersed the unarmed demonstrators and crushed belated attempts at insurrection. Through a series of misunderstandings and errors, the Mountain and the "people" had mutually "paralyzed and deluded each other" (*Works,* IX, 478).

Marx's bifurcated analysis of social democracy described a potential rather than an actual political division. At no time under the Republic did workers break with the leadership of the Mountain to form an independent party. Doubtless, workers in clubs and secret societies were more inclined toward insurrectionary violence than were middle-class parliamentarians, who were responsible beyond the militant working class to the movement as a whole.[30] Blanqui in particular advocated the arming of the proletariat to guarantee democratic rights and guard against betrayal by opportunistic parliamentarians, but the proletariat meant for him "thirty-two million Frenchmen who lived on the product of their labor"[31] and revolutionary violence only a democratic court of last resort. Before May 1850 the Blanquists still entrusted the verdict to the ballot box.[32] Revolutionary vigilance and preparedness aside, their program was indistinguishable from that of the Mountain and social democracy generally.[33]

[28] *Ibid.*, VIII, 281-85, X, 90-91.

[29] Cf. *ibid.*, IX, 477-79, with Sebastian Seiler, *Das Complot vom 13. Juni 1849* (Hamburg, 1850), 59-63; A. Ruges, *Briefwechsel und Tagebuchblätter aus der Jahren 1825-80* (Berlin, 1886), 103-06; Georg Weerth, *Sämtliche Werke* (Berlin, 1957), V, 313-15, and Alexander Herzen, *Erinnerungen* (Berlin, 1907), 60-63.

[30] Cf. my "June 13, 1849: The Abortive Uprising of French Radicalism," *French Historical Studies,* 14 (Spring 1984), 392; with Aminzade, *Class, Politics and Industrial Capitalism,* Chap. 6.

[31] Auguste Blanqui, *Textes choisis,* ed. V. P. Volguine (Paris, 1971), 132.

[32] M. Dommanget, *Auguste Blanqui à la citadelle de Doullens* (Paris, 1954), 67-78.

[33] Blanqui, *Textes choisis,* 109-40. Under a revolutionary government Blanqui's reform

All the working-class demonstrations that Marx later presented as evidence of political independence—February 25, March 17, April 16, May 15, and the June Days—expressed continued support for social democratic leaders and policies. Blanqui, whom Marx designated as leader of the revolutionary proletariat on May 15, actually walked away from this impromptu uprising in disgust.[34] Called to defend both Louis Blanc and Polish freedom, this demonstration turned into an attempted uprising only because of a police blunder. Rather than an expression of political independence, the June Days were a spontaneous protest against the government's betrayal of social democratic leaders and program.[35] Provoked by the dissolution of the National Workshops, workers fought a dogged but largely defensive battle without the political leadership and offensive strategy attributed to them by Engels. The Raspail candidacy did express a popular desire to control elected representatives, but outside Lyon it did not win worker majorities or lead anywhere to a permanent split in social democracy. Popular clubs and secret societies had forced the Mountain to live up to its principles and commitments on June 13, but, while failing the test of military planning and initiative, it had not shied away from the call to arms.[36]

The defeat of European democracy in June determined Marx's rupture with social democracy. Already in April Marx had resigned from the middle-class Rhenish Committee of Democrats in order to concentrate on building a workers' party around Stephen Born's Brotherhoods,[37] thus introducing to Germany the same political class division that he believed had taken place with the Raspail candidacy in France. Though wary of his middle-class allies, he supported their campaign for the imperial constitution, urging the Left at Frankfurt to assume command of the insurrections breaking out all over Germany. While refusing an official position in the Palatinate, Engels went off to fight with workers against Prussian troops at Elberfeld and Baden.[38] Exiled in London after the fiasco of June 13, Marx split off from the main body of German democrats, launched a new monthly edition of his party organ, and began

program would have been essentially the same as Blanc's. See *ibid.*, 103, and Blanqui Mss. N.A.F. 9592 (I, 380-81).

[34] Peter Amann, *Revolution and Mass Democracy: The Paris Club Movement in 1848* (Princeton, 1975), 205-47, and his "A *Journée* in the Making: May 15, 1848," *Journal of Modern History,* 42 (1970), 42-69.

[35] Amann, *Revolution and Mass Democracy,* 300-15; Price, *Second French Republic,* 158-71, 182; and Charles Tilly and Lynn Lees, "The People of June 1848," *Revolution and Reaction,* 170-209.

[36] Moss, "June 13, 1849," 390-414.

[37] *Works,* IX, 197, 403, 494-95, 503-04, 507. Cf. Draper, *Marx's Theory of Revolution,* 232-49, who exaggerates the degree to which Marx had broken with social democracy in Spring 1849.

[38] *Works,* IX, 416-17, 447-49, 454, 467, X, 149-239, XXXVIII, 203, 215.

to reorganize the League as a vanguard party capable of leading workers in revoluntionary struggle.[39]

In two historical works published in the new organ, Marx and Engels settled accounts with social democracy. In articles on the German campaign, written at Marx's suggestion, Engels pinned the blame for the debacle on the leadership of the petty bourgeoisie:

> This class is invariably full of bluster and loud protestations, at times even extreme as far as talking goes, as long as it perceives no danger; faint-hearted, cautious and calculating as soon as the slightest danger approaches; aghast, alarmed and wavering as soon as the movement it provoked is seized upon and taken up seriously by other classes; treacherous to the whole movement for the sake of its petty-bourgeois existence as soon as there is any question of struggle with weapons in hand—and in the end, as a result of its indecisiveness, more often than not cheated and ill-treated as soon as the reactionary side has achieved victory (*Works,* X, 150).

The paralysis of the burghers of Elberfeld, the procrastination of the Left at Frankfurt, the cheerful incompetence of the Palatines, and the willful sabotage of Bruno Brentano, the leader of Baden, all manifest the vacillating transitional status of the petty bourgeoisie, which only assumes a revolutionary position when pushed by the armed proletariat (*ibid.,* 150-51). Middle-class students and parliamentarians desert the military campaign while workers and Communists fight to the bitter end.[40] The insurrection radicalizes the artisanal workers of Baden. Having experienced betrayal at the hands of the petty bourgeoisie, they will surely take the lead next time (*ibid.,* 237-38). Middle-class leaders undoubtedly displayed a pattern of moderation and compromise that could be related to class position and ideology, but Engels tended to reduce even psychological and moral characteristics—procrastination, incompetence, treachery, and cowardliness—to class determination, a reductionism that was not entirely absent from Marx's essay *Class Struggles.*

The latter essay was written from January to March 1850, when Marx expected a new revolutionary round set off by an economic downturn in Britain and a popular uprising in France. Engels had reported on the radicalization of the French peasantry, weighed down by taxes and mortgage payments, and their growing alliance with urban workers and shopkeepers against the bourgeoisie (*ibid.,* 17-26). Ferdinand Wolff (1812-95), Marx's close friend and ally, reported from Paris that since the fiasco of June 13 people were turning away from the leadership of the Mountain toward the Blanquists and secret societies. "Blanqui has become their

[39] *Ibid.,* XXXVIII, 207-08, 211-12, 218-20; and *Der Bund der Kommunisten: Dokumente und Materialien,* Band 2, 1849-1851 (Berlin 1982), esp. 136-45, 195-201, 323-34. Hunt, *Political Ideas,* Chaps. 7 and 8, can only deny Marx's support for a revolutionary party by ignoring or explaining away the circulars and statutes of the League.

[40] *Works,* X, 166-67, 224-26.

real leader," he wrote, "the permanent Revolution their goal. . . ."[41] On March 10 elections were held to replace the deputies of the Mountain who had been condemned for participation in June 13. Engels interpreted the victory of Paul de Flotte (1817-60), a former naval officer transported for his role in the June Days and known for his connections to secret societies, as a sign that people were following the lead of the revolutionary working class.[42] It was in this mood of revolutionary optimism that Marx issued the March 1850 Circular[43] to the League, formed an alliance with Blanquists and other 'putschist' elements in London, and penned the triumphant third chapter of *Class Struggles.*

This epic essay describes the emergence of the proletariat from the fraternal illusions of February and defeats of June 1848 and 1849: by suffering defeat the proletariat matures and becomes aware of its revolutionary role and destiny (*Works,* X, 47). Marx saw the relative backwardness and uneven industrial development of France not as a barrier but as a stimulus to revolution. The proletariat plays a leading role not because of France's industrial advance, but because of the strategic geographical position it commands in Paris (*ibid.,* 56-57). The subordination of industrial to finance capital and of French to English capitalism forms the basis for a broad coalition of peasants, workers, artisans, and industrialists against the landed and financial oligarchy that exploits all producers through the secondary mechanisms of rent, interest, and taxes. The economic immaturity of the classes is overcome in the revolutionary process. In 1849 "different classes of French society had to count their epochs of development in weeks where they had previously counted them in half centuries" (*ibid.,* 97). Exposure to socialist ideas and the broken promises of conservative governments make radicals of the peasantry. "Revolutions are the locomotives of history" (*ibid.,* 122). The pre-industrial, idealist republican tradition spurs on the subordinate classes, carrying even a section of the bourgeoisie beyond the economic limits of its class to lead the democratic bloc against the Party of Order (*ibid.,* 83-95).

The historical model that Marx employed was that of the permanent revolution. The armed workers pushed the petty bourgeoisie forward in February but were abandoned by it in April, May, and June. After the defeat of June they raised themselves up by "intellectual victories" and formed a separate socialist party around the Raspail candidacy (*ibid.,* 81, 98). The fiasco of June 13 freed them from their last republican

[41] Wolff's newspaper article of Sept. 6, 1849, *Bund der Kommunisten,* 513, may well be the source for Marx's belief that the French proletariat had adopted his strategy of permanent revolution. See also, *ibid.,* 100-02.

[42] *Works,* X, 27-29.

[43] Hunt, *Political Ideas,* 235-58, attributes the Circular to Blanquist influence, but its validity is re-affirmed in the December 1850 circular written after Marx's break with the 'putschists,' *Bund der Kommunisten,* 329-30.

illusions. They rally increasingly around the revolutionary socialism symbolized by the name of Blanqui and the victory of de Flotte on March 10. As a last resort the ruling classes were going to prepare a monarchical restoration, but this attempt would only hasten the proletarian revolution: "*Après moi le déluge!*" (*ibid.,* 131).

The restoration of political order served merely to polarize the social classes. The triumph of the combined Party of Order—Legitimists, Orleanists, and Bonapartists—drives the exploited middle classes into an alliance with the working class (*ibid.,* 74-76, 94-99). The government then resorts to political repression and Catholic indoctrination, but measures directed against school-teachers and local officers only stiffen resistance, inoculating "every village with revolution" (*ibid.,* 123). Even industrialists join the popular coalition defending their program of free trade and balanced budgets as socialist measures for the emancipation of the proletariat! (*ibid.,* 125-26).

Marx's sectarian turn is most evident in his analysis of the provisional government and social democracy. In 1848 Engels had analyzed the government as contradictory: divided between a radical socialist minority and a moderate majority, committed to socialist reforms in theory but reluctant to attack the capitalist order in practice. Marx describes it simply as a bourgeois regime of bankers, lawyers, and businessmen that maintained capitalist rule but established a "socialist synagogue" at the Luxembourg as a sideshow to delude the workers (*ibid.,* 54-64). He not only ridicules social democratic slogans such as "the organization of labour" and "the right to work" that he previously endorsed, but belittles the social and administrative reforms—e.g., better wages and hours of work, employment and cooperative projects, personnel changes in the state bureaucracy—that did not last very long. What is sectarian about the new version is not so much the conclusion, for the government did by its financial measures capitulate to the bankers, but the Machiavellian suggestion that this policy was deliberate and automatic, rather than the outcome of contradictory tendencies and external constraints.

In the revised class analysis each political faction is shifted to the right, apparently reduced to the class background of its leaders with the wealthy leaders of the *National* standing in for the republican faction of the bourgeoisie rather than for the petty bourgeoisie, and the petty bourgeois leaders of *La Réforme* representing their own class rather than a bloc of working and middle classes.[44] The working class, provisionally represented by Albert and Louis Blanc, emerges as an independent force

[44] While both republican factions professed a program of social democracy, the more liberal *National* appealed essentially to the professional and commercial bourgeoisie; only the more radical *Réforme* was linked to the organized working class. Cf. Aminzade, *Class, Politics and Industrial Capitalism,* Chaps. 5 and 6, with Frederick A. de Luna, *The French Republic under Cavaignac-1848* (Princeton, 1969), Chap. 2 and 81-99.

only under the leadership of Blanqui. The government and Ledru-Rollin conspired with the bourgeoisie to eliminate working-class influence on April 16 and in the June Days; Marx regarded May 15 as a deliberate attempt by the proletariat to recapture revolutionary influence. In the June Days the bourgeoisie provokes workers into an uprising "without leaders, . . . a common plan, . . . [or] means." Through defeat the workers learn that social reform is utopian under the bourgeois republic. In the place of social-democratic demands appear the revolutionary slogans: "Overthrow of the bourgeoisie! Dictatorship of the working class!" (*Works,* X, 67, 69)

What was previously described as a comedy of errors on June 13 is attributed to class determination, the "parliamentary cretinism" [45] of the petty bourgeoisie—its naive faith in the force of abstract rights and constitutions, its lack of courage and resolution, and its abhorrence of revolutionary violence (*ibid.,* X, 101-06). From his new vantage point Marx decries the Mountain's attempt to carry out a "parliamentary revolution"—to call a revolution to defend the parliamentary system and to begin with an unarmed peaceful demonstration. If the Mountain delayed in calling to arms, it was not because it wanted to build popular support by exhausting all constitutional means,[46] but because it feared unleashing the proletariat. The tension and passion of the day are purged from this account. The cries of the demonstrators are rendered cold, hollow, and mechanical, the final call to arms conscience-stricken and perfunctory (*Works,* X, 105-06). June 13 destroyed workers' faith in the Mountain. Ceding cooperative socialism to the petty bourgeoisie, workers will turn to revolutionary socialism and assume leadership of the democratic bloc. The victory of de Flotte, marking the ascendancy of the proletariat, is merely a prelude to revolution (*ibid.,* 127-30).

Marx's and Engels' optimism was soon dampened when de Flotte's victory was followed not by insurrection but by another electoral victory. Elected in two districts, de Flotte had opted for the Haut Rhin, thus triggering a second election in Paris in which the social democratic candidate was Eugène Sue. As a candidate, Sue was no less radical than de Flotte; his victory caused a veritable panic on the stock exchange.[47] But, Marx and Engels, who had ridiculed the novelist in 1845 for his sentimental humanism (*Works,* IV, 55-76), regarded him as a representative of "well-meaning, 'soft-sawder', sentimental shopcrat-socialism" (*ibid.,* X, 31). The second by-election diverted workers away from the armed struggle in which they would take the lead back toward the

[45] Engels applied this term to German democrats in 1851, *Works,* XI, 79.

[46] Cf. Moss, "June 13, 1849", 413.

[47] Ch. Seignobos, *La Révolution de 1848—Le Second Empire (1848-1859).* vol. VI of *Histoire de France contemporaine,* ed. E. Lavisse (Paris, 1921), 132; and Philippe Vigier, *La Seconde République dans la région alpine,* 2 vols. (Paris, 1968), II, 279.

electoral arena, which was dominated by the petty bourgeoisie. The electoral way to socialism would give the petty bourgeoisie a free hand to slough off the proletariat, acquire capital for itself, and reconstitute capitalist relations (*ibid.,* 30-32).

An even greater blow to their hopes came from the tepid parliamentary response to the restriction of suffrage on May 31. League members were in contract with secret societies in Paris. On May 7 Ernst Dronke informed Engels of plans by secret societies to respond with an uprising that would abolish parliament and establish a revolutionary dictatorship headed by Blanqui for ten years.[48] Tension rose as secret societies awaited the signal from the Mountain, but it suddenly abated after May 17, when moderate republicans, joined by the Mountain, instituted a petition campaign.[49] Uncertain and divided after the failure of June 13, the Mountain decided to await a graver violation of universal suffrage before unleashing a revolution. Bitter and disabused, Engels blamed the failure to unleash a revolution on the cowardice of the parliamentarians and "fickleness" of the French character, but consoled himself with the belief that the workers, no longer content to die for historic figures such as Blanqui, were developing their own revolutionary formulas and would oppose the more drastic curtailment of the suffrage that was expected before the presidential election of May 1852.[50] He may have been encouraged in this belief by the fact that Blanquists in Paris were collaborating with League members on plans for the uprising.[51]

By September, however, Marx's and Engels' hopes for a European revolution had faded. Not only had resistance failed to materialize in France, but the business downturn expected in Britain had turned into a world-wide recovery. The revised estimate, which led to a break with the Blanquists and other 'putchist' elements in London,[52] was reflected in an article on the European situation, published in their journal.[53] By its abject response to the restriction of suffrage, the Mountain had removed itself from serious historical consideration. Nothing more could be expected from workers exhausted by repeated defeats and from peasants who were incapable of social initiative. With the threat of proletarian revolution averted, the ruling classes could now settle the question of

[48] *Bund der Kommunisten,* 184. Whether or not Marx and Engels approved of this particular plan, they had evidently placed their hopes in an insurrectionary movement to overthrow parliamentary democracy. Cf. Hunt, *Political Ideas,* 249-58, and Chap. 9.

[49] Vigier, *Seconde République,* II, 252, 278-83; and R. Huard, "La Défense du suffrage universel sous la Seconde République," *Annales du Midi,* **83** (1971), 317-22.

[50] *Works,* X, 34-40.

[51] *Ibid.,* 376-77. Maurice Dommanget, *Les Idées politiques et sociales d'Auguste Blanqui* (Paris, 1957), 383-84.

[52] *Works,* X, 484, 625-29, XXXVIII, 610, n. 313.

[53] Engels extracted a portion of this article, *ibid.,* X, 490-532, for use as the final chapter of *Class Struggles.*

political power amongst themselves, seeking to overcome their parliamentary division by strengthening executive power. Revolutionaries would have to wait until a new cycle of expansion and contraction produced an explosion (*ibid.*, 132-145).

Having broken with both 'putchists' and social democrats, Marx and Engels now found themselves politically isolated for the first time. Turning by necessity to more scholarly pursuits, they could reevaluate their revolutionary experience with some detachment.[54] Engels admitted that they had deluded themselves about the extent of their influence; not even their followers had really understood their ideas. In retrospect the attempt to short-circuit the course of history seemed vain and futile. Engels wrote to Marx:

> A revolution is a purely natural phenomenon which is subject to physical laws rather than to the rules which determine the development of society in ordinary times. Or rather in revolutions these rules assume a more physical character, the material force of necessity makes itself more strongly felt. As soon as one steps forward as the representative of a party, one is dragged into the whirlpool of irresistible natural necessity (*ibid.*, 290).

This historical fatalism marks Engels' history of the German revolution begun in September 1851. In *Revolution and Counter-Revolution in Germany* he proposed to omit minor accidental events and personalities and to elucidate only the most important "rational" causes of the revolution (*ibid.*, XI 5-6). Failure was inscribed in the economic backwardness of Germany—the legacy of feudalism and corporatism, the immaturity of the bourgeoisie and proletariat, the absence of cosmopolitan manufacturing centers and of a national capital capable of unifying uneven regional struggles. Revolutionary experience could not make up for the immaturity of the proletariat after all. Compared with the "wide-awake" factory hand of Britain, the bashful small-town German tailor was incapable of revolutionary initiative (*ibid.*, 10). Democratic politics was reduced even more schematically than previously to the occupational mentality of the shopkeeping class. The petty bourgeoisie "failed . . . by showing in politics the same short-sighted, pusillanimous, wavering spirit which is characteristic of its commercial operations" (*ibid.*, 95). Though poorly integrated into the overriding determinist model, Engels' activist voice was not completely stifled as he regrets that offensive military action was not taken by the revolutionaries in November 1848 and May 1849, when in the context of European events it might have reversed the downward course of the revolution.[55]

[54] *Ibid.*, XXXVIII, 289-91, and *passim.*

[55] *Ibid.*; XI, 68, 85-86. Engels' work is marked by a dichotomy between an overarching historical determinism and instances of political voluntarism. His last statement on the 1848 revolutions, made shortly before his death in 1895, was resolutely determinist;

In 1851 Marx and Engels regarded the developing constitutional crisis in France with irony and detachment. No longer did they receive inside reports or newspaper accounts[56] of a popular movement that had gone underground.[57] Engels derided the parliamentary opposition as "jackasses," bemoaned the "native stupidity" of the French peasant and despaired over prescribing a course of action for "these Frenchmen."[58] After learning that Louis Napoléon had carried out his *coup* on December 2 without meeting resistance, he exclaimed testily, "What is the rabble worth if it has forgotten how to fight?" (*ibid.*, 513) He excused the proletariat for not acting after years of exhaustion and betrayal, but mocked the French exiles for their heroic posturing, and described the peasantry as a "race of barbarians,"[59] giving credence to newspaper reports of brutal atrocities committed against tax collectors and their wives. Engels covered his disappointment with the spirit of irony and sarcasm. Louis Napoléon's *coup d'état,* he wrote Marx, is a travesty of Napoleon Bonaparte's *Eighteenth Brumaire;* from the "standpoint of world history,"[60] of the inexorable Hegelian world historical spirit, it is a tragedy reenacted as farce. He wondered however how Louis Napoléon could win the elections and stay in power without a party of his own (*ibid.*, XXXVIII, 503-06).

The *Eighteenth Brumaire,* written by Marx in December 1851, took up the theme, position, and problem suggested by Engels. In contrast to the ascendent line of his epic *Class Struggles,* it is a tragedy written as farce that seeks to explain why the proletarian hero falls and the Napoleonic anti-hero triumphs. Tempting fate by its revolutionary activity, the proletariat "runs ahead of itself, positing solutions which under the circumstances, degree of education and relations could not be immediately realized."[61] Submitting to its fate in June 1848, it recedes into the background, allowing history to pass over its head in May 1850 (*ibid.*, 146). The inexorable revolutionary process is personified by the burrowing old mole, who methodically sets up parliamentary power to be overthrown and then perfects executive power in order to concentrate his efforts against it (*ibid.*, 185).

Marx's attitude to the events is no longer passionate and involved,

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Introduction, *Class Struggles in France, 1848-1850* by Karl Marx (New York, 1964), 9-27. Cf. Leonard Krieger, Introduction, Friedrich Engels, *The German Revolutions* (Chicago, 1967), ix-xlvi.

[56] The only newspapers Engels received from France were the moderate *Journal des Débats* and *Le Charivari, Works,* XXXVIII, 280.

[57] Margadant, *French Peasants in Revolt,* Chaps. 5-9.

[58] *Works,* XXXVIII, 357, 360, 479, 484.

[59] *Ibid.*, 517. Cf. Maurice Agulhon, *The Republic in the Village: The People of the Var from the French Revolution to the Second Republic* (New York, 1982), 261-94.

[60] *Works,* XXXVIII, 505. See also *ibid.*, VII, 362.

[61] *Ibid.*, XI, 109. Marx's formulation of the problem is less economistic than Engels's.

but ironic and "non-committal".[62] The narrative is full of appearances, shams, illusions, ridiculous postures, and the spirit of paradox (*ibid.*, XI, 124-25). Where in *Class Struggles* the subordinate classes achieve independence and self-consciousness, in the *Eighteenth Brumaire* they are paralyzed by tradition and benighted by false consciousness. Where the spirit of 1792 radicalized these classes in the first essay, carrying a fraction of the bourgeoisie beyond the boundaries of its economic interest, in the second essay it "weighs like a nightmare on the brain of the living" (*ibid.*, 103), weakening resistance and inhibiting the growth of a materialist class-consciousness. Deprived of its socialist content, republicanism becomes an abstract doctrine without force that veils the class struggle and serves the cause of French imperialism.[63]

In the *Eighteenth Brumaire* the model of permanent revolution is run in reverse as restoration *en permanence.* The revolution begins deceptively at its highest point with the proletariat provisionally in the lead and proceeds in descending order. The petty bourgeoisie throws off its proletarian appendage in May and June and leans on the Party of Order. Unable to mediate historic differences between the landed aristocracy and financial bourgeoisie, this party comes to rest on the bayonets of Louis Napoléon. Each contending class, infected with the weakness of the class above, abandons its more radical subordinate, only to be tossed aside by its conservative superior. Order is restored (*ibid.*, 124).

Deprived of its revolutionary leader Blanqui on May 15, the proletariat throws itself into the arms of the "equivocal petty bourgeoisie" with its "doctrinaire" cooperative experiments (*ibid.*, 110). Louis Napoléon's "regime of the gendarme, consecrated by the regime of the priests . . . demoralize[s] the immature masses" (*ibid.*, 141). Incapable of social initiative the peasantry falls prey to the sirens of the Napoleonic legend (*ibid.*, 187-93). The bourgeoisie invokes the aid of a strong man not because workers and peasants are beating at the gates but because rumors of conspiracy and constitutional quarrels are bad for business (*ibid.*, 174-76). With the masses lying prostrate and the Mountain awaiting an electoral miracle in 1852, the drama was resolved among the elites on the level of the political superstructure in the dispute between legislative and executive power.

Missing from the *Eighteenth Brumaire* is the polarization of French society, the profound radicalization that occurred after June as the counterpart of political restoration. The adhesion of workers to socialism after June is no longer treated as an "intellectual victory" but as a debilitating compromise with the petty bourgeoisie that breaks off their revolutionary point (*ibid.*, 130). No mention is made of the missed opportunities that

[62] Engels suggested that Marx write a "diplomatic non-committal epoch-making article" for Weydemeyer, *ibid.*, XXXVIII, 516.

[63] *Ibid.*, XI, 112, 120, 127, 142.

previously aroused Marx's hopes, the crises of January 29 and March 21, 1849, which are now viewed retrospectively as rehearsals for Napoléon's *coup d'état* (*ibid.*, 121-23). No longer is June 13 a *journée manquée,* an opportunity missed because of "parliamentary cretinism," but rather a provocation, a trap set by the government to destroy the opposition (*ibid.*, 131-33). The protest was doomed to failure, Marx concludes, because it was based on appeals to abstract justice rather than to the material interests of workers and soldiers. By tailoring the facts he depicts social democracy—Mountain, press, and National Guards—deserting the cause and infecting the proletariat with its weakness.[64] The failure of social democrats to take up arms on May 31 and December 2 removed them from serious historical consideration. The proletariat—in whom hopes for the future lie—is excused because of the arrest of its leaders, mistrust of the Mountain, and sheer exhaustion,[65] but the small-holding peasantry, now described as an atomized "sack of potatoes," is considered so "prejudiced" and so easily persuaded that it plebiscites Napoléon on December 20 even in the former "red" districts (*ibid.*, 187, 189, 193).

While the *Eighteenth Brumaire* as an essay focusing on the elites and political superstructure and written from the "non-committal" "standpoint of world history" has received most scholarly acclaim,[66] it is *Class Struggles* that stands up better in the light of recent work, it shows a society polarized between two class blocs, a conservative bloc of aristocratic and bourgeois elites and a social democratic bloc of workers and middle classes radicalized by uneven economic development and the republican legacy.[67] Such a social democratic bloc may have been headed by petty bourgeois intellectuals but its most active supporters were urban workers and small-holding peasants who fiercely resisted Napoleonic repression. The conflict between the two blocs constituted the inner dynamic of politics under the Republic, a politics that was, as in *Class Struggles,* open-ended, i.e., subject to the normal contingencies and vagaries of human intervention. The fear of social revolution, whether by insurrection or "miracle" in the presidential election of 1852, was a major reason for the *coup d'état* of December 2, 1851,[68] the *Eighteenth Brumaire of Louis Bonaparte,* from which essay however it is largely absent.

The reason for Marx's minimization of this cause, his depreciation of the "red" menace, was the sectarian and ultrarevolutionary position he had assumed in 1850. Marx and Engels used their historical essays in this period to combat a social democratic strategy they had previously

[64] Cf. Moss, "June 13, 1849," 403-04, 410.

[65] *Works,* XI, 184.

[66] Exceptionally Krieger, "Marx and Engels as Historians," 385-86, has noted its closed determinist premises.

[67] See *supra,* nos. 4-6.

[68] See Forstenzer, *French Provincial Police,* 3-23, 145-47, 226-47.

supported. By 1850 they had foreclosed the possibility of the working class achieving socialism through a socially heterogeneous bloc and borrowed social consciousness and of a transition taking place essentially through the parliamentary process. That Marx was too optimistic in *Class Struggles* about the political independence of the working class and too pessimistic about its influence in the *Eighteenth Brumaire* was due to his break with the working class movement that was still incorporated within social democracy. This rupture determined the narrative form, style, theme, and interpretive models of his historical essays.

When Marx resumed political activity as leader of the First International in the 1860s, he returned to what he called the "real movement" of the working class, framing programs—"*fortiter in re, suaviter in modo*"—from the standpoint of the actual rather than the future workers' movement.[69] What mattered for Marx was not so much the actual program of the International, which was still largely social democratic, but the fact that it represented the independent movement of the working class. The same cooperative program that Marx had condemned as "petty bourgeois" and "doctrinaire" in 1850-51 was to be hailed by him as authentic communism under the Paris Commune.[70] Marx defended the Commune because it was the "positive form" of social democracy, a government directly representing the working class and its allies (*ibid.*, 67, 182). He recalled the radicalization of workers and peasants under the Second Republic (*ibid.*, 175) and acknowledged that the "cry of 'social republic' with which the Revolution of February was ushered in by the Paris proletariat, did but express a vague aspiration after a Republic that was . . . to supersede . . . class rule itself" (*ibid.*, 67). Marx's commitment to the Parisian workers led him to revise his prior judgments.

Yet, after the split with the Bakuninists in the International over the formation of working-class parties, Marx again broke with the French labor movement, which remained "Bakuninist", i.e., federalist in orientation, and revised his optimistic assessment of the Paris Commune.[71] If Marx's materialist method of analysis remained constant, his historical interpretations continued to reflect shifting strategies and alliances—essentially political choices. Were then Marx and Engels simply theorists and revolutionaries but not true historians?

While focusing on Marx and Engels as historians of French social democracy, my essay should help resolve some salient debates concerning

[69] K. Marx and F. Engels, *Selected Correspondence* (Moscow, 1965), 149, 269. Moss, *Origins,* 52-56, 73-76.

[70] K. Marx, *The Civil War in France* (Peking, 1966), 73.

[71] "Apart from the fact that this [the Paris Commune] was merely the rising of a city under exceptional conditions, the majority of the Commune was in no wise socialist nor could it be," Marx and Engels, *Selected Correspondence,* 338. See also Moss, *Origins,* 115-16.

their politics. Though based upon a fundamental materialist mode of analysis, Marx's politics must always be interpreted in the light of circumstances.[72] This examination of Marx's historical works provides further evidence of a shift from a broad social democratic strategy in 1847-48 to what could roughly be called a Leninist position in 1850.[73] This shift was not a temporary aberration or stage in Marx's development,[74] for it was essentially repeated after the Paris Commune when Marx broke with the existing labor movement to accelerate the formation of Marxist political parties. Such strategic shifts were inherent in the circumstantial nature of Marx's politics, but the shift made in 1850, as Marx implicitly acknowledged in the *Eighteenth Brumaire,* was sectarian; it was too advanced for the existing level of working-class organization and consciousness. Such a political mistake could result from the dilemma—described by Engels—of the revolutionary who foresees necessary solutions that are beyond the economic and political possibilities of the moment.[75] All critical examinations of Marxism must recognize the difficulty of translating its theory into practice and the possibility of political error.

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[72] This circumstantial interpretation differs from the contextual method proposed by Gilbert, *Marx's Politics,* 7-13, 256-71, in that it assumes effective determination by underlying laws and structures.

[73] *Contra* Hunt, *Political Ideas,* and Monty Johnstone, "Marx, Blanqui and Majority Rule," *The Socialist Register 1983,* eds. R. Miliband and J. Saville (London, 1983), 296-318.

[74] Cf. George Lichtheim, *Marxism: An Historical and Critical Study* (London, 1961), esp. 122-29.

[75] *Works,* X, 470.

REVIEW

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On Editorial Policy

Review is committed to the pursuit of a perspective which recognizes the primacy of analyses of economies over long historical time and large space, the holism of the socio-historical process, and the transitory (heuristic) nature of theories.

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We invite contributions of articles that fall within the general perspective, very loosely defined, of the journal, or articles that are specifically critical of the perspective.

There is no limit of size. We prefer articles that discuss the concrete world but welcome also attempts at conceptual redefinition. We will not exclude articles that are highly technical nor articles that are essays. Our central criterion is that an article seems in our judgment to grapple seriously with the intellectual issues it confronts, and that it confronts serious intellectual issues.

We will publish articles primarily in English, but we will be willing to publish articles in other scholarly languages. We will, from time to time, translate into English an article already published in another language. We will even be willing, from time to time, to republish an article that first appeared in English, if we believe that the readership of our journal and that of the original locus of publication are highly unlikely to overlap.

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In short, we reject some of the fetishes of academic reviews, but lay claim to sharing the central traditions of world scholarship. Though we are published in the United States, we hope to make our journal a forum that will reflect the true diversity of contemporary world scholarship.

The Editors

*Internationalization of the Oil Industry: Simple Oil Shocks or Structural Crisis?**

Cyrus Bina

The oil crisis of 1973–74 was the symptom of the underlying fundamental changes that forcefully led to the internationalization of the oil industry. The production and pricing of crude oil associated with the various oil producing regions of the world have since become part of a unified process through global competition.

Contrary to the prevailing opinion, the significance of the oil crisis lay not with the temporary shortage that resulted from the imposition of the embargo; rather, the embargo was the symptom that revealed an underlying transition that had already been taking place toward the globalization of the oil industry. One has to realize that the process of structural transformation in oil production had already begun in the late 1960's and early 1970's. The 1973 oil crisis was simply the culmination of that process, which ushered in an entirely new period in which an end was put to separate regional price formations, inade-

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quate unification, and localized value-formation within the global structure.

The oil crisis of 1973–74 was not an ordinary oil shortage, similar to the ones that we experienced in 1956 or 1967. This crisis was accompanied by a severe shortage resulting from the Arab oil embargo, but its social significance nevertheless cannot be explained by the suddenness of supply interruption and shortage alone. The resulting changes influenced the restructuring of the entire industry, accommodating a price determination through global competition, including competition among the least and the most productive oil regions of the world. These conditions, in turn, necessitated the formation of market prices that were based upon the production cost of the least productive oil region, and the simultaneous determination of differential oil rents that would correspond with the existing productivities of various oil regions at the international level.

We shall demonstrate that the formation of differential oil rent came about through increased competitive conditions rather than through monopoly. We shall identify the U.S. oil region as the least productive in the world, and show that during the period leading up to the crisis there was a significant decline in the productivity of the aging U.S. oil fields. The increase in the cost of production of the least productive oil region together with the internationalization of oil production, led to the generalization of high market prices within the entire industry.

The first section is a critical review of the literature on the oil crisis. The second section examines the characteristic features of U.S. oil production. The third section presents an alternative theory of the oil crisis. The paper will conclude with a brief summary of our major findings.

I. A CRITICAL SURVEY OF THE LITERATURE

The oil crisis of 1973–74 was an important economic and political event that has been producing controversy ever since. At first glance, because of the diversity of opinions and the number of unsettled questions, there seem to be as many theories about the oil crisis as there

are theorists in this field of inquiry. But it may be helpful to distinguish the common threads among prevailing views on the subject in order to be able to discern various theoretical lines and schools of thought.

We divide the prevailing views on the oil crisis of 1973–74 into three main categories: (1) traditional theories of the oil crisis; (2) dependency theories of the oil crisis; and (3) conspiracy theories of the oil crisis.

A. Traditional Views of the Oil Crisis

There are in this category an extensive spectrum of arguments about the nature of the oil crisis of 1973–74. The analyses often contain references to such notions as the oligopolistic structures of the oil companies, the collective decision making of OPEC, and the operation of supply and demand in the international oil market. Although many disagreements exist among these theorists, nevertheless, the majority tend to approach the oil crisis of 1973–74 more or less in the same theoretical and methodological fashion.[1] To summarize the arguments made by these theorists, one needs to join together a combination of emphases which add up to an explanation of the oil crisis of 1973–74. The first emphasis is the upon "law of supply and demand," within the sphere of exchange (Vernon, 1975). The second emphasis is upon the element of monopoly and "ability" on the part of OPEC to set prices at will (Penrose, 1975). Thirdly, some speak of the dependence of the United States economy on foreign oil, especially on OPEC oil (which in turn created the severe monetary shortage that is said to have threatened "the supply security," as the determining factor (Lenczowski, 1975; McKie, 1975; Blair, 1976). Finally, it is often said that it was the suddenness of the price change and the problems of adjustment that resulted in the crisis; if there had been a possibility for a smooth transition, the oil crisis might have been avoided (Blair, 1976). In addition, from the methodological standpoint, the crisis either explicitly or implicitly is considered to have resulted from the change in the perception of the actors involved in the oil market, rather than being the outcome of the changed realities of the time (Dasgupta & Heal, 1979: ch. 15).

From the viewpoint of supply conditions (Blair: 1976), the shortfalls were short-lived after the oil embargo. In other words, a temporary shortage developed which, according to conventional economic theory, was similar to previous oil shortages and thus would not have

any significant impact upon long-term equilibrium prices. As the history of this period vividly indicates, however, exactly the opposite resulted. But the conventional theory insists that the factors that established a higher floor for the post-embargo price of oil were the result of price determination by OPEC, and the dependence of the United States on imported oil.

It should be noted from the outset that the first step in this analysis is to identify the cause or the causes of the oil crisis. Despite this necessity, most theorists in this category considered quite a few factors that were associated with the crisis without being able to understand the systematic relationship among them in order to identify the underlying causes (see Bina, 1985b, chs. 3–4). In the final analysis, for the majority of the theorists of this category, "OPEC-determined" oil prices, along with the notion of United States "dependence" on imported oil, was considered to be the principal cause of the oil crisis.

There are, however, a number of misconceptions in this conclusion. First of all, the two mechanisms of the "posted price" and market price of oil are being confused. Secondly, price determination is considered to depend upon the will of OPEC, rather than understood as the outcome of objective production conditions. Thirdly, the conclusion tends to imply that the United States was unable to challenge OPEC because it had become a net importer and could no longer supply oil to the world market as much as it had during the 1958 and the 1967 Middle East conflicts that also had led to temporary interruptions. The question to be asked here is why, considering the condition of excess supply that prevailed following the removal of embargo, the oil prices did not decline significantly. If the law of supply and demand did not hold in this particular case, then what kind of mechanism tends to regulate the process of price formation in this industry?

Another common feature of these theorists is that they have not developed a mechanism to connect the process of price determination in the pre-embargo period with that of post-embargo conditions. The reason for this seems to be the lack of adequate theoretical and historical perspective. These theorists either relied on supply and demand conditions within the sphere of exchange, or resorted to the notions of monopoly, cartel, and oligopoly to describe the sudden price change of 1973–74 that affected the entire globe (see table 1 for the suddenness of the increase in the posted oil price).

TABLE 1

Average "Posted Price" and Percentage Change in Price of Saudi Marker Crude Oil, 1970–1980

Date	Average "Posted Price" (dollars per barrel)	Year-to-Date Percentage Change
1970	1.80	0.0
1971	2.23	23.9
1972	2.48	11.2
1973	3.63	46.4
1974	11.45	215.4
1975	12.18	6.4
1976	12.13	-0.4
1977	12.40	2.2
1978	12.70	2.4
1979	17.26	35.9
1980	28.67	66.1

Source: Exxon, 1980: 25.

Not only after the oil embargo ended, but even prior to it, the market was flooded with huge quantities of crude oil. Moreover, even the decline in demand resulting from the worldwide recession of 1974–75 did not seem to cause any substantial drop in the price of oil. In fact, after the oil embargo of 1973, a new floor for oil prices was clearly established. This implies that changes in supply and demand conditions were themselves the consequence of more fundamental changes in the international oil industry. In the final analysis, the traditional theorists argue, OPEC acted like a monopoly in setting the oil price unilaterally at its fourfold increase level. When they are asked why OPEC did not act in the same manner that it had in the previous years, most of these theorists reply that, in addition to the existence of monopoly, factors such as the United States' "dependence" on the foreign oil and the rising tides of resource conservation contributed to the crisis. The most explicit argument of this sort is developed by Dasgupta and Heal (1979) who state that all these developments resulted from changes in the perception of the actors involved and not the result of changes in the actual situation.

There is a fundamental problem with the above formulation. It sug-

gests implausibly that objective realities do not exist outside of one's subjective perception (Dasgupta & Heal, 1979: ch. 15). That is why they can state that, in the absence of futures markets, it is difficult to know how the perception of buyers and sellers are formulated. What the "futures market" does, however, is to present the extent of fluctuations and not the fundamental changes that might occur in the structure of value formation (the center of gravity in both classical and Marxian approaches) and, ultimately, in price formation in a particular industry (see Semmler, 1984).

In retrospect, one can observe a great deal of displacement in the interpretation of the traditional school in the determination of the underlying cause of the crisis that established a nearly fourfold price increase, and brought about a transfer of a significant amount of wealth in the form of differential oil rent to the more productive oil regions. But it should be realized that the majority of these theorists were initially correct in describing the events and circumstances that were unfolding during the crisis. For instance, the description of the "OPEC monopoly," or the notion of "dependence" of the United States on imported oil, are correct observations. But what is rarely acknowledged is the distinction between observable effects and their causes.

As a result, these theorists were unable to explain the process of the oil crisis of 1973–74; at best they described the consequences of the crisis and its conditions. Their description of the supply-demand relation, the "posted-price" determination by OPEC, and the U.S. dependence on the foreign oil is certainly true. What is also true is that these theorists failed to penetrate beyond the appearance of these facts in order to build a theory of the oil crisis.

B. Dependency Theories of the Oil Crisis

The dependency theories of the oil crisis of 1973–74 are deeply rooted in dependency theory in general.[2] The present study neither claims nor intends to evaluate all the issues involved. The task is rather to reproduce specific arguments of dependency that relate directly to the analysis of the oil crisis. Thus, to begin with, we will concentrate on Girvan's (1975) evaluation of the oil crisis of 1973–74, together with the analyses of such authors as Tanzer (1974) and Stork (1975), who have made significant contributions to this subject from the standpoint of dependency theory. The major argument expressed by most of these

theorists presumes a hypothesized "OPEC offensive"[3] against the industrialized countries of the West in order to achieve self-determination and sovereignty. This "offensive," however, is said to be a reaction to the prolonged relations of domination that existed between the Imperialist countries on the one hand, and the Third World countries on the other. Such a domination was accompanied by unequal relations, and consequently unequal exchange in trade, between the "center" and the "periphery." Some authors added that the atmosphere of the post-Vietnam era created a general political condition that permitted the dominated countries of the Third World, notably OPEC, to launch this "offensive" (Girvan, 1975: 147).

The most fundamental error of these theorists is eclecticism, i.e., putting all the arguments of a general political and economic nature on an equal footing without seeking to determine their structural relationship or to single out the specific underlying cause(s) of the oil crisis. For instance, the process of price formation in the oil industry is identified with the determination of "posted prices" by OPEC. There is no consideration of the laws of motion of capitalism in general, and value and price formation in the international oil industry through competition. Instead the emphasis is upon determination by the almighty monopoly power. It is not surprising that the dependency view considers the oil crisis as an offensive against unequal exchange. Some even called it a phony crisis, since at the end it did not change the magnitude of "unequal exchange."

These theorists have scarcely recognized that prices are the phenomenal form of values in production and that value formation emerges through competition. They have made the double mistake of emphasizing the idea of monopoly as opposed to competition, and price determination by market power without an actual and objective theory of value formation in the oil industry.[4] Discussing the notion of competition, these theorists equate the existence of a large number of firms in an industry with competition, and that of a very few firms with monopoly. It should be pointed out that such equations constitute a clear misconception of both monopoly and competition in capitalism. Here one moves from competition to monopoly through a quantitative spectrum, a fictional device that is based on a fictitious construct called pure competition. These theorists obviously have failed to realize that monopoly and competition in capitalism are part and parcel

of a synthesis; monopoly and competition cannot be dichotomized based upon the number of firms in an industry, contrary to the neoclassical theory of pure competition (Clifton, 1977; Semmler; 1984, Shaikh; 1980; Weeks, 1981; Fine & Harris, 1979; Bina 1985a).

The oil crisis of 1973–74 is thus seen to result from the direct political action of OPEC. For instance, Tanzer argues: "As a result of the Arab oil embargo in late 1973, the OPEC countries effectively took over the ownership of their crude oil reserves and oil pricing, while the companies became primarily suppliers of technology and markets" (1980: 110). These changes seem to be at a phenomenal level, even entirely arbitrary in nature, if one does not accept the arguments advanced by the dependency theorists. These analyses are arbitrary insofar as they are not the outcome of an identified mechanism of value formation in production and of eventual price determination via competition. Consequently, most of these theorists do not offer any systematic analysis, except through the arguments of unequal exchange.

In this category, as in others, the various theorists do not completely agree with each other. For instance, in his explanation of the oil crisis, Tanzer's emphasis is on the monopoly aspect of the international oil industry, whereas Girvan's primary concern is the "OPEC offensive." Finally, some of the dependency theorists allege that the social and political conditions of the post-Vietnam era, i.e., the defeat of U.S. imperialism, are the cause of the oil embargo and the "OPEC offensive." Still others put together numerous factual observations, such as the United States' political decline, increased participation of OPEC internationally, and increased income of the OPEC countries, in order to demonstrate that dependency theory is compelling. These arguments are controversial and misplaced: partly because the hypothesized "OPEC offensive" supposedly resulted from a contradiction between the masses of the Third World and U.S. imperialism rather than from the increased development of capitalism and transformation of the oil sector in the OPEC nations; and partly because the political actions of OPEC by themselves cannot possibly be understood without a prior analysis of the underlying cause of the crisis. The "OPEC offensive," far from being the cause of the oil crisis, is simply one condition of its realization.

C. Conspiracy Views of the Oil Crisis

This view is based on the idea that the U.S. government, in collaboration with the international oil companies and OPEC, deliberately brought on the oil crisis of 1973–74.

The conspiracy view of the oil crisis is centered around the rivalry between the United States and Europe and Japan in the context of international trade and balance of payments. It is believed that the sudden increase in the price of crude oil in 1973–74 was the result of the coordinated efforts of the U.S. government, the major oil companies, and the most accommodating members of OPEC, to increase the price of crude oil (Greider & Smith, 1977). Although the United States became a net importer, it is said, the burden of the price hike fell more heavily on Japan and Europe, where almost all the oil consumed was imported (Tsurumi, 1975). Another feature of the conspiracy theory is the amount of discretion that it assigns to price determination in oil. The price hike neither reflects the conditions of supply and demand nor is associated with the restructuring of the industry, but is rather the result of a pure coordinated exercise of political will (Greider & Smith, 1977). The plausibility of this rests on the assertion that a great deal of harmony existed between the oil companies and OPEC, and that the primary contradiction in the world-economy is between the United States on the one hand, and Europe and Japan on the other.

The basic error committed by these theorists is the exclusive reliance on the balance of trade. Of course, it is apparent that the increase in the price of oil had a relatively more severe impact on the balance of trade of those economies that were heavily dependent on imported oil. But this outcome does not have anything to do with the cause(s) of the oil price change, unless one believes, a priori, that the price of oil is determined by the U.S. government, oil companies, or OPEC monopolistically by discretion.

Once again, we are confronted, more or less, with the same problems that we encountered with the previous theoretical formulations. But here the difficulty has a different dimension. The static and direct determination of prices through monopoly power is one thing; its conspiratorial determination by a state or an agency is another. This argument offers no theoretical economic explanation of the process of

price formation in general, and the formation of the oil prices during the crisis of 1973–74 in particular.

Similarly, there is no economic and political connection between the actual cause of the oil crisis and its consequences. There is only the alleged motivation for engagement in conspiracy on the part of the United States against its so-called allies of wishing to have a more favorable balance of trade. Meanwhile, it is evident that, within a short time after the crisis, the U.S. balance of trade declined substantially as the favorable differential impact of the oil prices deteriorated much sooner than expected.

Another major obstacle associated with this view is the impossibility of its empirical verification. It is practically impossible to prove or disprove that it was through a conspiracy that this crisis was created. Even if one were able to document that in fact United States officials has eagerly welcomed the oil price hike, one still has to build a crisis theory independent of such a motivation. Economic crisis is not a phenomenon that can be created or prevented through discretionary action by one or more authorities (Shaikh, 1977). That is why the conspiracy theory of the oil crisis is a subjective theory at the lowest level. This theory concerns the state of mind of the U.S. officials, international oil executives, and the OPEC representatives, which relates to a totally different enquiry. It does not take into account the objective economic and political forces that led to the oil crisis, regardless of its political and economic consequences. This theory is addressed to the effects of the crisis. Once these effects are demonstrated, these theorists resort to speculation in order to determine the cause of the oil price change. In this sense, the above theory can be called a "speculative" theory of the oil crisis. It should be understood that we do not wish to deny the possibility of conspiracy that probably accompanied the oil crisis. But in fact, the proof of the existence of such conspiracies depends fundamentally upon the identification of the actual cause of the oil crisis and not the other way around. To deny the validity of the conspiracy theory, therefore, does not mean to deny the rivalry among the modern industrialized nations, for rivalry is a real phenomenon and an objective process in capitalism. The lack of validity of the above analysis is due rather to mistaking a phenomenal form for its essence. In so doing, the cause of the oil crisis is attributed to the subjective minds of individual actors by way of conspiracy (see Bina, 1985a).

To summarize, we have seen that all the above theories of the oil crisis are more or less subjective in nature and speculative to various degrees. These theories deal with the effects of the oil crisis, and either partly or entirely tend to regard these effects as causes. Some of the theorists associated with the traditional theories of the oil crisis in fact deny that the crisis was an objective process. Instead, they emphasize changed perceptions. Others in this category, while acknowledging some objective changes, do not penetrate below the surface of appearance far enough and therefore end up describing the phenomenal form of the crisis. The dependency theory of the oil crisis emphasizes the notion of an "OPEC offensive" within "center-periphery" economic relations (Girvan, 1975; 1976; Tanzer, 1980). Thus, most of the theorists of this category stress unequal exchange and the "challenge" of OPEC as a cause of the crisis. Finally, conspiracy theorists reason that through a demonstration of the differential impact of the oil crisis on the balance of trade of the United States, western Europe, and Japan, that there was a conspiracy in bringing about the oil crisis on the part of the U.S. government, oil companies, and OPEC (see Anderson & Whitten, 1977). All of the theorists that we have examined ultimately fail to realize that their arguments view the crisis as a voluntary act rather than as an objective social and economic process. Thus, they commit the error of taking the reflection of the crisis for its substance.

II. ANALYSIS OF U.S. OIL PRODUCTION

We shall argue that the oil crisis of 1973–74 was the consequence of a significant increase in the long-term production costs of oil in the United States prior to October, 1973. Due to the nature of the industry, and to its social relations of production, the U.S. oil region has become the least productive in the world. In addition, as a result of the integration of production at the global level, oil values, oil rents, and market prices are no longer subject simply to the framework of national economies, but are determined internationally. Table 2 shows the investment costs necessary to produce a new daily barrel of oil in a selected number of oil-producing countries. Clearly, U.S. oil production is by far the most expensive in the world; on the other hand, production in the Middle East oil region is the least expensive. Thus,

TABLE 2

Approximate Cost of Capital Investments of New Daily Barrel of Crude Oil* (Selected Countries)

Country	1960–1972
Canada	3,100
Indonesia	1,400
Libya	200
Nigeria	800
Saudi Arabia	200
United Kingdom	3,500
United States	3,700
Venezuela	1,000

*All figures in U.S. Dollars
Source: Wyant, 1979:117; Tables 5-13.

the analysis will focus on the U.S. oil industry vis-à-vis the Middle Eastern oil industry.

We shall demonstrate that the combination of critical arguments advanced so far, along with the empirical expositions presented below, will corroborate the above hypothesis and support our theory of the oil crisis. The task here is to show that the retention of the aged U.S. oil fields, which resulted in a decline in the average oil recovery, was the underlying factor that necessitated the reorganization of production, and formation of new structures in value, market price, and rent (royalties) in the international petroleum industry. This reorganization ultimately emerged through the crisis of 1973–74 which, as we have seen, did not confine itself to one country or two, but quickly swept through the global structure.

A. Recognition of Different Spheres of Oil Production

According to the literature on the petroleum industry there are three different ways by which additional reserves of petroleum can be developed and brought up to the surface: new discoveries; extending the old discoveries; and recovering additional oil from the existing oil fields. It goes without saying that these methods differ in the conditions of

capital investment and the resultant capital intensity. While useful in principle, statistics provided in this study concerning the classification of domestic oil reservoirs do not provide a clearcut procedure that would separate the latter two types of oil production, i.e., the extension of oil discovery as opposed to the enhancement of oil recovery. But, fortunately, we need not be too concerned about this, since there is a general consensus that these deeper oil wells that produce more than 32 barrels a day are normally the likely candidates for extension as compared with more shallow oil wells of lower productivity. It is the latter category of oil wells that usually becomes the subject of enhanced oil recovery methods through intensification of capital investment. In addition, the sphere of new oil discovery was more productive, both prior to and during the period of the 1973–74 crisis (U.S. Dept. of the Interior, 1967; 1976; U.S. Dept. of Energy, 1978). The significance of the above classification will become clear as we proceed to analyze the impact of long-run investments on the production of oil in the United States during the period leading up to the crisis.

B. Intensification of Production and the Reversal of the Oil Recovery Trend

More than 90% of U.S. crude oil was produced from reservoirs located in nine states during the period, 1965–74. Of this, nearly two-thirds was produced in Texas and Louisiana. The remaining one-third came from California, Oklahoma, Wyoming, New Mexico, Alaska, Kansas, and Mississippi.[5]

Studying the trend of average oil recovery in the United States and in the principal oil producing states, in conjunction with the long-run investment per barrel, is one possible way of examining the actual emerging conditions that led to the formation of the present cost structure in the oil industry. The identification of decline, either in the trend of oil recovery from the old oil fields or in the rate of new oil discoveries, in conjunction with the long-term cost of oil associated with these spheres of production during the 1971–74 period, reveals which area actually regulates the restructured industry's market value and prices.

A comparison of these trends requires calculation of the average oil production per well for the above-mentioned major U.S. oil-producing states for 1965, 1971, and 1974. But the average of these averages does not represent the true average, without assigning appropriate weights, such as the actual production shares of these in-

TABLE 3

Average Oil Recovery Per Well and Production Share of Major Oil-Producing States in the U.S.

Major Oil Producing States	1965		1971		1974	
	Average Oil Recovery***	% of Production Share	Average Oil Recovery	% of Production Share	Average Oil Recovery	% of Production Share
Texas	12.82	36.0	18.1	36.5	21.0	40.7
Louisiana	46.88	20.0	69.7	25.8	62.3	21.3
California	21.13	12.2	24.3	11.0	21.8	10.7
Oklahoma	7.37	8.1	8.0	5.8	6.4	5.6
Wyoming	52.18	5.2	56.9	4.6	47.5	4.6
New Mexico	21.92	4.4	22.3	3.4	19.4	3.1
*Alaska	—	—	1240.5	2.5	951.6	2.4
Kansas	6.28	4.0	6.8	2.3	4.0	2.0
Mississippi	51.69	2.1	52.6	2.0	48.1	1.7
**Illinois	6.03	2.5	4.1	1.2	3.2	0.9
		94.5%		95.1%		93.0%

*Alaska was not considered an oil-producing state in 1965.
**Illinois is not among the nine principal oil states in 1971 and 1974.
***Average daily oil recovery per well in barrels.

Source: U.S. Department of the Interior, 1967,1975a; Department of Energy, 1978.

dividual states. Table 3 shows the average oil recovery and the corresponding shares of oil production for the major U.S. oil-producing states for 1965, 1971, and 1974.

Since the scope of our analysis includes the aging U.S. oil reservoirs located in the continental states, and since the Alaskan oil region is among the most productive within the United States, it may be excluded from the present analysis. At the same time, Illinois, a major oil-producing state in 1965, lost his position by 1971. For the sake of uniformity, therefore, it seems advisable to disregard the production of oil from this state. What we have for comparison is the weighted average of oil recovery for the eight remaining oil-producing states for 1965, 1971, and 1974.

In table 4, the first column shows the weighted average of oil recovery per well for the above years in the eight major U.S. oil-producing states (excluding Alaska). Oil recovery per well first increased during

TABLE 4

Weighted Average of Oil Recovery Per Well of Major Oil-Producing States in the U.S.

Year	Weighted Average Oil Recovery	Weighted Average Oil Recovery for All Except Texas
1965	24.11	31.37
1971	35.35	46.82
1974	31.43	40.09

Source: Bina, 1985a: ch. vii, table 12

1965–71, and then declined in the subsequent period. (During the period of 1971–74, the average oil recovery in Texas, in spite of individual trends in other major producing states, increased. Yet such an increase did not have enough influence to reverse the declining national trend.)

Table 5 offers a summary of the average oil recovery trends under different circumstances. The point to be emphasized is that there has been a consistent trend in average oil recovery, whether oil includes or excludes Texas, the only oil-producing state to exhibit an increase in oil recovery per well for the period of 1971–74. This point is significant because nearly two-fifths of U.S. oil production comes from the Texas oil fields.

These findings show that the conditions of capital investments and production during 1971–74 were entirely different from those in the previous period. The increasing volume of capital investments on the existing oil fields, and the production of reserves by way of intensification, extension, and enhanced recovery methods, led to the subsequent decline of average oil recovery per well in the aging U.S. oil fields.[6]

One has to bear in mind that this decline is not simply incidental to the oil crisis of 1973–74. The crisis is, in fact, both the symptom of and the social mechanism for the generalization of production conditions under these newly-emerged circumstances. The magnitudes of

TABLE 5

Average Change in the Oil Recovery Trend of U.S. Oil
1965–1974*

	1965–71	1971–74
Trend of Average Oil Recovery Per Well	+46.7	-11.1
Trend of Average Oil Recovery Per Well for all Major Producing States Except Texas	+49.2	-14.4

*Figures are in percentages

Source: Bina, 1985a: ch. vii, table 13.

the cost of production and of the individual value produced for the aging U.S. oil fields, due to the intensification of production, had significantly increased. Being the least productive of all U.S. oil fields, their corresponding newly-formed individual value has become the social value of the entire industry.

C. Production Cost and Individual Values in Different Spheres of Production

In this section it will be shown that total U.S. oil capital expenditure per barrel tripled during the period of 1971–74. During the same period, the U.S. domestic oil price also tripled. In this particular analysis, the 1971–74 period provides the framework for understanding the 1973–74 oil crisis.

Empirically, the relationship between the total U.S. cost of investment per barrel and the average U.S. well-head price of oil is the basis for the argument that the increase in the price of oil was greatly influenced by an increase in its capital cost. Given the fact that the U.S. region was the least productive oil region of the world, one might have expected that, with the internationalization of production, the global price of oil would be determined by the newly-emerged U.S. cost structure. In other words, the U.S. production conditions determined the regulating market value of oil for the entire international oil industry.

To analyze the source of this cost increase, one has to separate the effect of exploration from the effect of development capital expenditures (the two most significant constituent parts of total capital cost). Having done that, one can see (table 6) that the primary source of the

TABLE 6

Oil Price and Different Categories of the Capital Expenditures per Barrel in the U.S. Oil Industry*

Year	Well-head Price of Oil	Total Capital Costs per Barrel	Development Capital Costs per Barrel	Exploration Capital Costs per Barrel
1966	2.88	1.138	0.984	2.456
1967	2.92	1.190	1.048	2.270
1968	2.94	1.770	1.579	2.886
1969	3.09	1.929	1.646	4.072
1970	3.18	1.193	1.055	2.209
1971	3.39	1.272	1.075	3.987
1972	3.39	2.897	2.787	3.404
1973	3.89	2.308	2.068	4.590
1974	10.13	3.953	3.885	4.321
1975	12.03	5.319	5.769	3.797

*All the figures are in U.S. dollars

Source: Bina, 1985a: appendix A.

cost increase has been U.S. oil development costs. In other words, an increase in the cost of oil produced from the older U.S. oil fields, rather than the cost of new oil discoveries, was the principal source of the U.S. cost increase.

Table 6 shows the trend of the total U.S. capital expenditures per barrel, exploration costs per barrel, and development expenditures per barrel for the period, 1966–75. The total capital costs per barrel include the exploration and development costs per barrel. The exploration costs refer to the capital costs associated with oil recovery from the newly-discovered oil fields or the new reservoirs within the previously-discovered oil fields. The development costs, on the other hand, include those capital investments that are applied to the aging U.S. oil fields, called "extensions" and "revisions" in the literature on petroleum.

In table 7, the highest increase is associated with the development costs per barrel during the period of 1971–74: from $1.075 to $3.885, or more than 300 percent. On the other hand, the increase in the trend

TABLE 7

Changes in the Trend of U.S. Capital Expenditures per Barrel and Prices

	Percentage Change During 1966–70	Percentage Change During 1971–74	Average Price Increase per Barrel 1966–71	Average Price Increase per Barrel 1972–75	Change in the Average Price Increase of the Two Periods (1966–71;1972–75)
Exploration Costs per Barrel	10% (decline)	8.3% (increase)	$2.98	$4.03	35%
Development Costs per Barrel	7% (increase)	261% (increase)	1.23	3.63	195%
Total Costs per Barrel	5% (increase)	211% (increase)	1.41	3.62	158%
Well-head Oil price	10.4% (increase)	199% (increase)	3.07	7.36	140%

Source: Bina, 1985a: table 15.

of exploration costs per barrel is only 8%, an insignificant increase by comparison. Primarily because of the increase in development costs, the total oil cost per barrel also more than tripled during the 1971–74 period. It is interesting to note that the changes that took place in the trend of all the categories of costs during the period, 1966–70, are far smaller (see table 7).

A comparison of the changes that have taken place during the 1971–74 period with the changes in the average costs associated with the periods of 1966–71 and 1972–75 demonstrates that there was a significant increase in the development costs and total costs per barrel in the latter period. In fact, both the development costs per barrel and total costs per barrel more than tripled during the period, 1971–74. This result is in conformity with the tripled level of the U.S. oil prices during the same period. It should be emphasized that in the main the measure of productivity used throughout this study is cost per barrel. This measure is referred to as the capital-output ratio in the economics literature. The availability of relevant statistical data for various oil regions of the world has made the usage of this particular measure widespread in the oil industry. In this connection, it is evident (1) that the more than threefold increase in the trend of development costs per barrel conforms to the oil price increase, and (2) that the increase in the trend of exploration costs per barrel is insignificant by comparison. Moreover, this increase of 8.4% in the average exploration costs led to the recovery of more (15% more), rather than of less, oil during the period of 1971–74 (see table 8).

The development costs are the capital expenditures made on currently producing U.S. oil fields. The correspondence between the fourfold increase in the "posted price," and the threefold increase in the U.S. oil price, in conjunction with a more than threefold increase in development costs, reveals the significance of the aging U.S. oil fields in the crisis that led to the restructuring of the industry. It may be inferred that the increase in the U.S. oil cost structure led to the establishment of higher value output for the U.S. oil industry. Accordingly, being among the least productive in the world, the U.S. oil region simultaneously prepared the way for a higher market price for oil through international competition among different oil-producing regions.

One has to realize that, objectively, prior to the crisis there were two distinct possibilities for the U.S.: (1) abandon the majority of the

TABLE 8

Total New Field Exploration and New Oil Discovery Rates for the United States, Excluding Prudhoe Bay, Alaska

Year	New Oil Discovery per Foot* (barrel of oil)	Average Change	New Field Exploration Per Foot** (barrel of oil equivalent)
1965	18.64		-
1966	14.33		23.00
1967	16.49	(1966-71)	26.01
1968	14.09	13.55%	14.20
1969	9.71		12.14
1970	18.39	(1971-72)	19.52
1971	8.28	15%	13.08
1972	14.26		13.11
1973	14.22	(1972-75)	16.89
1974	17.68	15.58%	18.15
1975	16.18		18.70

*Crude oil only
**Oil and gas together

aging and declining U.S. oil fields (excluding them from the production process) in order to keep the prevailing price structure intact, or (2) allow the conditions prevailing in such oil fields, i.e., those of declining productivity, to be generalized for the entire industry. Historically, we noticed that with the emergence of new value and market prices it was the second possibility that turned into an actuality during the 1973–74 crisis.

It might be asked why, in the event of such an unprecedented increase in the U.S. production price during the 1973–74 oil crisis, these highly unproductive and seemingly inefficient U.S. domestic producers were not entirely eliminated from the market by the more efficient producers of the Middle East.

First of all, the significance and the size of the U.S. oil production, both prior to and during the 1973–74 period, should not be underestimated. We know that U.S. oil production has been traditionally the largest among the oil-producing countries. Given the structure of social demand and the existence of shortages, it would seem unlikely

that the aging U.S. oil fields could have been forced out of the market during the 1973–74 oil crisis.

Secondly, the productivity of the U.S. oil industry varied substantially from field to field, and from oil well to oil well. In fact, there is a great deal of productivity differentiation even within the continental United States. Thus, even if some of the most unproductive oil fields might have been eliminated, the bulk of U.S. oil production originating from the more productive areas would have remained intact, the relatively less productive fields located in the North Sea and elsewhere in the world being squeezed out of the market first.

A remarkable example that supports the above point is the wholesale elimination of the least productive U.S. oil fields during the recent oil crisis (1986). The prolonged condition of oversupply that had been created principally by Saudi Arabia's overproduction, and that has, once again, resulted in the restructuring of global production in the oil industry, seems to be the leading cause of this massive elimination of the high-cost producers within the U.S.

Even though the production price is still being originated from the U.S. oil region, the regulating value of the entire industry today conforms to the individual market value of the more productive U.S. oil fields. As a result, we observe a substantial decline in the magnitudes of market prices, "posted prices," etc. that are necessarily gravitating around the center of newly-formed regulating value (or the production price).

Finally, the notion of "political intervention" and the immediacy of political motivation should not be overemphasized. The *polity* is a distinct, objective, and historically specific social category. We admit that the nature of the relationship between the political and the economic realm is somewhat controversial, but despite the dialectical interactions of the two, one cannot rely on the immediacy of these interactions. In other words, the study of political motivations (as the end results) may not necessarily bring us to the understanding of the social forces that may or may not have anything to do with those motivations. The social significance of polity, in our opinion, is much more than that. Kolm argues: "To say that the economy, in a more traditional sense, is inextricably involved with other social phenomena, e.g., psycho-social, 'pure' political, etc., is to state a self-evident truth. It is, in fact, more an aspect, a side of the same social whole" (1981:210).

It is in this particular sense that political motivations (e.g., the state of mind of politicians, such as conspiracy cannot be used to identify, or even to justify, the fundamental basis of their so-called originating process, except by way of speculation. The task, however, is to understand the process directly, and then possibly to find out whether or not there may have been a conspiracy involved.

D. The Role of New Oil Discoveries

As we have pointed out, the production of oil reserves assumes three different forms. We have dealt with two of these possible forms, i.e., with extensions and revisions, in the previous sections. It is the task of this section to deal with the remaining type, new oil discovery. First of all, we need to follow the same pattern of periodization that we have used in the previous section, for the sake of uniformity and the possibility of comparison. Thus, the trend of productivity of the U.S. new oil discoveries for the familiar periods of 1965–71 and 1971–74 has to be analyzed to determine whether or not they correspond to the crisis period.

The productivity of new oil discovery is usually shown by the number of newly discovered barrels of oil per foot of drilling during a specific year. To be able to come up with the corresponding figures for oil exclusively for each year, however, we must separate the volume of oil exploration from that of natural gas and other associated hydrocarbons. Table 8 points to a 15% improvement in the rate of discovery for the period of 1972–75 over the period of 1965–71. Obviously, the above improvement, if it were determining of value and of price, would have implied the existence of a market price of even smaller magnitude; this is exactly the opposite of what actually took place in the crisis.

During the periods of 1965–71 and 1971–74, the corresponding trends of productivity of new oil exploration exhibit respectively a decline of 55% and an increase of 113%. Even if one disregards the extremely low productivity of 1971 and considers the periods of 1965–72 and 1972–74 for the analysis, one still will come up with 23% decline and 24% increase, respectively. In addition, the corresponding average oil-finding ratios for the periods of 1965–72 and 1972–74 are 14.27 barrels per foot and 15.39 barrels per foot, somewhat of an improvement.

As for the total finding rates (oil and gas), for the periods of 1966–71 and 1971–74 one finds a similar trend. More specifically, we have a

43% decline in the productivity of hydrocarbon exploration in the pre-crisis period and a nearly 39% increase in the period leading up to the crisis. In this connection, table 9 shows the existing trends of productivity within the sphere of new exploration for both the pre-crisis period and the period immediately leading up to the crisis.

What is significant here is that during the period that coincides with the oil crisis of 1973–74, productivity of both new oil and total hydrocarbon exploration increased substantially. This indicates that if the oil crisis were the result of structural changes in the sphere of exploration, we would have had a decrease rather than an increase in the productivity trend of this sphere of production, whereas the productivity of exploration exhibited a significant decline during the pre-crisis period. But the decline in the productivity of exploration during the 1965–71 period seemingly did not have an impact upon the value and the price structure of that period. The above conclusion is also true for the period of 1971–74. In other words, the conditions of capital investment and the impact of productivity developed in the sphere of exploration do not seem to conform to the circumstances that led to the oil crisis of 1973–74.[7] It would be reasonable to conclude then that the center of the oil crisis was actually within the aging and already producing oil fields.

E. Fragmentation of U.S. Oil Leases

A study that was completed in the early 1970's concluded that there is a major distortion in the exploration of oil that primarily "results from a widely divided ownership of land in the United States" (Miller 1973: 415). This situation stems from the fact that the size of the oil fields is often larger than that of the corresponding U.S. oil leases belonging to the firms that made the initial discovery. The result is that the full benefits will rarely go to the primary discoverer.

In order to substantiate the above point, Miller (1973) attempts to measure the extent of fragmentation of oil leases through the examination of proportions of profits received by the main discoverer of the field. As a first approximation, this study uses the production share of the largest producer of a field as the proxy of the firm's profit share.

Given the above empirical work, it was discovered that "the percentage of the benefits from a well received by the discoverer declines with the size of the field" (Miller 1973: 416). The effect of the frag-

TABLE 9

Trends of New Oil and Total Hydrocarbon Discovery per Foot

Productivity Trend	1965–71	1965–72	1966–71	1971–74	1972–74
Trend of New Oil Discovery	-55%	-23%	-42.2%	+113%	+24%
Trend of Total Hydrocarbon Discovery	-	-	-43.1%	+38.8%	+38.4%

Source: Bina, 1985a: ch. VII, table 17.

mentation of the pattern of land ownership is to move capitalist investors away from developing new and larger oil fields which often require assembling large tracts of land prior to exploration.

The above study also demonstrates that the "fields under 500 acres accounted for 60.73 percent of the [oil] fields but for only 14.43 percent of the total area. It is again clear that most oil must lie in fields under more than one ownership" (1973: 417–18).

Another problem caused by the fragmentation of oil leases is with secondary and tertiary recovery methods, where the whole field needs to be put under the control of a single management to eliminate waste and enhance the productivity of the extraction process; this process is called unitization. It would seem obvious that having a large number of leases in a particular oil field undoubtedly works against production according to a predetermined schedule for the oil wells (Miller, 1973: 423). The above condition demonstrates why firms either move toward intensive exploration in the same areas, or simply concentrate on investing in existing oil fields for further recovery.

Even in the case of government-owned lands, due to the existence of non-competitive leases and also to the practice of granting inadequate size leases to individuals through a system of lottery, there is a great deal of speculative activity combined with the considerable fragmentation of ownership in the U.S. oil fields (McDonald, 1971).

Confronted with the above impediments to the production of oil, capital investments are directed either to exploration in the vicinity of the aging oil fields, or to further development of oil from existing

oil wells. The comparison of the U.S. oil-well abandonment rate during the periods of 1965–71 and 1971–74 reveals that there has been a tremendous decline in the rate of abandonment of commercially-exhausted oil wells in the latter period, even though the average life-span of oil wells declined (from 26 to 24 years) in the same period (see table 10). This shows that although the average life-span of producing wells during the period leading up to the oil crisis had become shorter, they were nevertheless not abandoned as rapidly as they used to be.

The intensification of capital investment within existing oil fields is clearly the consequence of the impediment of the prevailing pattern of land and lease ownership in U.S. oil production. In this context, the structure of landed property and the fragmentation of oil leases played an influential role in the direction of capital investments and the structure of accumulation in the U.S. oil industry long before the oil crisis of 1973–74, and thereby set a new basis for the formation of values, oil rents, and market prices at the global level.[8]

F. The Role of Productivity Decline in the Oil Crisis of 1973–74

Throughout the previous sections, an attempt was made to define the notion of the average oil recovery of an oil field, to specify the major producing states, to identify the conditions of oil lease and ownership, to distinguish between the crisis and non-crisis periods, and to measure the changes that occurred during such periods. The remaining task, however, is to establish the relationship between the prevailing state of oil recovery and the crisis during the period, 1973–74.

The trend of the average level of oil recovery reflects the evolving production conditions that prevailed in the oil fields. Given the geological structure of the oil reservoirs, production conditions are the consequences of the circumstances of capital investment in the entire industry. The concentration of capital investments in the aging oil fields, if widespread, can require the restructuring of the entire industry. In other words, if the cost structure of production in the aging oil fields, as a result of further "capital deepening," were to rise, then the magnitude of the individual value associated with those oil fields and possibly of the social value for the entire industry would have to change as well.

It turns out that the trend of average U.S. oil recovery, i.e., the trend of the weighted average of daily barrels of oil per well for the

TABLE 10

U.S. Oil-Well Abandonment and the Life-Span of Oil Wells (1965–1974)

Subject	1965–71	1971–74
The Life Span of Oil Wells (years)	26.01	24.25
Cumulative Abandonment Rate of Oil Wells	+21.38%	+6.18%
Cumulative Abandonment Rate of Oil Wells per Year	+3.05%	+1.54%
Average Number of Oil Wells Abandoned per Year	24,749 (wells)	17,187 (wells)

Source: Bina, 1985a; ch. VII, table 20.

period, 1965–71, shows a considerable increase. But the recovery trend for the period, 1971–74 (the period leading up to the crisis) shows exactly the opposite (see table 4). Considering that investments are made either in the form of "capital widening" or by way of "capital deepening" (the extension of the existing oil fields, or the massive application of enhanced recovery methods), these figures necessarily imply capital investments through "capital deepening."[9]

In addition to the above conditions, the average life-span of U.S. oil wells was substantially shortened during the period, 1971–74, as compared with the trend of 1965–71 (American Petroleum Institute, 1979). This shows that the depletion of existing oil fields increased substantially as further capital investments were applied to the existing oil reservoirs on a massive scale during the 1971–74 period. Likewise, the rate of cumulative abandonment of oil wells during the 1971–74 period declined as well. Abandonment is considered when an oil well is commercially exhausted. As table 10 indicates, the average rate of

oil-well abandonment per year for 1971–74 is 1.54% or about half of the corresponding figure for the 1965–71 period. Consequently, one has to conclude that in the period of 1971–74 a substantial number of oil wells, which in previous periods would have been abandoned, were retained for further production. Obviously, to keep the production flowing from such wells, additional investments of capital were necessary. Given the conditions of the oil wells, one has to expect an eventual decline in the productivity of such investments.

As we have pointed out earlier, the oil crisis of 1973–74 is the consequence of the generalization of the conditions of production in the aging U.S. oil fields for the entire industry. At the same time we have shown that, due to the existence of a particular property relation within the oil industry, the least productive producer tends to determine the magnitude of value for the entire industry. Consequently, the more productive regions, in addition to their share of normal profit, can appropriate a surplus profit in the form of oil rents or royalties (Bina, 1985b). Finally, the generalization of production conditions in the least productive U.S. oil fields led to the formation of a new value and cost structure, oil rent, and of newly-formed market prices within the context of the entire industry globally.

III. AN ALTERNATIVE THEORY OF THE OIL CRISIS

To develop an alternative theory of the oil crisis, one needs to start from the critique of the prevailing views on the oil crisis of 1973–74. As we have seen earlier, the majority of explanations tended to explain the events that occurred during the period leading up to the oil embargo. But none of these theories was able to show the relationship between these outward appearances and the inner essence of the oil crisis. What is lacking in these theories is the identification of the laws of motion of the crisis. It would appear that they all missed the underlying cause of the crisis because they took the effects of the crisis at their face value. Thus, the existing theories of the oil crisis, from those with the most conservative orientation to those with the most radical, suffer from the dominance of idealism and the lack of proper perspective.

An adequate alternative theory of the oil crisis should reflect the internal development of the international oil industry, and the under-

lying forces that led to the crisis. This requires the explanation of the timing of the oil crisis. We have seen that none of the existing theories was able to demonstrate, for instance, why oil prices changed so drastically, except the neoclassical theory of monopoly or cartel. But the underlying forces of monopoly or cartel during the time of the crisis were not adequately identified, except by pointing to the "dependence" of the United States on the foreign oil. Thus, the static notions of monopoly and cartel, combined with that of subjective determination of prices by the U.S. government, were among the reasons for the oil crisis given by most theorists.

A. Periodization of Capitalist Development in the Middle Eastern Oil Industry

The history of oil production in the Middle East has passed through three distinct periods: (1) the era of early concessions (1901–50), (2) the transitional stage to capitalist development (1950–70), and (3) the era of capitalist production (Bina, 1985a: ch. 3). The era of early concessions is the period within which the international oil companies divided the entire Middle East region among themselves by obtaining concessionary rights for exploration and production of crude oil. The areas subjected to these concessions were often almost the size of the countries involved, with contracts that lasted nearly up to a century (Cattan, 1967). The existence of pre-capitalist social relations, along with the lack of private property in land and the political dominance of international capital, were the principal features of this period. The second period is associated with the further development of capitalist production in the Middle Eastern oil industry. The distinguishing features of this period are nationalization in Iran (and its reversal through a *coup d'etat*), and subsequent pseudo-nationalization of the oil industry and the formation of the Organization of Petroleum Exporting Countries (OPEC) (Walden, 1962; Rouhani, 1971; Mikdashi, 1972). With the development of capitalist social relations under the economic and political dominance of international capital in this period, the process of the internationalization of capital in the oil industry accelerated. Finally, with the commencement of the third period, value formation, and with it price formation in the petroleum industry, for the first time in history took an international dimension that extended into the entire global structure (Alnasrawi, 1985; Bina, 1985a).

B. The Nature of Property Relations and the Theory of Oil Rent in the Oil Industry

One of the distinguishing features of oil production is production through the intervention of the ownership of oil fields. In other words, production of oil in capitalism is dependent upon the surrender of rights of ownership of crude oil to the capitalist producers by the owners of the sub-soil. It is the condition of the above surrender that constitutes the intervention of landed property in petroleum production. This intervention in the process of production through competition leads to the phenomenon of oil rent, just as the intervention of landed property in agricultural production leads to agricultural rent.[10]

Historically, oil rent, like any other social phenomenon, has passed through different and specific stages of development. During the era of early concessions, when the domination and subsequent expansion of international capital in the Middle East and elsewhere in the Third World had just begun, a primitive and still undeveloped form of oil property relation emerged that was associated with the state ownership of land in most societies of these regions. Because oil rent at this particular stage was not a barrier to production, there was no impediment to capital investment in oil production. Therefore, in the early period, the determining condition of the magnitude of oil rents was based exclusively upon the direct political dominance of international oil companies within the entire Middle Eastern oil region. This is also true for other regions as well. With the gradual development of capitalism, the emerging oil property relations that led to the phenomenal form of rent, in conjunction with internationalization of capital, have placed all the oil-producing regions potentially in an organic relation with one another. As the international oil industry extended its range of economic and political domination over the entire globe, the extent and intensity of this organic relation increased. Meanwhile, one has to realize that production of oil was taking place under very different technical and social production conditions in the various oil-producing region in the world. Thus, the magnitudes of production costs and individual values produced in these regions must be necessarily different from each other. With the social value for the entire international industry emerging from the least productive region of the world, production from the more productive oil regions will accompany differential oil rents over and above the general rate of profit. Figure 1 reveals

that the U.S. oil region is the most heavily drilled area in the entire world. The combination of small oil fields and the high intensity of drilling are among the significant factors that resulted in a high cost of oil production in that region (Bina, 1984). In contrast, the Middle Eastern oil region has the highest level of productivity and therefore the lowest cost of production.

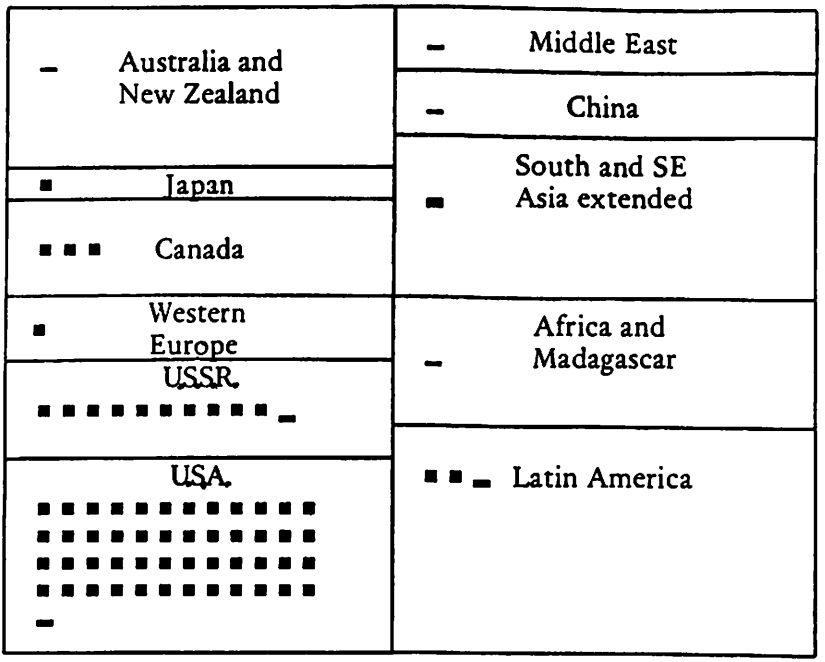

Figure 1. Wells Drilled in Relation to Prospective Areas Around the World in 1975.*

Source: Parker, 1979: 12.

*The areas within the rectangles represent, to scale, the area of petroleum prospects within the country or region named. Both onshore and offshore prospects up to a water depth of 200m. are included. The black squares represent the cumulative drilling, exploratory plus developmental, in each area, up to the end of 1975. A full square represents 50,000 wells and the smaller section proportions thereof. Completion of the remaining area of the U.S. would correspond to a saturation level of drilling.

Table 11 illustrates the average daily production per oil well for a selected number of oil-producing countries (see also figure 1). The United States, at the bottom of the scale, produces on the average about

TABLE 11

Average Production per Well for a Selected Number of Countries (Late 1960's)

	Expressed in Daily Barrels
Iran	11,838
Middle East, all countries	4,684
Kuwait	4,665
Libya	2,985
Venezuela	301
Indonesia	248
U.S.S.R.	99
World	56
U.S.A.	17

Source: White, 1978: 15, table 9

17 daily barrels, whereas the average production per well in Iran is 11,838 daily barrels. (The average daily production per oil well in the Middle East is 4,684 barrels). This shows that the United States and the Middle East are at the opposite ends of the spectrum of productivity within the international oil industry today. A comparison of selected number of regions can be made by examining their cost of finding and developing of a barrel of new oil.

The average costs of finding and developing of oil per barrel in the United States and the Middle Eastern oil region are $4.06 and $0.12 respectively. Again, the United States is relatively the most expensive oil region of the world (see table 12).

The theoretical implication of the above investigation is twofold: (1) The magnitude of the value and the price level for the entire international oil industry is regulated by the least productive oil region; therefore, U.S. oil production and its cost structure regulate the values, oil rents, and the market prices of crude oil globally. (2) The size of the royalty and the rent payments received by the oil-producing states, including OPEC, is neither arbitrary nor dependent upon the neoclassical theory of cartel behavior; rent emerges here through competition (see Bina, 1985a; ch. 6).

TABLE 12

Average Cost of Finding and Developing of a Barrel of New Oil for a Selected Number of Regions (1974–1978)

	In U.S. Dollars
United States	4.06
Canada	2.45
Western Europe	1.48
Africa	1.27
Far East	0.90
Venezuela	0.18
Middle East	0.12

Source: *Petroleum Outlook*, XXXII, 5, May, 1979, p. 1.

C. The Process of Value-Formation and Price Determination

It should be pointed out that there are many types of prices in the oil industry, with different and distinct characteristics. To name a few, there are "posted prices," "spot prices," and "buy-back prices." From the standpoint of political economy, however, one has to know the difference between the "oil spot prices" and "posted prices" and the way in which they relate to the process of value formation in the oil industry.

The "spot price" is the price of a single volume of crude oil bought and sold in the spot market (Minard, 1980). This is the price that is usually referred to as the market price in economics texts. A characteristic of the "spot price" is that it fluctuates around the center of gravity of social values in the entire industry. Such fluctuations are brought about by market conditions in which demand and supply play an important part.

The "posted price," on the other hand, is a mechanism that was traditionally used for the internal transfer of crude oil within the network of major oil companies and their subsidiaries. The major significance of "posted price" is in its usage in the calculation of oil rents (royalties) since the 1950's (Cattan, 1967; Bina 1985a). After the replacement of the early oil concessions by the new method of 50–50 prof-

it sharing, the "posted price" was used to determine the share of the oil revenues due to the oil-exporting governments. Historically, this represented a further step in the development of modern oil rent in the Middle Eastern oil industry. Although the "posted price" does not function as a price in an ordinary sense, it nevertheless has been constituted as a variable basis for the determination of oil rents since the transition from the era of early concessions.

Even though the meaning of the term "posted price" has not changed since its emergence in the 1950's, its essential characteristic, as a mechanism in determination of the oil rents, has nevertheless evolved. This change is associated with the gradual increase in the level of socialization of production, the internationalization of capital, and the development of full-fledged capitalist relations globally. One of the significant events during the post-transitional period was the emergence of spot markets in crude oil that initially aided the Iranian, Nigerian, and Libyan governments to receive unprecedented bids of between $17 to $24 per barrel during the month of December, 1973 (Penrose, 1975: 51). As we have observed, the spot price or market price did not decline significantly after the removal of the embargo, even with the world-economy moving into a major recession during the period of 1974–75. During the embargo period the "posted price" increased fourfold to the level of $11.65 for the marker crude (Arabian light crude oil of 34 degrees API gravity) (Blair, 1976). This change increased the magnitude of differential oil rents not only for the OPEC nations but also for other oil-producing governments, such as the United Kingdom and Mexico. Almost simultaneously, the well-head price of the so-called U.S. new oil increased to the world level.

Since 1970 the international oil industry has become an organic whole, with all different oil regions of the world in mutual relationship. The oil crisis of 1973–74 is therefore historically the first economic crisis of the industry at its present stage. Although the above crisis was, for obvious reasons, associated with oil shortage and the consequent supply restrictions, one cannot explain it through oil shortage alone as was often previously the case.

As we pointed out earlier, the magnitude of value, as the center of gravity of the market prices for the entire oil industry, is regulated by the costs and conditions of productions in the U.S. oilfields, i.e., the least productive oil region.[11] As the total and development costs

of oil per barrel had almost tripled (and the trend of development costs alone explains that) this center of gravity had to increase significantly. This increase is the reflection of the increased level of expenditures that are made to develop oil from the older oil fields within the U.S. region.

The U.S. oil region has been the least productive area even prior to the threefold cost increase of the 1971–73 period. But continuous intensification of capital investments on the existing oil fields, in conjunction with the fragmentation of the existing oil leases, led to even further increases in the magnitude of U.S. production costs. These changes would necessarily require a complete reorganization in the structure of oil production that materialized through a crisis (Bina, 1985a). Therefore, the October War of 1973 was the immediate triggering condition of the above reorganization but not the cause of the crisis. During this reorganization, in conjunction with a substantially higher magnitude for regulating social value, increased levels of differential oil rents, and market prices emerged globally.

As for the present oil crisis, there is a substantial decline in spot market prices together with a great deal of bankruptcies (plugging of high-cost oil wells), which in turn have led to speedy elimination of relatively unproductive fields in the continental United States, a significant number of which are located in Texas, Louisiana, and Oklahoma. The severity and suddenness of these bankruptcies are clear signs of a restructuring of the oil production and formation of a substantially lower regulating market value (and production price) for the entire oil industry globally. The so-called "free fall" of the oil prices, as indicated by most market analysis, is not a pure market phenomenon but rather a market response to abrupt structural changes that are under way. Thus, the political anxiety of the Reagan administration over the fall of the price of oil in the mid-1980's, and the sending of an emissary to the Middle East to put a lid on Saudi oil production, despite its nearly fanatical market advocacy and outlook, failed to reverse the fundamental changes that have already been developed in the oil industry's structure of production.

D. Monopoly and Competition in the Oil Industry

The existence of the dominant but erroneous concept of monopoly is common to all the prevailing views on the oil crisis. Without ex-

ception, all the existing theories, either implicitly or explicitly, tend to agree that the price of oil is directly determined by the OPEC cartel, or through the monopoly of oil firms or both. For instance, the dependency theory of the oil crisis implies that oil prices prior to the events of the early 1970's were determined by the oil companies, but after the "OPEC offensive," which was a move against unequal exchange at the international level, they were set by the oil-exporting countries. The conspiracy theory argues that the increase in the price of oil was primarily initiated by the U.S. government in conjunction with the major oil firms and the concerted effort of OPEC. The conventional theory of the oil crisis contends that controls of the production, distribution, and marketing operations do not allow the law of supply and demand to operate properly. Therefore competition is imperfect (Salant, 1982; Robinson, 1969). The common denominator of all these views is the quantitative theory of competition and monopoly (see Shaikh, 1980; Semmler, 1984. Weeks, 1981: 152–58; and Bina, 1985a: chs. V–VI).[12] The notion of monopoly is perceived to be dependent upon the number of firms within the industry. Accordingly, if the number of firms operating in an industry is small, it is called a "monopoly" or an "oligopoly." On the other hand , it the numbers of firms in an industry are many, it is believed that competition prevails (Clifton, 1977; Shaikh, 1980; Weeks, 1981; Bina, 1985a).

In contrast with the above views, since competition and centralization of capital (i.e., monopoly) are not mutually exclusive in the process of the production of value, one cannot talk about monopoly without competition. The formation of value in an industry in general, and in the oil industry in particular, necessarily emerges through competition. In the oil industry, just like in any other industry, competition among different production units, with different individual values, leads to the formation of social value for the entire industry. In addition, production of oil is intertwined with the formation of rent, which in turn develops through competition (Fine, 1983; Bina, 1985b). Thus, competition as an inner nature of capital will always be present in the process of accumulation and value-formation. Accordingly, the competitive struggle among capitals leads to concentration, centralization, and the further monopolization of capital in the accumulation process; thus competition leads to monopoly and monopoly leads to further competition. As a result, it is hardly surprising that the exist-

ing theories all failed to recognize the true nature of the oil crisis of 1973–74, and the significance of post-crisis developments.

IV. CONCLUDING REMARKS

We have attempted to develop an alternative to the prevailing views concerning the oil crisis of 1973–74 by demonstrating that the above crisis was qualitatively different from the simple international shortages that occurred in the past. We have contended that the above crisis was the consequence of the globalization of production in the oil industry, in conjunction with the reorganization of U.S. production, that has brought all the oil-producing regions into an organic whole, leading to a unified system of value, price, and rent determination through competition.

In order to explain the oil crisis, we have developed a theory of the internationalization of capital, a theory of differential oil rent, a theory of value, and finally a theory of oil crisis in the oil industry. The internationalization of the oil industry in the Middle East has gone through three distinct historical periods: (1) the era of early oil concessions; (2) the era of transition to capitalist production; and (3) the period of development of a full-fledged capitalist production. We have demonstrated that the phenomenon of oil rent in the early period was the consequence of the direct political dominance of international capital, the predominance of pre-capitalist social relations, and state ownership of land, as opposed to what was prevailing in the capitalist countries. With the gradual development of capitalist social relations, the phenomenon of oil rent became value-determined.

Formulating the notion of differential oil rent, we attempted to show the significance of the historical and social conditions within which the existing oil regions developed. We have argued that, due to the intervention of property relations, i.e., the circumstances that led to the separation of ownership of the oil leases from the ownership of oil fields, the individual value (production price) associated with the least productive producer has become the regulating market value of the entire industry. As a result, the more productive producers were in a position of appropriating a differential oil rent. The regulating value of oil, therefore, tended to determine the magnitude of differential oil rents and market prices through competition. The "posted price" here is a

key mechanism for the calculation and appropriation of the above differential oil rents. Finally, we have shown that the conditions of oil production in the United States (the least productive oil region) became the basis for regulating the market value of oil throughout the industry globally. With the substantial increase in the investment costs of U.S. oil during the period leading up to the crisis, the magnitude of U.S. oil prices has increased. Given the internationalization of the oil industry, this change produced a shock wave throughout the world, leading to the restructuring of the industry at the global level. Thus, we have to make a distinction between the previous shortages that simply resulted in temporary imbalances and the above crisis (as well as the ones that followed it) that were symptomatic of the fundamental changes that occurred in the entire industry in the 1970's, which in turn has set the stage for the years to come.

APPENDIX

The following is a brief summary of the computations of some of the figures and tables presented by the author in the article.

The figures in table 4 are calculated from the appropriate columns in table 3, reflecting the published data by the U.S. Energy and Interior Departments (see the sources at the end of table 3). These figures are the weighted averages of the size of oil recovery per well from the major U.S. oil-producing states (weighted by their respective production shares) during 1965, 1971, and 1974. Likewise, the figures in table 5 are calculated from table 4 for the periods 1965–71 and 1971–74.

As for the sources associated with table 6 and the manner in which various columns in that table are computed, the reader can consult the following tables.

Calculation of the Total Capital Costs, Exploration Costs, and Development Costs per Barrel of Oil in the United States

(1) Year	(2) Number of Producing Exploratory Oil Wells Drilled (thousands)	(3) Success Rate of Exploratory Wells Drilled (per cent)	(4) (2:3 × 100) Total No. of Oil and Dry Exploratory Wells (thousands)	(5) No. of Total Producing Oil Wells Drilled (thousands)	(6) Success Rate of Total Wells Drilled (per cent)
1966	1.20	18.4	6.522	16.78	58.1
1967	0.99	17.1	5.789	15.33	58.9
1968	0.95	16.2	5.864	14.33	58.1
1969	1.08	17.5	6.171	14.37	57.3
1970	0.79	16.5	4.788	13.02	60.0
1971	0.65	15.7	4.140	11.86	60.7
1972	0.68	17.0	4.000	11.31	59.5
1973	0.62	20.3	3.054	9.90	61.2
1974	0.81	23.3	3.476	12.78	63.2
1975	0.97	23.3	4.163	16.41	64.4

Year	(7) (5:6 × 100) No. of Total Oil and Dry Wells Drilled (thousands)	(8) No. of Total Oil and Gas Wells Drilled (thousands)	(9) (7:8) Proportion of Wells in Total Oil and Gas (per cent)	(10) (4:7) Proportion of Exploratory in Total Oil Wells
1966	28.881	36.380	0.794	0.226
1967	26.027	32.230	0.807	0.222
1968	24.664	30.600	0.806	0.238
1969	25.078	32.190	0.779	0.246
1970	21.700	28.120	0.772	0.221
1971	19.539	25.850	0.756	0.212
1972	19.008	27.290	0.696	0.210
1973	16.176	26.590	0.608	0.189
1974	20.221	31.700	0.638	0.172
1975	25.481	37.240	0.684	0.163

Year	(11) Total Oil and Gas Capital Expenditures (Millions of Dollars)	(12) (11 × 9) Total Oil Capital Costs (Millions of Dollars)	(13) (12 × 10) Oil Exploration Costs (Millions of Dollars)	(14) (12 - 13) Oil Development Costs (Millions of Dollars)	(15) Total Oil Discoveries (Millions of Barrels)
1966	4250	3374.07	762.540	2611.530	2963.978
1967	4365	3524.74	782.492	2742.248	2962.122
1968	5390	4344.34	1033.953	3310.387	2454.635
1969	5250	4090.27	1006.206	3084.064	2120.036
1970	4775	3684.87	814.356	2870.514	3088.918 (1)
1971	3900	2947.62	624.895	2322.725	2317.732
1972	6480	4513.32	947.797	3565.523	1557.848
1973	8140	4952.38	936.000	4016.380	2145.831
1974	12355	7881.25	1371.337	6509.913	1993.573
1975	10250	7013.05	1143.127	5869.923	1318.463

Year	(16) Total New Oil Discoveries (Millions of Barrels)	(17) Total Oil Development (Extensions & Revisions (Millions of Barrels)	(18) (12:15) Total Oil Capital Costs per Barrel (Dollars)	(19) (13:16) Oil Exploration Costs per Barrel (Dollars)	(20) (14:17) Oil Development Costs per Barrel (Dollars)
1966	310.422	2653.556	1.138	2.456	0.984
1967	344.686	2617.436	1.190	2.270	1.048
1968	357.746	2096.889	1.770	2.886	1.579
1969	247.184	1872.852	1.929	4.072	1.646
1970	368.637	2720.281	1.193	(1) 2.209	1.055
1971	156.710	2161.022	1.272	3.987	1.075
1972	278.430	1279.418	2.897	3.404	2.787
1973	203.913	1941.918	2.308	4.590	2.068
1974	313.726	1679.846	3.953	4.321	3.885
1975	301.064	1017.399	5.319	3.797	5.769

(1) The oil reserves in Prudhoe Bay, Alaska are excluded from 1970 oil recovery in order to find a usual picture of reserve addition in the United States. The amount of oil recovery in Prudhoe Bay is estimated at 9.6 million barrels.

Source: API, *Basic Petroleum Data Book,* vol. 1, no. 1, section III, table 2; section V, table 9; API, *Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada as of December 31, 1979,* vol. 34 (June, 1980), p. 24, table II; Department of Energy, *Annual Report to Congress,* vol. 2, various issues.

Calculation of the changes in the trend of U.S. oil capital expenditures (per barrel) and prices in table 7 is directly based upon the readily available figures in table 6. At the same time, the figures for the trends of new oil and total hydrocarbon discovery per foot, in table 9, are all derived from table 8, the sources of which are all indicated therein.

Finally, the figures in table 10 are taken from Bina (1985a). These figures are originally compiled by the author from API (1979).

NOTES

1. There is a growing literature that represents the main characteristic of this category. The results of a symposium held after the oil crisis, with contributors such as Raymond Vernon, Romano Prodi, Alberto Clo, Edith Penrose, George Lenczowski, and James McKie were edited by Vernon and published in *Daedalus,* Fall, 1975. See also M. A. Adelman (1972), and Taki Rafal (1974).

2. There is an extensive literature on dependency theory, but perhaps the popular arguments can be found in Arghiri Emmanuel, *Unequal Exchange* (1972) and in Samir Amin, *Accumulation on a World Scale* (1974). See also André Gunder Frank (1969a; 1969b; 1972).

3. Norman Girvan uses the phrase of "OPEC offensive" to show that the oil crisis was the consequence of the nationalism of the Third World.

4. For the analysis of monopoly and competition see Bina (1985: ch. VI) and Semmler (1984).

5. This is valid as of 1974. In 1965, Alaska was not yet considered as an oil-producing state. Instead, Illinois was among the top nine producing states.

6. It is important to note that we are concerned with the average oil recovery per well, in association with the entire volume of capital investment that is applied to the oil fields, rather than the so-called investments at the margin, a prevailing concept in neoclassical economics. For additional information see Ben Fine and my own book (Bina, 1985a: ch. V).

7. It should be understood that the oil crisis of 1973–74, contrary to the general periodic crises, evolved through the generalization of a process that prevailed in lesser productive regions, rather than the generalization of new and productive techniques.

8. We have demonstrated that the market prices of all other sources of energy, including coal, natural gas, etc., are also regulated by the value of oil produced from the aged U.S. oil fields (Bina, 1984).

9. It should be noted that we do not speak of the necessity or lack of necessity of fresh oil reserves. What we have in mind is the fact that the production conditions prevailing in the aged U.S. oil fields would tend to dominate the entire industry's market values and prices.

10. Regardless of their apparent similarity, oil production and agricultural production cannot be subjected to one "general" theory of rent, because the phenomenon of rent results from the barrier of property relations, which tend to emerge under different historical and material circumstances. Thus, there is no general theory of rent in reality, and Marx's theory of rent is specific to agriculture. Agriculture rent itself is the effect of a specific property relation that may not exist in other production, such as oil. In fact, the above argument forms a demarcation line between Marx's economics on the one hand, and either classical political economy, post-Marxian, post-Keynesian, or neo-Ricardian economics on the other.

11. Due to oil price regulation in the United States, two categories of crude oil were recognized and a two-tier price system was established. "Old oil" referred to crude oil extracted

from the oil wells discovered prior to 1972, and "new oil" was the oil produced from the newly-discovered oil fields, or the volume extracted from the old oil wells over and above their 1972 production level. (See Department of Energy, *Monthly Review,* for specific figures.)

12. All of the above authors argue that difficulties in both orthodox and radical economics, on the subject of competition and monopoly, arise from uncritical acceptance of the theory of pure competition.

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MORISHIMA ON PASINETTI ON RICARDO*

by

Heinz D. Kurz and Neri Salvadori

I. Introduction

In his recent book *Ricardo's Economics - A general equilibrium theory of distribution and growth* (1989) Michio Morishima put forward a criticism of Luigi Pasinetti's article 'A Mathematical Formulation of the Ricardian System', published in 1960.[1] Morishima's main objection to Pasinetti's formalization of Ricardo's approach to the theory of value, distribution and growth reads:

> Pasinetti does not classify various sorts of land according to their quality. He instead has only one aggregate production function for agriculture as a whole, with the logical consequence that he is unable to explain the rent of a land as the surplus which it yields ... His theory of rent, accordingly, can hardly be a theory of differential rent, though it may be called a marginal productivity theory of rent. (Morishima, 1989, pp. 50 - 51)

The solution suggested by Morishima consists in considering a production function for each quality of land.

The purpose of the present paper is to scrutinize this objection and other propositions by Morishima in his latest book. His criticism of Pasinetti's model is demonstrated to be untenable. It is shown that Pasinetti's approach to the theory of

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* *We should like to thank without implicating Mauro Baranzini, Geoff Harcourt and Ian Steedman for helpful comments on a previous draft of this paper.*

1 *See Pasinetti (1960), reprinted in Pasinetti (1974); in what follows all references will be to the 1974 collection of essays.*

rent is rooted in the analysis contained in Chapter XI, 'Land', of Piero Sraffa's *Production of Commodities by Means of Commodities* (1960).

The structure of the paper is as follows. In Section II we briefly summarize Sraffa's analysis of extensive and intensive rent. In Section III we show that, given the simplifying assumptions underlying Pasinetti's formulation, the production function for agriculture as a whole used by Pasinetti can easily be constructed. In Section IV Morishima's criticism of Pasinetti's treatment of the 'natural wage rate' is shown to be untenable. Section V deals with Morishima's treatment of fixed capital, Section VI with his treatment of the standard of value and, in particular, Sraffa's Standard commodity. Section VII contains some concluding remarks.

II. Sraffa's Analysis of the Rent of Land

In his chapter 'Land', Sraffa extends his analysis to cover the case of natural resources which are used in production and which, if they are in short supply, enable their owners to obtain a rent. In accordance with previous chapters, Sraffa starts from a given *system of production,* i. e. given quantities of the commodities produced and given methods of production in use, and a given distribution of income between wages and profits. He then indicates how such a constellation can be conceived 'as the outcome of a process of "extensive" ... [or] "intensive" diminishing returns' (Sraffa, 1960, p. 76). Elaborating on Sraffa's approach, several contributions were concerned with the study of changes in the relations between the distributive variables (including rents) and prices, corresponding to autonomous changes in one of the distributive variables (the rate of profits r or the wage rate w)

or in outputs.[2] In what follows, some of the basic findings of Sraffa and the literature rooted in his approach will be briefly summarized.

Generally speaking, the scarcity of natural resources is reflected in the co-existence of two or several processes producing the same commodity.[3] In the pure case of *extensive* diminishing returns, in which there exists only one process for the production of corn for each quality of land, different qualities of land will be used side by side in order to produce the amount of corn required. If there were no scarcity, cost minimization would imply that only one quality of land (and only one method of production), i. e. the one that allows production of the commodity at lowest cost per unit, would be used, and there could be no rent. However, if the best-quality land is in short supply, one or several additional qualities of land have to be cultivated and hence one or several additional methods of production are used to produce the required amount. That quality of land which, among all those cultivated, exhibits the highest cost per unit of product (but no higher unit cost than any of the lands lying fallow) yields no rent, whereas the scarcity of the other lands in use is reflected in positive differential rents, and rents are such that corn is produced at the same unit cost by all the processes operated.

In the pure case of *intensive* diminishing returns, in which there exists only one quality of land but a variety of methods of production to cultivate it, 'the only evidence of [the] scarcity [of land] to be found in the process of production is the duality of methods' (Sraffa, 1960, p. 76). If land were available in abundant supply,

2 *See, for example, the papers on rent theory by Montani (1975) and Kurz (1978) reprinted in Steedman (1988, vol. II, part II), the article by Quadrio-Curzio in Pasinetti (1980), and Salvadori (1984).*

3 *For the sake of the argument, we shall, in what follows, assume that there is only one product, say 'corn', in the production of which land is used. The complications which arise when there is more than one agricultural product have been investigated by D'Agata (1984).*

only the cheapest method of production would be operated and there could be no rent. However, as soon as the required amount of the product can no longer be produced by this method, even if it occupies all the land, the price of corn has to rise up to the point where an additional method becomes eligible which, although characterized by a higher cost per unit of output, yields more corn per acre. Thus, with scarce homogeneous land, two methods of production to produce corn will be employed side by side in general and will allow the determination of the (uniform) rent of land and the price of corn. With an increase in demand for corn, output will increase 'through the gradual extension of the method that produces more corn at a higher unit cost, at the expense of the method that produces less' (ibid.). As soon as the second method has completely replaced the first one, further increases in output presuppose that a third method will be introduced which produces still more corn per acre at still higher unit cost, etc.

As should be clear from the foregoing, in answering questions like 'Which kinds of land (or methods of production) will be used in order to produce given outputs?' a problem of the choice of technique has to be solved. This problem consists of finding, for a given wage rate (or, alternatively, a given rate of profits), a cost-minimizing system of production, in which commodity prices, rents and the rate of profits (wage rate) are non-negative and no process yields extra-profits. Since the prices of commodities and hence the cost of production cannot generally be determined independently of distribution, i. e. the level of wages (the rate of profits), the implication is close at hand that in order to produce the same vector of outputs, at different levels of w (r) the criterion of cost minimization may lead to the cultivation of different kinds of land and/or the activation of a different pair of methods on a given kind of land. Furthermore, if produced means of production are used there is no reason to exclude the possiblity that the same system of production can return at different levels of w (r); i. e., the reswitching of techniques that use non-produced means of production can occur. The view frequently to be found in the economic

literature that there exists a 'natural' ranking of the various plots of land in decreasing order of profitability (or 'fertility'), and the related view that this ranking coincides with a parallel one according to rent per acre, are generally unwarranted. Both orders 'may vary with the variation of r and w'(Sraffa, 1960, p. 75) and may deviate from one another.

III. A Production Function for Agriculture as a Whole

We may now construct the production function for agriculture as a whole, used by Pasinetti. In order to do so we first recall the basic assumptions underlying his simplified analysis (cf. Pasinetti, 1974, p. 7):

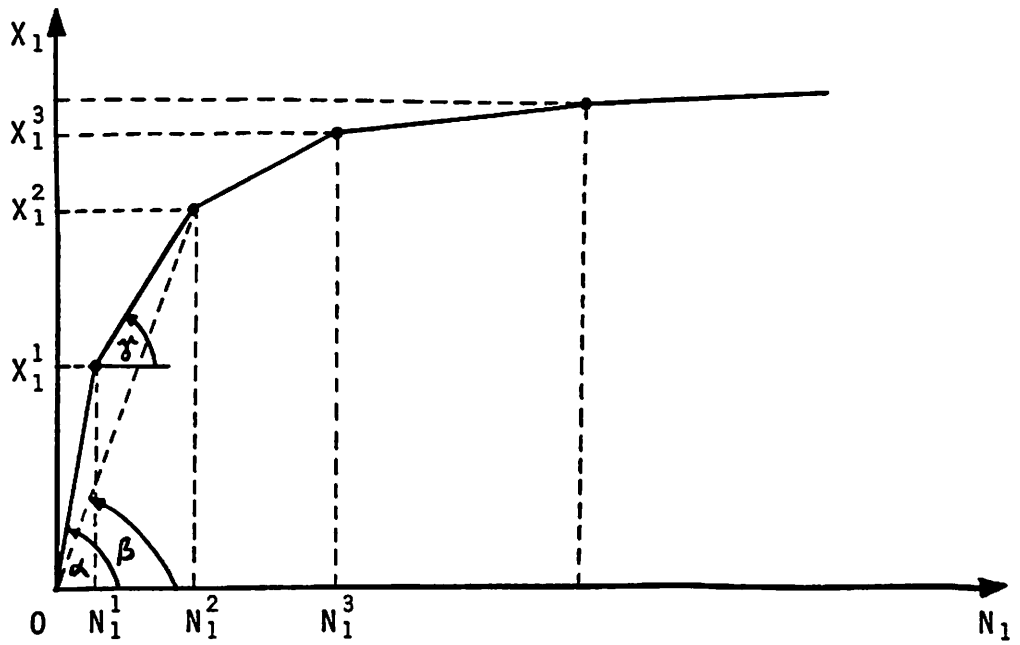
(i) there is only one type of agricultural product, called 'corn';

(ii) corn is the only wage-good and capital consists entirely of the wage-bill, i.e., corn is produced by labour and land only.

The production function for agriculture as a whole expresses the following 'course of events' in an economy, satisfying assumptions (i) and (ii), in which capital is accumulated and a growing labour force has to be provided with corn. At first only one method of production will be employed, that which maximizes the output per worker (since there are no produced means of production). Total output can be increased by gradually extending the cost-minimizing method to the entire available amount of the quality of land (call it quality A) utilized by this method. In Fig. 1 the maximum output to be produced with this method is given by X_1^1; the corresponding employment on land of quality A is N_1^1; tg α is the output-labour ratio.

Fig. 1

The production function



A further increase of output can take place either by taking into cultivation another quality of land (call it quality *B*) or by gradually replacing the first method of production by another one which utilizes the same quality of land, but produces more corn per acre at a higher unit cost, i. e. a higher quantity of labour per unit of output. The farmers will choose the cheapest method available. If the cheapest method available happens to be that one utilizing land of quality *B*, then in Fig. 1 the maximum output to be produced with this method is given by $(X_1^2 - X_1^1)$; the corresponding employment on land of quality *B* is $(N_1^2 - N_1^1)$; tg γ is the output-labour ratio. On the contrary, if the cheapest method available is another method utilizing land of quality *A*, then in Fig. 1 the maximum output to be produced with this method is given by X_1^2; the corresponding employment is N_1^2; tg ß is the output-labour ratio.

Similarly, a further increase of output can take place either by taking into cultivation still another quality of land or by gradually replacing (one of) the operated method(s) of production by another one which utilizes the same quality of land, but produces

more corn per acre at a still higher labour input per unit of output. Once again farmers will choose the cheapest method available.

Clearly, with a continuum of methods of production available to cultivate each quality of land, the production function for agriculture as a whole need not, as in Fig. 1, consist of a series of straight lines.

After this illustration of the idea underlying the concept of a production function for agriculture as a whole, let us now construct this function.[4] Because of assumptions (i) and (ii) the technology of the agricultural sector can be described in terms of the labour input vector **l**, the land input matrix **C**, and the ouput vector **b**. The number of rows of **l**, **C**, and **b** equals the number of the available methods (or processes) of production; and the number of columns of **C** equals the number of existing qualities of land. It is assumed that **l** and **b** are positive vectors and each row and column of matrix **C** is semipositive. This means that each process produces a positive amount of corn by employing a positive amount of labour (and, as a consequence, capital) and at least one quality of land. All qualities of land may be used in the production of corn.[5]

For each amount of labour employed in the corn production, N_1, the following set of inequalities and equations must hold,

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4 *The following argument draws on some of the material contained in the Laurea thesis submitted by Giuseppe Freni to the University of Catania (1987); we are grateful to Giuseppe Freni for allowing us to do so. It is to be hoped that he will publish his dissertation soon.*

5 *With Morishima's description of agricultural technology (cf. Morishima, 1989, p. 37) each row of matrix* **C** *would have one and only one positive element, all other elements being zero. We do not need this assumption, so we can allow, for example, that corn is produced by using a particular quality of land and water, both in short supply, the water coming from a source located on another quality of land whose proprietor obtains a rent for the use of the source.*

$$\mathbf{x}^T\mathbf{C} \leq \mathbf{h}^T, \tag{1}$$

$$\mathbf{x}^T\mathbf{C}\mathbf{q} = \mathbf{h}^T\mathbf{q}, \tag{2}$$

$$\mathbf{b} \leq w(1+r)\mathbf{l} + \mathbf{C}\mathbf{q}, \tag{3}$$

$$\mathbf{x}^T\mathbf{b} = w(1+r)\mathbf{x}^T\mathbf{l} + \mathbf{x}^T\mathbf{C}\mathbf{q}, \tag{4}$$

$$\mathbf{x}^T\mathbf{l} = N_1 \tag{5}$$

$$\mathbf{x} \geq \mathbf{0}, \tag{6}$$

$$\mathbf{q} \geq \mathbf{0}, \tag{7}$$

$$w(1 + r) \geq 0, \tag{8}$$

where $\mathbf{x}$ is the process intensity vector, $\mathbf{h}$ is the vector of the available amounts of the different qualities of land, $\mathbf{q}$ is the vector of rent rates, w is the wage rate in terms of corn, and r is the profit rate.

Because of the Equilibrium Theorem of Linear Programming (see, e. g., Franklin, 1980, p. 66), the system (1) - (7) is satisfied if and only if the following two dual linear programmes have optimal solutions:

Maximize $\mathbf{x}^T\mathbf{b}$ subject to

$$\mathbf{x}^T\mathbf{C} \leq \mathbf{h}^T \tag{9}$$

$$\mathbf{x}^T\mathbf{l} = N_1$$

$$\mathbf{x} \geq \mathbf{0};$$

Minimize $\mathbf{h}^T\mathbf{q} + w(1+r)N_1$ subject to

$$\mathbf{b} \leq w(1+r)\mathbf{l} + \mathbf{C}\mathbf{q} \tag{10}$$

$$\mathbf{q} \geq \mathbf{0}.$$

Let

$$N_1^* \equiv \text{Max } \mathbf{z}^T\mathbf{l} \text{ subject to}$$

$$\mathbf{z}^T\mathbf{C} \leq \mathbf{h}^T$$

$$\mathbf{z} \geq \mathbf{0}.$$

Then programme (9) has a feasible solution for each N_1 such that $0 \leq N_1 \leq N_1^*$, whereas programme (10) has always a feasible solution. Hence both programmes have optimal solutions for $0 \leq N_1 \leq N_1^*$. Moreover, the theory of Parametric Programming (see, for example, Franklin, 1980, p. 70) ensures that the function

$$X_1 = f(N_1), \tag{11}$$

where X_1 is the value of the maximum of programme (9), is continuous, concave, and piecewise linear for $0 \leq N_1 \leq N_1^*$. Moreover, since

$$X_1 = \mathbf{h}^T\mathbf{q} + w(1+r)N_1,$$

$f'(N_1) = w(1+r)$ for each point in which the function $f(N_1)$ is differentiable. Finally, let

$$X_1^{**} = f(N_1^{**}) \equiv \text{Max } \mathbf{z}^T\mathbf{b} \text{ subject to}$$
$$\mathbf{z}^T\mathbf{b} \leq \mathbf{h}^T,$$
$$\mathbf{z} \geq \mathbf{0},$$

and let

$$N_1^{**} \equiv \text{Max } \mathbf{z}^T\mathbf{l} \text{ subject to}$$
$$\mathbf{z}^T\mathbf{C} \leq \mathbf{h}^T,$$
$$\mathbf{z}^T\mathbf{b} \geq X_1^{**},$$
$$\mathbf{z} \geq \mathbf{0}.$$

Obviously, $N_1^{**} \leq N_1^*$ and $X_1^{**} > 0$. X_1^{**} is the maximum output producible with the given technology and the given amounts of the different qualities of land available. Therefore, for $0 \leq N_1 \leq N_1^{**}$ the function is non-decreasing. Thus, for $0 \leq N_1 \leq N_1^{**}$ the system (1) - (8) has a solution and function (11) is the production function used by Pasinetti to represent the production of the corn sector as a whole.

We may conclude that Morishima's proposition, according to which 'there is no simple aggregate production function for agriculture' (1989, p. 103) if land is diversified in quality, cannot be sustained. Hence his criticism of Pasinetti's formulation has to be rejected.

IV. On the 'Natural Wage Rate'

A brief comment should be made on Morishima's discussion of which variables should be regarded as exogenous. In his analysis Morishima considers as given the existing amounts of wage goods and capital goods and the number of workers in the economy. He contends that Pasinetti (1960) takes as given the existing amount of capital and the natural wage rate, defined as the wage rate which keeps population constant, and comments:

> This means that [Pasinetti's] model ... is concerned with an 'open' economy where workers freely emigrate or immigrate so as to keep the real wage rate at a given level. (pp. 51 - 2)

From this Morishima derives a further criticism:

> In the long-run analysis Pasinetti defines the long-run equilibrium as a state where the real wage rate is set at the natural rate and the profits are zero. There is no doubt that Ricardo also has the same definition. But there is a big difference between the models of the two authors. Ricardo's economy is a closed economy, whilst Pasinetti's is open. If Pasinetti had correctly taken the openness of his economy into consideration, that is, if he had not forgotten that workers can freely immigrate or emigrate, he would have seen that the long-run equilibrium real-wages need not be at the natural level, because the wage rate at which the population remains stationary has no relevance in such an 'open' economy. The wage rate can be kept at an arbitrary level even in the long run. (p. 52)

As against this the following may be said. In Pasinetti's analysis two dynamical processes are considered: first a sequence of market equilibria which leads to a

'natural' equilibrium; and second a sequence of 'natural' equilibria which leads to the stationary state equilibrium. It is only in investigating the latter dynamical process that Pasinetti takes as given the natural wage rate. In contradistinction, in investigating the former dynamical process he takes as given the existing amount of capital and the number of workers in the economy.[6] Thus the forces which are envisaged to push the wage rate to a specific level are not immigration or emigration of workers, but those of Malthus's 'law of population'. Therefore, this specific level cannot be different from the natural real wage rate. Hence Morishima sees a fault where there is none.

V. Morishima on Fixed Capital

In this Section we shall comment on Morishima's treatment of fixed capital. He presents in chapter 1 what he considers to be an adequate formalization of Ricardo's view on how relative prices are determined. The price system suggested can be written in our notation as

$$\mathbf{p} = w\mathbf{l} + \boldsymbol{\delta}\mathbf{K}\mathbf{p} + r(w\mathbf{l} + \mathbf{K}\mathbf{p}),$$

where $\mathbf{p}$ is the vector of prices, $\mathbf{K}$ is the matrix of capital coefficients, and $\boldsymbol{\delta}$ is the diagonal matrix 'with the ith diagonal element δ_i being the rate of depreciation of capital good i'. (Morishima, 1989, p. 20; similarly p. 62) The latter assumption is

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6 *The literature following the publication of Pasinetti's formulation has criticized the fact that the second process begins when the first is concluded. Yet Pasinetti was aware of the incompleteness of his analysis: in the third section of the Appendix to his paper he studies the local stability of the stationary state equilibrium when both dynamical processes are considered.*

known as 'depreciation by radioactive decay' or 'depreciation by evaporation' (Hicks) and has frequently been adopted in the literature on capital and growth.[7]

As Garegnani pointed out some time ago in his criticism of Samuelson (1962), who employed the same assumption, '[t]his way of dealing with fixed capital evades the problems specific to *fixed* capital, which are problems of joint production' (1970, p. 409, n. 3; Garegnani's emphasis). A proper treatment of durable capital goods has been provided by Sraffa (1960, chap. X) and the literature following the publication of his book.[8] As is well known, the method of treating what remains of fixed capital goods at the end of the production period as part of the gross output allows the correct calculation of the annual charge on the fixed capital. This charge consists of the payment of profit at the uniform rate and the depreciation that makes possible the replacement of the durable instrument of production when it is worn out. It is shown that the depreciation quotas and thus the prices of ageing fixed capital items cannot be ascertained independently of distribution. Hence, *ad hoc* rules of depreciation such as the one adopted by Morishima cannot generally be sustained.

As Sraffa pointed out, the method of treating fixed capital as a joint product 'fits easily into the classical picture.' He added:

> It was only after Ricardo had brought to light the complications which the use of fixed capital in various proportions brings to the determination of values that the plan in question was resorted to. It was first introduced by Torrens in the course of a criticism of Ricardo's doctrine. ... Thereafter the method was generally adopted, even by the opponents of Torrens's theory: first by Ricardo in the next [i. e. third] edition of his *Principles*. (Sraffa, 1960, pp. 94 - 5)

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7 *It has also been used, for example, by Pasinetti (1973) who called it a 'simplifying assumption.'*

8 *Important contributions in this tradition are collected in Pasinetti (1980), Steedman (1988, vol. II, part I) and Salvadori and Steedman (1990).*

The reference is to a passage in Ricardo, in which the value of corn, which is taken to be produced by unassisted labour, is compared with the value of 'the machine and cloth of the clothier together ... and the machine and cotton goods of the cotton manufacturer' (*Works* I, p. 33).

While Ricardo recognized the possibility of treating fixed capital in terms of the joint production method he did not develop it. However, as numerical examples in the *Principles* indicate, Ricardo knew the annuity formula

$$p_{m0}\frac{r(1+r)^n}{(1+r)^n - 1},$$

where p_{m0} is the price of the new machine, r is the general rate of profits, and n is the life of the machine (cf. *Works* I, pp. 54 - 62). It would, of course, have been most surprising had a highly successful stockbroker, like Ricardo, not known this result. As is well-known, this formula gives the correct annual charge to be paid for interest and depreciation in the special case of a machine operating with constant efficiency throughout its lifetime of n years (cf. Sraffa, 1960, pp. 64 - 6). Ricardo was thus also well aware of the fact that the pattern of depreciation cannot be ascertained independently of income distribution, i. e. the level of the rate of profit.

Hence we may conclude that the method adopted by Morishima cannot be regarded as adequate to deal with the problem of fixed capital and that it is, at any rate, inconsistent with Ricardo's approach.

VI. Morishima on the Standard of Value

Morishima stresses that 'the wage-profit frontier ... plays a most crucial role in the Ricardian economics'; he therefore considers it appropriate to 'carefully examine the various methods of deriving the frontier and discuss their merits and demerits' (1989, p. 28). This is done in chap. 3 of his book. There we read:

> In this sort of analysis, we must clearly define, as Ricardo did, what is taken as the standard of measure of prices and wages. This is Sraffa's problem of standard commodity or the problem of numeraire, which is dealt with significantly differently by Ricardo, Sraffa and myself. (p. 61)

As regards the 'significant differences' alluded to, Morishima points out that his position is similar to the one entertained by Walras, i. e. that any commodity, or any bundle of commodities, could serve as numeraire. He rejects Ricardo's concept of an 'invariable measure of value' on the grounds that 'I do not assume existence of such a commodity because I do not take the labour-value theoretic approach'. (*ibid.*)

Against Sraffa's Standard commodity he objects:

> Whatever terminology and rhetoric are used, the hypothetical character of the standard system is clear. It is doubly hypothetical. First, it neglects the workers' demand for commodities as well as the wage payment [sic!]. Secondly, it assumes that commodities are produced in the fixed proportions necessary for the standard economy to grow at a uniform rate. Such an imaginary state is extremely remote from the actual observed economy, and Sraffa's share *W* [the share of wages], as a proportion of 'the standard net product', has nothing to do with the workers' share in the actual economy. In addition to this, Sraffa's formula [$r = r^*(1-W)$] has a defect in that this real wage rate in terms of the standard commoditiy ... does not accurately reflect the consumers' true 'real

wage rate' in terms of their consumption bundle ... , although there is some parallelism between them. (p. 65)

On the construction of the Standard system he comments: 'Of course in this system too, labour is needed for producing commodities, even though no wage payment is made.' And in parentheses he adds: 'I ignore ... this paradoxical character of the standard system and do not ask whether workers will work without reward. Even slaves would not really work if they were not rewarded, in the form of food at least.' (p. 64)

There are various misconceptions here, some of which are also to be found elsewhere in the literature on Ricardo and Sraffa. Since we have written extensively on the subject (cf. Kurz and Salvadori, 1986, 1987, 1989), a few remarks must suffice.

Clearly, a standard of value or numeraire is chosen by the theorist and does not depend on 'observed facts.' However, some standards have useful properties that can be utilized by the theorist. As is well known, Ricardo's search for an 'invariable measure of value' aimed at rendering precise the properties a standard would have to exhibit[9] in order to answer his concern with (i) intertemporal and interspatial comparisons; and (ii) the impact of changes in distribution on relative prices (see also Pasinetti, 1974, pp. 3 - 4). While the first refers to measurement with respect to *different* technical environments, the second refers to measurement with respect to the *same* technical environment, but a changing distribution of income. Ricardo considered the first property to be fulfilled by a commodity (or a bundle of commodities) used as a standard which 'now and at all times required precisely the

9 *In the Principles Ricardo stresses: 'It is ... of considerable use towards attaining a correct theory, to ascertain what the essential qualities of a standard are, that we may know the causes of the variation in the relative value of commodities, and that we may be enabled to calculate the degree in which they are likely to operate.' (Works I, p. 17 n. 3)*

same quantity of labour to produce it' (*Works* I, p. 17 n. 3). As to the second property, he was of the opinion that the commodity (or the bundle of commodities) used as a standard had to be produced with a proportion of labour to means of production 'which may fairly be considered as the medium between [the] extremes, and as agreeing more nearly with the circumstances under which the greater number of commodities are produced than any other which can be proposed' (*Works* IV, p. 372). There is, however, no reason to presume that there exists a commodity (or a bundle of commodities) which will be produced at all times with a constant amount of (direct and indirect) labour. And even if such a commodity (or bundle of commodities) existed, there would be no reason to presume that it would at all times be the medium between the extremes. Hence Ricardo's search for an 'invariable measure of value' which fulfilled both requirements resembled, as Ricardo became increasingly aware of, the search for a will-o'-the-wisp.

Scrutiny shows that Sraffa in *Production of Commodities by Means of Commodities* (1960) saw only a single analytical purpose for the concept of the Standard commodity elaborated by him: it is conceived as a tool capable of simplifying the study of the effects of changes in the distribution of income on relative prices, given the technical conditions of production. When Sraffa in his book relates the Standard commodity to Ricardo's search for an 'invariable measure of value', this is done explicitly with regard to the second aspect of Ricardo's problem only, whereas the first aspect plays no role whatsoever. What Sraffa has provided is a tool which allows us to say both when Ricardo's problem is solvable (and when it is not), and to construct the solution whenever it exists.[10]

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10 *For a detailed discussion of the role of the Standard commodity in Sraffa's analysis and its relationship to Ricardo's search for an 'invariable measure of value', see Kurz and Salvadori (1989).*

In the literature on Sraffa there is an unfortunate tendency to assign meanings to the Standard commodity other than the one just mentioned. A case in point is Morishima's interpretation quoted above. The Standard commodity was explicitly designed by Sraffa as a numeraire (with useful properties) and just that. If Morishima's objections - that the Standard commodity 'neglects the workers' demand for commodities as well as the wage payment' and that it 'does not accurately reflect the consumers' true "real wage rate" in terms of their consumption bundle' - were to be taken seriously, then they would also have to be applied, for example, to the Walrasian normalization favoured by Morishima (that is, setting the price of any commodity, or any bundle of commodities, equal to one). As will become clear below, the Standard commodity was most certainly *not* designed as a method for measuring 'real wages'. Hence Morishima is worried about an issue that cannot even arise with respect to the standard of value used by Sraffa.

It has been stated in the above that the numeraire chosen by the theorist does not depend on 'observed facts'. It goes without saying that the reverse is also true, i. e. the observed facts do not depend on the numeraire chosen. As Sraffa emphasized, the Standard system is 'a purely auxiliary construction' which 'may give transparency to a system and render visible what was hidden, but ... cannot alter its mathematical properties' (1960, pp. 31 and 23).[11] Hence speculations like that entertained by Morishima - that the construction of the Standard system implies that 'workers will work without reward' - are entirely unwarranted.

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11 *This has not always been properly understood. See, for example, the opinion expressed by Blaug that a change in distribution 'has no effect on relative prices measured in terms of the Standard commodity for the simple reason that the change alters the measuring rod in the same way as it alters the pattern of prices being measured' (1987, p. 436). If this were true, by mere choice of numeraire prices could be made independent of distribution and therefore the choice of numeraire would affect relative prices.*

Since Morishima rejects both Ricardo's measure of value and Sraffa's Standard commodity, it is interesting to see which numeraire he proposes. He favours a bundle of commodities as standard of value which in chapter 1 of his book has been identified as 'the consumption vector at some basic level' (p. 22). He calls the wage rate in terms of units of this bundle 'the real wage rate ω' and the relationship between ω and the rate of profit r the 'wage-profit frontier'. Obviously, Morishima is of the opinion that the latter is in general the only meaningful expression of the constraint binding changes in the distribution of income.

This becomes clear when he confronts the wage-profit frontier with Sraffa's distribution formula. He points out that the two coincide with each other in the case in which the proportion between labour and the means of production is the same in all industries, i. e. the case in which the simple labour theory of value holds. He adds:

> We may now conclude that this is the only case in which Sraffa's formula ... is meaningful; otherwise it deviates from the wage-profit frontier, because of the relative price effects, and is nothing else but a law concerning the *imaginary* 'standard' system. (p. 67; Morishima's emphasis)

This contention is best answered in terms of Sraffa's own argument. Sraffa begins his analysis by assuming that wages consist of the necessary subsistence of workers. Accordingly, *real* wages are given. He then observes that wages, besides the ever-present element of subsistence, may include a share of the surplus. Consequently, the real wage rate can no longer be considered given.[12] Hence, *if* the wage rate were still to be given from outside the system of production, it would have to be 'in terms of a more or less abstract standard, and [would] not acquire a definite meaning until the prices of commodities are determined' (Sraffa, 1960, p.

12 *As Joan Robinson succinctly remarked, 'we could hardly imagine that, when the workers had a surplus to spend on beef, their physical need for wheat was unchanged'. (1961, p. 54)*

33). To start, as Morishima does, from a given and constant composition of the goods bundle consumed by workers simply evades the issue mentioned by Sraffa. Somewhat ironically, of two measures of value neither of which can be said to 'accurately reflect the consumers' true "real wage rate" ' (p. 65), Morishima criticizes the one which has expressly been designed for a different purpose and adopts the one which was indeed meant to accomplish this task, but fails to do so.

Finally, in order to avoid misunderstandings, a comment is in place on Morishima's attempt to restrict the meaningfulness of the Standard system to the case of equal proportions of labour to means of production in all industries. While the Standard system is a *construction* related to a given actual system, equal proportions is an extremely special *assumption* about the actual system. With equal proportions no question would arise whether any particular change in the relative price of a commodity is due to the peculiarities of the commodity which is being measured or those of the measuring standard, since no change in relative prices could occur. Therefore, with equal proportions no problem of a standard of value which is invariable with respect to changes in distribution could arise. Hence, rather than being the only case in which the Standard system is 'meaningful', equal proportions are the only case in which it is meaningless.

We may conclude that Morishima's treatment of the problem of the standard of value is unsatisfactory. His objections against Sraffa's Standard commodity are either wrong or not pertinent because they concern problems to the solution of which the Standard commodity has not been designed by Sraffa. The numeraire adopted by Morishima, on the other hand, fails to accomplish the task ascribed to it by him, i. e. to reflect accurately the 'true "real wage rate" '.

VII. Conclusion

The present paper scrutinizes some of the opinions entertained by Morishima, in his recent book *Ricardo's Economics*, on Ricardo and two major interpreters of Ricardo, Piero Sraffa and Luigi Pasinetti. It is shown that with respect to the issues under consideration Morishima's views cannot be sustained. In particular, it is shown that Morishima's criticism of Pasinetti's utilization of a production function for agriculture as a whole in his 1960 formalization of the Ricardian system is ill-conceived. Given the simplifying assumptions underlying Pasinetti's model, such a production function can be construed by starting from an approach which is in the tradition of Sraffa's analysis of extensive and intensive diminishing returns. Moreover, it is shown that Morishima's treatment of fixed capital is unsatisfactory and that his objections to Sraffa's concept of the Standard commodity are either wrong or not pertinent.

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"The Communist", Feb 1944

AMERICAN CAPITALISM AND TEHERAN

BY GILBERT GREEN

IT WAS Stalin who said that there are two schools of Marxism—the school of dogmatic Marxism, and the school of creative Marxism. Comrade Browder has given us a brilliant example of creative Marxism in action. His penetrating analysis of the profound changes that have occurred brings to mind the prophetic thought of Lenin that history is always richer in content, more varied, and more subtle, than the best parties can possibly imagine, because the best vanguards express the consciousness, the will and the imagination of tens of thousands; but history is made by the consciousness, the will and the imagination of tens of millions.

When has this been more true than today—when tens of millions are making history on the field of battle alone?

It seems to me that in our approach to the period ahead we must avoid two dangers. First, the failure to comprehend the deep-going character of the changes that have occurred; the tendency to stick to old shibboleths; the fear of drawing new practical and theoretical conclusions from the new phenomena of our time. On the other hand, we must avoid the tendency that may arise to improvise answers based upon wishful thinking. We are duty-bound to keep our feet more firmly planted on the soil of solid facts than ever before.

Capitalism remains capitalism. Imperialism remains imperialism. Socialism remains socialism. But one would indeed be blind not to see that each of these must operate today under new and more complex conditions and in an ever changing world—must therefore operate in new ways.

I want to discuss a few of the new conditions under which American imperialism must operate and their relation to the basic perspectives outlined by Comrade Browder.

The war has brought about a tremendous acceleration of the concentration of production and capital; has thereby greatly strengthened the relative weight and dominant role of monopoly capital in American economic life. This fact is hardly disputable. But it is a mistake to draw the conclusion from this that monopoly capital is emerging from the war with a greater freedom of movement than in the past.

Let me give an example. We know that monopoly capital tends to restrict economic development, and that this tendency toward economic stagnation becomes most pro-

nounced in the epoch of the general decline of capitalism.* Yet, what has actually happened? The powerful impact of the war, the development of a war economy, has not only radically arrested this development, it has for the time being reversed it. Total production leaped from the Federal Reserve Board index figure of 108 in 1939 to that of 245 for November, 1943. This represents the most rapid industrial expansion in any period of American history!

We have literally witnessed an upsurge in production; brand new industries have been built; new technological changes introduced; and many new scientific inventions long suppressed by monopoly capital successfully employed.**

Of course, we know that this was brought about by the exigencies of the war, by the incentives of an unlimited market and because this expansion was not dependent upon the investments of private risk capital, but accomplished through outright large-scale government investments in industrial plants.*** But the fact nonetheless remains that this great industrial expansion has taken place and that this has a most direct bearing on the problems and perspectives for the post-war world.

In the pre-war period both government and big business spokesmen developed the pet theory that American industry had been over-developed,* that the year 1929 with its national income of $82 billion represented a high peak hardly to be reached again and never to be surpassed.

Today, however, nearly every spokesman for government and business underlines the point that America's normal post-war income and production must be considerably higher than 1929, in fact, that America dare not go below a national yearly income of $100 billion.**

There are two basic reasons for this change of tune. The first is a hard economic law: the tendency of the declining rate of profit. Modern large-scale industry with its tremendous investments in fixed capital, with its enormous overhead, must utilize more than 50 per cent of capacity in order to operate profitably, and the greater the de-

* From 1860 to 1880, American production increased by 113 per cent; and from 1890 to 1913, by 156 per cent. However, from 1913 to 1929, the rate of increase declined sharply to but 70 per cent and from 1929 to 1932 there was no increase but an *absolute* decline in production of 46 per cent! For an entire decade after 1929 there was no general rise in production as compared with the period immediately prior to it. (From "New Data on Lenin's Imperialism" by Varga and Mendelsohn.)

** A case in point is the jet-propulsion plane which while invented in 1930 was not given a fair trial until the war and now is being proven so successful as may revolutionize the entire aviation industry in the next decade.

*** In a speech delivered on July 21, 1943, Jesse Jones estimated that the government had spent "probably 25 billion dollars in building plants and facilities of one kind or another. The title to most of these properties is in the hands of the government."

* This view was shared by Franklin D. Roosevelt, who, speaking in San Francisco during his 1932 Presidential campaign, stated: "Our industry is already built up. It is a question whether it has not been built up too much. Whoever wants to build new factories and new streets, and to organize new trusts, would be more of a hindrance than a help to us. The days of the great initiators, of the finance titans are gone. Our task is not to find and exploit new material wealth, and not to produce a still greater quantity of commodities, but to learn how to carry on with the existing resources and the existing factories."

** The economic staff of the *United States News* in the issue of December 17, 1943, believes that "the national income in the post-war period is likely to hover around $112,000,000,000." But it points out that this is not good enough as it would represent a "depression compared with war standards, but prosperity compared with pre-war standards."

gree of capacity in use, the higher the rate of profit.* The wartime industrial expansion, therefore, makes more difficult a return to pre-war production levels, for these would no longer be high enough to insure large profits.

The second reason is a political one. Even the most optimistic observers admit that there has taken place such a revolution in production technique and labor productivity, that merely to return to the 1929 production level is to guarantee a permanent army of at least 18,000,000 unemployed.** These observers also admit that the American people will not accept that kind of post-war America. The people will insist that what could be done for war can also be done for peace.***

What are the material possibilities for the realization of the post-war goal of higher production levels? There will, of course, be a considerable backlog of purchasing power in the form of war bonds and savings estimated to total from $100 to $130 billion by the end of the war. Furthermore, there will be a period of reconversion, reconstruction and repair, lasting a few years and requiring considerable outlays of capital. But while both of these factors will undoubtedly give a stimulus to production in the first period after the war, they are not in themselves potent enough to provide a large enough market over a number of years.

Whether higher production levels are possible for any length of time after the war depends greatly upon the creation of a larger foreign market for American goods than at any previous period in our history. And this foreign market is available. The reconstruction of first Europe and then the Far East will create a ready market for American industrial and agricultural commodities for many years and alongside of this America will be in a most advantageous position to meet the increased needs of the Latin-American market.

But this in turn poses another very difficult problem. War-torn Europe and Asia will be in no financial position to buy large quantities of American goods unless American capital stands prepared to finance these purchases for a considerable period of time. This will require a great export of capital—

* With a fall in the national income from $82,000,000,000 in 1929 to $69,000,000,000 in 1930, there was a fall in the rate of profit from 7.5 per cent in 1929 to 1.7 per cent in 1930. With a further fall in national income and production for the years 1931, 1932, and 1933, there was a *minus* rate of profit for these three years, *i.e.*, industry operated at a loss. (From *Statistical Abstract* of the Department of Commerce, and Louis Corey's *Decline of American Capitalism.*)

** The output per man hour increased 11 per cent from 1939 to 1942. In the aircraft industry there was an estimated increase in labor productivity of 50 per cent in the 18-month period ending April, 1943. (From *Economic Notes*, Labor Research Association, October, 1943.)

Dr. Alvin H. Hansen, of the Federal Reserve Board, believes that this country can maintain a 1929 production level with from 18 to 19 million permanently unemployed.

*** Another factor to be considered is the fear of certain business circles that the failure to bring about full employment in the post-war period may in turn bring about a great public clamor for direct government operation of the some 1500 new industrial plants owned outright by the government. They prefer to own and operate these plants themselves.

Of interest also is the fear expressed that unless American capitalism ensures full employment the people may make invidious comparisons between the American and Soviet economic systems. The *United States News* of September 3, 1943, states: "Russia can keep full employment, with government running everything. U. S. and Britain may face serious post-war unemployment problems." And it concludes: "The concern is that Russia's example may influence the populations of Europe. . . ."

a period of large-scale foreign investments.*

Lenin, in his classical work on imperialism, pointed to the new significance attained by the export of capital and established this as one of the basic characteristics of imperialism. And yet, since the last world war the rate of export of capital on the part of world imperialism has steadily fallen and since 1930 the normal export of capital has ceased entirely. In 1929, America's direct investments abroad totaled some $7½ billion, but by 1940 this had declined to $7 billion. In 1930, America's indirect investments abroad totaled more than $8 billion. But by 1935 the value of these investments had declined to less than $5 billion.

What is the basic reason for this relative and absolute decline in investments abroad? It cannot be explained by any lack of idle capital; there were ample quantities seeking outlets for increased profits. Nor can it be explained by any lessening in the role of foreign investments as a means of obtaining and holding spheres of influence and new markets.

It is to be explained mainly by a political factor! *The unstable state of world relations* which tended to transform investments abroad from a sure source of super-profits into a rather precarious undertaking. What were the factors contributing to this unstable state of world relations?

In the first place the Russian Revolution, which not only removed one-sixth of the earth from imperialist exploitation, but also expropriated the imperialist enterprises. The second was the awakening of the colonial millions—the Chinese Revolution, the marked tendencies in Latin America to curb the most ruthless features of imperialist exploitation, as well as, in the case of Mexico, the outright expropriation of major imperialist holdings. All this caused concern for the safety of investments in the backward countries and removed the incentive to make new investments.

A third factor was the reneging of nearly all European countries on their war and post-war debts and the great depreciation in the value and income from foreign investments that followed the world capitalist economic crisis.

And, lastly, was the rise of German fascism and Japanese militarism, the drift toward a new world war and the subjugation and colonization of most of the European nations by German imperialism and most of the Far East by Japan.

If these are the reasons for the decline in foreign investments, what are the prospects for the post-war period, especially if we bear in mind that, without these investments and loans, a much larger foreign mar-

* S. Morris Livingston, head of the National Economics Unit of the Bureau of Foreign and Domestic Commerce, in a report for the Department of Commerce, sees foreign sales of food, clothing and industrial equipment at huge volumes after the war—"provided means of paying for them can be arranged."

The *United States News* of October 1, 1943 writes: "They [American post-war planners] cannot see investment outlets inside this country that will absorb savings that now run between $20 billion and $30 billion a year. It is expected that some machinery will have to be devised to guide an important proportion of those savings into fields of foreign investment."

ket for the period ahead is out of the question?

There is only one way by which this problem can be met by American capitalism, and that is by helping to bring into being a degree of world stability.* But this can be achieved only by the establishment of a new equilibrium based upon the new relationship of world forces.

The old "stability" was based upon the imperialist domination of the earth. It was this kind of "stability" that world imperialism sought to re-establish for nearly a quarter of a century. It was for this that American and British finance capital helped bring Hitler to power, armed him and appeased him, with the hope of thereby destroying the Soviet Union, which to them represented the fountainhead of world instability.

But such a "return to normalcy" is no longer possible. To continue to pursue this will-'o-the-wisp is to toy with disaster, for it will bring the very opposite results, as has been so graphically proven by the whole recent course of world events. Any stability that is to be established in world relations after this war can only be based upon the recognition of the new world reality: on the continued existence and ever-growing strength of the Soviet Union; on a democratic Europe; on a greater freedom and independence for the colonial and semi-colonial peoples throughout the world; and on the maintenance of the Anglo-Soviet-American coalition as a pre-condition for a durable and lasting peace. Without this there can be no stability and without a degree of stability American capitalism cannot solve its economic problems by peaceful means.*

This in essence is the greater significance of Teheran and why Teheran does represent the complete negation of the bankrupt Munich policy and ushers in an entirely new perspective for world humanity.

Of course, this perspective is not yet realized and cannot be realized without struggle. There are powerful forces in this country that will oppose it, even though the opposite course can lead only to disaster, to America striving to replace German imperialism in the struggle for complete world domination. And the most reactionary sections of American imperialism have far less chance of achieving that objective than had Hitler. Teheran represents the only intelligent course that America can pursue, and its perspective can be realized because it represents not only the interests of the wide masses of the people who want a durable and lasting peace and a greater degree of security, but the interests of American capitalism as well.

* "It is highly doubtful if this country is to finance large-scale projects in other parts of the world that do not promise at least a fair chance of paying out." (From *United States News*, October 8, 1943.)

* On a much more limited scale American capitalism in the past decade has had to take into account the changed conditions in Latin America; had to aim at bringing about a hemispheric unity based upon a new relationship of forces. It was the effects of the economic crisis in the United States, the need for increased foreign markets, plus the threat of fascist penetration in Latin America that brought about the discarding of the old bad-neighbor policy, under which marines followed the dollar and Wall Street puppet governments followed the marines, and its substitution with a more realistic good-neighbor policy. Some of the failures of U. S.-Latin American policy since then have not been a result of the good-neighbor policy but a consequence of the failure to apply this policy consistently.

GEORGE WASHINGTON—PATRIOT AND STATESMAN

BY CARL ROSS

AMERICA this year commemorates the anniversary of George Washington's birth at a moment when our nation is engaged in working out its destiny along the path charted by the Moscow-Cairo-Teheran Conferences. Our nation must choose the path of collaboration with all democratic peace-loving peoples as projected at Teheran, a policy upon which we can also construct enduring national unity, or we shall face the alternative of national catastrophe. This is for us the single, dominant issue determining everything else.

In commemorating Washington's birthday, by drawing inspiration and guidance from the leadership of Washington during the founding years of our nation, we can help today to unite the overwhelming majority of the American people around the only policy that can truly serve our national interest—the policy of Teheran. The enemies of Teheran include among their number those who have helped to weave a reactionary legend about the great figure of the Father of our Country, presenting him to the American people as the symbol of "isolationism" and his Farewell Address as its bible. Our modern reactionaries and Tories invoke the name of Washington and the abstract slogan of "no entangling alliances" to conceal their reactionary and defeatist policies under the mask of patriotism.

It is time, in the interest of a sound policy of national unity and a sound foreign policy, to unmask once and for all these false conceptions of George Washington and to put in their place the real Washington who symbolized, above everything else, the national unity of early revolutionary democratic America and who helped to construct the foundations of our American foreign policy.

* * *

George Washington was an architect of the foreign policy best represented by such figures as Jefferson, Paine and Franklin. He was not only a military leader chosen to head the Colonial armies because of his proven ability as a soldier, but was a patriotic statesman of the first order. Declaring for the unconditional independence of the United States from Great Britain a full year before the signing of the Declaration of Independence, Washington also predicted the necessity for, and the consummation of, the alliance with France long before its

Anu,

This article by G. Green was written right after the Teheran Conference, and was published in "The Communist", Feb, 1944.

He tries to explain the existing problems and perspectives, and in some of the footnotes he refers to the growth rate and rate of profit.

Massoud

MURRAY F. FOSS

in US Bureau of Foreign & Domestic Commerce - Survey of Current Business V. 43 1963

The Utilization of Capital Equipment:

Postwar Compared With Prewar

INCREASES in output per unit of input over the long run have been attributed to many factors, such as the increased skill and education of labor, the increase in management knowledge, and the greater efficiency of new and existing machines resulting from technological and scientific advances. One element of importance which is related in part to some of the above factors has been the more intensive utilization of capital equipment in the postwar period as compared with prewar. This article is concerned with the measurement and significance of changes in hours worked by machinery and equipment in some major sectors of the American economy over this period.

This particular problem has received relatively little attention as a subject for serious investigation.[1] The topic is of particular interest at present in view of the recent appearance of major theoretical and statistical studies in this general area. The analysis and results in this article should be viewed as exploratory in character since at this time the basic data required for a definitive study are rather limited.

Most of this study deals with hours worked per annum by equipment in manufacturing, in particular, with changes from 1929 to the mid-1950's. It finds that for the bulk of equipment in this important industry division there has been an increase on the order of one-third to one-half in the utilization rate over this period. No attempt has been made to present similar estimates for the entire stock of fixed capital although the manufacturing experience is by no means unique: the upward shift in equipment utilization has appeared in other industries which have been examined, whether or not their capital stock is growing or declining.

An average unit of generating equipment in electric utilities in the mid-1950's worked about 60 percent more hours per year than in the decade of the 1920's. In mining, exclusive of petroleum, an average unit of machinery driven by electric motors worked about one-fifth more hours in 1955–57 than in 1929. While there has been no change in relative freight car use over this period, each locomotive in freight service is working about 20 percent more hours, and locomotives in passenger service, which have undergone a drastic decline in numbers, are working about two-thirds more hours per unit per year than they did in the 1920's. In general, the shift away from railroads toward trucking and pipelines has been one in which capital is used with greater intensity.

A comparison of the 1920's, particularly 1929, with the mid-1950's is considered to be a valid one in analyzing long-run changes; both were periods of high output and high relative resource utilization. To the extent that 1929 may differ from 1955 for cyclical reasons, however, some of the long-run change in equipment hours presented here may be overstated.

It has not been possible to demonstrate why these increases in relative equipment use have come about or to quantify the factors underlying the apparent changes, but a few reasons can at least be suggested. For one thing, there has been a definite tendency toward multiple-shift operations[2]—a development that may have been stimulated to some extent by the premium-pay-for-overtime provisions instituted by the Fair Labor Standards Act of 1938 and even by the NRA. The World War II experience must have constituted a powerful stimulus to multiple shifting and it is reasonable to assume that the experience acquired by many firms during the war with two- and three-shift operations was carried over into the postwar years of high-level demand. In fact, some of the illustrations used in this article suggest that the major change in relative equipment utilization took place during and immediately after World War II, and that changes since then (aside from cyclical movements) have been relatively small.

Also of importance over the long-run has been the advance in knowledge acquired by management in making more efficient use of machines. One example of this has been the efforts by many firms to smooth out within the year the production peaks which come from seasonal or other short-lived peak loads and which frequently entail the use of standby equipment with relatively low annual utilization. The success of the electric utilities in making more intensive use of capacity needed for peak loads—referred to further on—has been outstanding. Moreover, it is probably safe to say that over the long run, there has been a relative reduction in "downtime" for equipment repairs. The diesel locomotive is an excellent example of an innovation that has been successful in no small measure because

1. See Robert M. Solow, "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, August 1957; Edward F. Denison, "The Sources of Economic Growth in the United States" (Committee for Economic Development 1962) p. 97. Charles L. Schultze in "Some Effects of Changes in Working Hours on Investment, Output and Real Wages," a paper presented in September 1962 at the American Statistical Association meetings in Detroit, dealt with this problem mainly in terms of changes in multiple-shifting since the turn of the century.

2. As suggested, for example, by William Fellner in *Trends and Cycles in Economic Activity*, New York, 1956, page 92.

it has required relatively less time-out for repairs and has thus increased the available working time for locomotives.

Within particular industries there have undoubtedly been efforts to introduce continuous, automatic operations in which machines tend to be used with a high degree of intensity. Moreover, there has probably been a change in product mix toward industries in which continuous operations are important—aluminum, refined petroleum, chemicals, and electric power are important examples that may be cited.

Significance of findings

What significance can be attached to the increase in hours worked by equipment? First of all, it is important to keep in mind a few of the major findings that have emerged from recent studies of productivity and economic growth. Total output, it has been found, has risen at a faster rate than has the weighted total of factor inputs.[3] Although measured in various ways, in all cases this residual portion of growth—in "total factor productivity" or output per unit of input—has been very substantial and a quantitative explanation of the many and varied sources which may account for it is difficult.[4] Furthermore, as it has been measured in the framework of such studies, the contribution of the growth of fixed capital to the increase in total output has been found to be of relatively small magnitude.

Against this background, a rise in equipment hours per year from prewar to postwar may be viewed in two ways. On the one hand, it might signify that the contribution of fixed capital to long-run output growth is greater (and productivity correspondingly less) than has been calculated in previous investigations. This is because characteristically the changes in the input of fixed capital have been measured by the real volume of capital in place, without adjustment for changes in intensity of use.

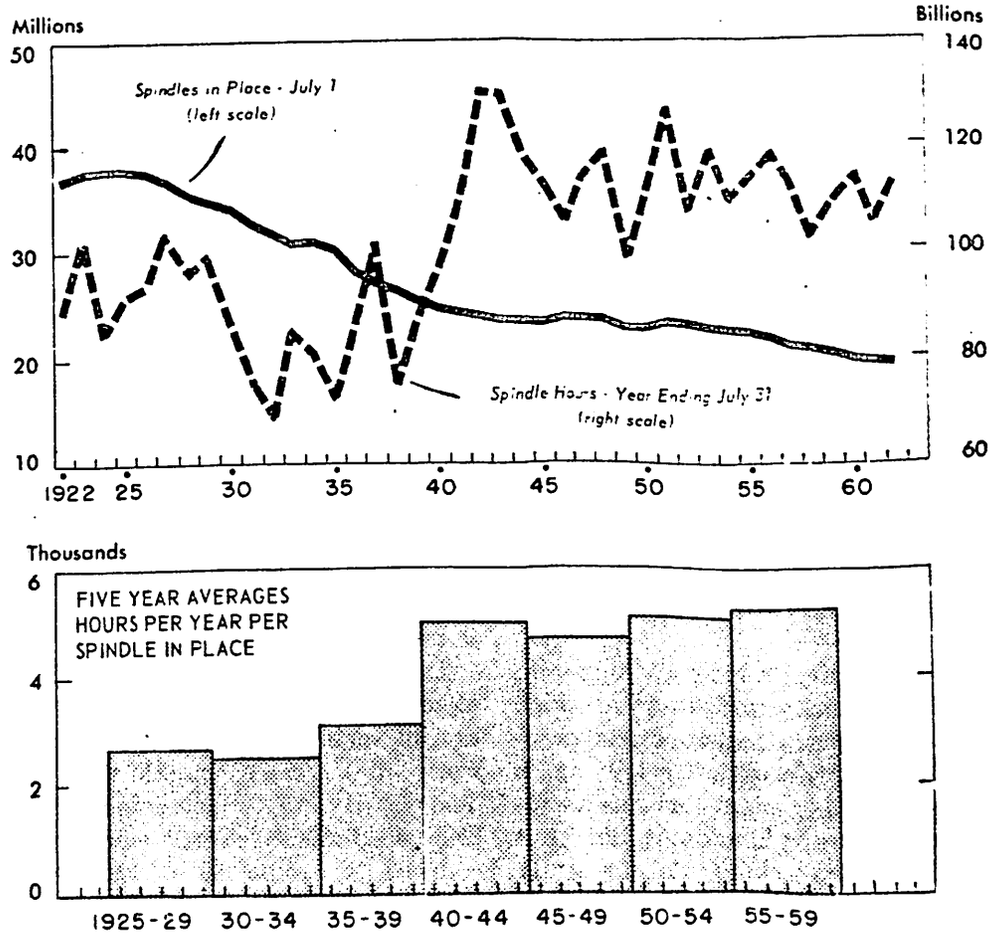
An adjustment for capital's contribution, due to increased equipment-hours worked per year, would be analogous to the adjustment of the labor input—number of persons employed—for changes in labor-hours per year. Possibly not all of the increased equipment-hours should be so handled but that part attributable to the advance in multiple-shift operations would seem to warrant such treatment.

According to the second view, the advance in hours worked by equipment should not be considered as an increase in the input of capital, which is better measured by capital in place. Instead, it should be looked at as the result (measurable in part) of certain forces that have contributed to a rise in total factor productivity over time: the advances in management efficiency, for example, that have grown out of the experience gained from working with machinery, and from engineering studies within the plant; and the gains from science and research as "embodied" in new machines of advanced technology. It may be that the first of these elements—the "advance in management knowledge"—bulks large as an explanatory factor in the increase in equipment hours since one of the focal points of management has been the reduction of idle equipment time. But increased management knowledge provides only part of the answer since it is likely that many of the new technologies incorporated in modern machinery go hand in hand with longer hours for equipment; this seems to be a distinguishing characteristic of many new processes that are labeled "continuous."

With capital input measured by stock of capital in place, a lengthening of

COTTON SPINDLES

Long Run Decline in Spindles in Place
Rise in Total Spindle Hours Since the 1920's Reflects Step-Up in Annual Hours Per Spindle



Basic data: Census

U.S. Department of Commerce, Office of Business Economics

63-6-4

3. See, for example, John W. Kendrick, "Productivity Trends in the United States," National Bureau of Economic Research, Princeton, 1961.

4. See Denison's study for a comprehensive analysis of the sources of U.S. growth.

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equipment hours per year is clearly a development of a capital-saving nature. In this connection, this shift may be a partial explanation for the observed decline in capital-output ratios from 1929 to 1955.

The pages that follow discuss in detail the basic data used to demonstrate changes in equipment hours per year in manufacturing and mining, and in a few other industries for which statistics pertaining to some important types of equipment were readily available.

Manufacturing

Labor hours of work per year have shown a fairly steady decline since the latter part of the 19th century; from 1909 to 1957 they declined from about 2,700 hours per annum to less than 2,100 hours. In manufacturing they fell from 44 to 40 per week from the 1920's to date. But hours of labor do not necessarily provide a reliable indication of machinery-hours. In principle, a 40-hour week for labor can be consistent with 40, 80, or 120 hours a week for a machine, depending on whether 1, 2, or 3, 40-hour shifts are employed.

To illustrate the use of machine-hours data, we can look at the cotton textile industry, from which the Bureau of the Census has been collecting monthly statistics on the number of cotton spinning spindles in place and the number of spindle-hours operated for approximately the past 40 years. For this type of equipment there was a 37 percent decline in the number of spindles in place from 1929 to 1956, but an 88 percent increase in hours worked per spindle in place and thus an 18 percent increase in the total number of spindle-hours worked. The basic trends are illustrated in the chart on page 9.

As a practical matter, a long-term series on capacity utilization, in which shift operations, down-time and product-mix changes were treated on a consistent basis, might serve as an index of equipment hours over time, but such figures are lacking though recently several capacity-use series for the post-war period have been published for manufacturing. It should be kept in mind that statistical measures of capacity utilization and of equipment utilization are not necessarily identical. An equipment utilization measure should merely reflect changes in hours per machine and should be independent of the complications which may possibly be introduced by changes over time in output per machine-hour.

Electric motors and electric power consumption

Although comprehensive data on machine hours for overall manufacturing are lacking, there is a body of statistics for manufacturing and mining which may yield what is needed, namely, the statistics on power equipment and on electricity consumption from the Census of Manufactures and the Census of Mineral Industries. Very briefly, the statistics provide the basis for estimates of hours worked by electric motors and thus hours worked by machinery driven by such motors, which have been the dominant source of power in American industry for many years.

For the years 1939 and 1954 Census statistics are available for each industry on the number and aggregate horsepower of electric motors in place at the end of each year; also given is aggregate electric power consumption—for all purposes—within the year, measured in kilowatt-hours. Statistics on horsepower of electric motors in place have also been published for 1929 but the electric power consumption on a detailed industry basis is confined to purchased power, as distinct from power generated in the manufacturing plant. Overall estimates of total power consumption in manufacturing, with a breakdown by broad industrial groups are obtainable, however, from other sources.

Attention is focused on electric motors because of the dominant position of such equipment as a source of work in American manufacturing industry. By 1929, according to the Census Bureau, electric motors accounted for some 80 percent of all mechanical work done in factories. The remaining 20 percent was accounted for by "prime movers" such as steam engines and turbines, gasoline engines and water wheels—which were directly connected to machines. By 1954 the electric motor ratio had risen to approximately 88 percent. If we can find out how intensively the motors were worked we should have an approximation of the intensity with which the machinery driven by the motors has been operated.

Electricity is consumed in factories for four major purposes: (1) for lighting, (2) for driving motors, (3) as a raw material in electro-chemical processes such as primary aluminum manufacturing, (4) for heating, as in heat-treatment furnaces. There are other miscellaneous uses such as welding, hand tools, measuring instruments, etc., which in aggregate are much less important than any of those shown above.

While a breakdown of power consumption in these uses for the years 1929, 1939, and 1954 is lacking, the

Table 1.—Industrial Electric Power: Distribution of Electric Energy by Major Uses, by Industry, 1945

Industry	Lighting	Motors	Electrolytic cells	Electric furnace	Other
	Manufacturing				
Food	10.6	87.3	1.6	(*)	0.5
Tobacco	14.8	84.3	.3	.....	.6
Textiles	9.8	89.4	(*)	0.2	.6
Apparel	34.3	64.6	.....	.....	1.1
Lumber	12.3	85.4	(*)	.....	2.2
Furniture	12.2	85.8	(*)	.3	1.8
Paper	3.9	93.1	2.2	.2	.6
Printing and publishing	20.2	75.0	.5	2.1	2.3
Chemicals	4.5	44.7	21.9	27.9	1.0
Petroleum and coal	5.6	93.7	(*)	(*)	.7
Rubber	12.1	87.5	(*)	.2	.2
Leather	15.2	84.1	(*)	.1	.6
Stone, clay, and glass	6.2	88.0	.1	4.4	1.3
Iron and steel	7.2	72.0	.4	18.7	1.7
Nonferrous metals	2.5	29.2	61.3	14.6	1.3
Electrical machinery	19.0	42.6	1.9	30.1	6.4
Machinery	19.8	59.2	.5	14.3	6.2
Automobiles	19.4	68.0	.2	7.3	5.1
Transportation equipment	27.0	46.6	.2	9.4	16.7
Miscellaneous products	18.4	73.0	.2	5.1	3.2
	Extracting				
Metal mining	2.8	96.6	(*)	(*)	0.5
Coal mining	4.2	92.1	0.2	(*)	3.5
Nonmetallic mining	4.7	95.0	.....	(*)	.3
Petroleum and natural gas	8.1	91.1	.1	.....	1.6

*Negligible amount, less than 0.05%.

Source: Taken from Federal Power Commission, "Industrial Electric Power in the United States, 1939-46" (F.P.C. S-46, Table H, p. X1).

Federal Power Commission conducted a fairly comprehensive survey covering the year 1945, which provides such a breakdown on a 2-digit industry basis. This study, combined with the Census data on motors in place and aggregate power consumed in each industry, provides the basic information for manufacturing. The statistics from the FPC study are shown in table 1.

The figures for a single year—1954—are considered first by way of background, although the main emphasis of this article is on change rather than on level. These calculations indicate that an average unit of electric-motor-driven machinery, measured by horsepower, was operated about 35 hours a week in that year. The computations used to derive this result are shown in the right-hand column of table 2.

Given the horsepower of electric motors in place at the end of 1954 (line 1), the first step was to assume that each electric motor could work continuously throughout the year—that is, 8,760 hours; this number times horsepower of motors in place gives total horsepower-hours of motors available in a year (line 2). The fact that such a theoretical maximum could never be attained in practice is irrelevant for the purpose at hand. Horsepower-hours were then converted to kilowatt-hours; in work measurement, 1 horsepower-hour =0.746 kilowatt-hours. The results of these calculations were adjusted upward by dividing through by 0.9, since modern electric motors have an efficiency of approximately 90 percent, that is, about 10 percent of power input into the motor is dissipated in the form of heat.[5] These calculations (line 3) give a theoretical maximum per year, measured in kilowatt-hours, against which actual kilowatt-hours of electricity consumed can be measured.

The proportion of power used for electric motors in all manufacturing (line 5) was then derived by applying the 1945 proportions of power for electric motor use, as given in table 1, to total power consumed in 1954 in each 2-digit industry, as shown in the Census of Manufactures. From this procedure, it was found that electric motors accounted for 64.6 percent of total power consumption in manufacturing in 1954, or 142.7 billion kilowatt-hours. Dividing this total by kilowatt-hours of motors in place in 1954—assuming year-round operation—indicates a utilization rate of 20.9 percent. This is the equivalent of 0.88 forty-hour shifts—since there are 4.2 forty-hour shifts in a full week of 168 hours.

Stock of capital is characteristically measured in constant dollars and in combining the utilization rates for industries, or for different machines within a plant, or plants within an industry, constant dollar weights should be used rather than horsepower. Horsepower may be justified as a basis for weighting, however, on the ground that there is probably a fairly good positive correlation between the horsepower of a machine and its dollar cost. In this paper no attempt was made to combine industries conceptually more appropriate through the constant dollar weights.

Cross-sectional results

Similar calculations were also run for each of the 4-digit industries shown in the 1954 Census of Manufactures. In doing this, we were limited by the data shown in table 1, so that it was necessary to use 2-digit industry factors on power consumed by motors for all 4-digit industries within a given 2-digit group. While this procedure introduced an element of error, the broad cross-sectional results are nonetheless of interest. If the figures have any significance at all, they should yield percentages well under 100—or 4.2 40-hour shifts—and should not exceed these maximum limits. Out of almost 400 industries for which calculations could be made for the year 1954, there were almost no industries in which completely impossible results were obtained from this simple calculation. The exceptional cases included primary aluminum, for example, where electricity is used as a raw material in an electrochemical process, and where a small error in the motor ratio could seriously bias the results. There was only one small industry which could not be be explained in this fashion.

In the mild recession year of 1954, the unweighted average number of 40-hour shifts for 397 industries turned out to be 0.90, or 36 hours per week. For durables, the ratio was 0.74 (30 hours), while for nondurable goods industries the ratio was 1.12 (45 hours). Partly this difference reflects the fact that durable goods were relatively depressed in 1954, and partly the fact that in nondurables continuous operations are more common than in durables. Relatively higher ratios were obtained for industries like petroleum, paper, cement, glass, cotton and rayon textiles, and hosiery, and relatively low ratios for the metal fabricating and machinery industries generally, which characteristically work far below full operations, and for seasonal industries such as fruit and vegetable canning.

Table 2.—Horsepower of Electric Motors, Power Consumption by Electric Motors, and Relative Utilization of Motors, Manufacturing, 1929, 1939, and 1954

	Unit	1929	1939	1954
(1) Horsepower of electric motors, total	Thousand horsepower	33,844	44,827	94,116
(2) Horsepower hours assuming year-round operation (line (1)×8,760)	Millions	296,473	392,685	824,456
(3) Kilowatt-hours of motors (line 2×0.746)÷0.9[1]	Billions of kilowatt-hours	245.8	325.4	683.3
(4) Electric power actually consumed, all purposes	Billions of kilowatt-hours	55.1	70.5	221.1
(5) Percent of power used for electric motors		71.1	70.1	64.6
(6) Power consumed by motors (line 4×line 5)	Billions of kilowatt-hours	39.2	49.4	142.7
(7) Percent utilization (line 6÷line 3)×100		15.9	15.2	20.9
(8) Number of equivalent 40-hour weeks (line 7×4.2)÷100		.668	.638	.878

1. The 0.9 adjustment was made to take account of the efficiency of electric motors and thus provide comparability with the power consumption data.

Sources: (1) Table 1, Horsepower of Power Equipment Used in Manufacturing Industries: 1954 and Earlier Years, Bureau of the Census, *1954 Census of Manufactures*, Volume I, Summary Statistics, p. 207-2.

The 1954 horsepower figure includes an upward adjustment of 2½ percent to allow for fractional horsepower motors, which had been included in the earlier years but omitted from the 1954 Census. The Census had characterized this omission as "insignificant" for the overall totals. The 2½ percent figure was based on a British Census of Manufactures for 1951 which showed fractional horsepower motors to represent 2.4 percent of all electric motors, measured in horsepower.

(4) 1939 and 1954—Table 4A, Fuels and Electric Energy Used in the Manufacturing Industries: 1954 and Earlier Years, *1954 Census of Manufactures*, Vol. I, p. 208-3. The 1954 Census total (247.7) was reduced by consumption of electric power for nuclear energy (=26.6 billion) as shown in Series S81-95 of Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957*, p. 511. The 1929 total for manufacturing is taken from this latter table.

5. The adjustment could also have been made by reducing the power consumption (see below) by 10 percent.

Changes over time

The measurement of the change in the utilization rate over time poses many difficulties. The earliest manufacturing figures refer to the year 1929. In that year the Census of Manufactures collected figures on horsepower of electric motors by detailed industry and type of motor (using purchased as against plant produced power). The information on power consumption, as noted earlier, was limited to purchased power only, that is, statistics were not collected on electric power produced and consumed in each industry. However, for many years the Federal Power Commission has obtained from industrial concerns reports on power produced by the plants themselves. These reports, plus the Census data, provided the basis for an estimate by FPC of power consumed for all manufacturing plants, together with a breakdown into three broad groups consuming large amounts of power: chemicals and paper; primary metals; and all other manufacturing.[6]

Within each of these groups a weighted percentage of power used for motors was obtained. For this calculation the percentages used were those for 2-digit industries shown in table 1. The weights used to combine industries were estimated total power consumption by 2-digit industry. To obtain estimates of total power consumed in each 2-digit industry the assumption was made that power consumed by motors run by plant-produced power stood in the same ratio to the horsepower of such motors as purchased power was relative to motors run by purchased power. It is not likely that a serious error has been introduced into the 1929 figures by the weighting procedure.

The summary figures for manufacturing for 1929, 1939 and 1954 are shown in table 2. It may be noted on line 5 that the proportion of total power devoted to motors was less in 1954 than in either 1929 or 1939. This is because the motor ratio is smaller in durable goods manufacturing than in nondurables, and because durables were higher relative to nondurables in 1954 than in either 1929 or 1939.

6. The estimates are shown in *Historical Statistics of the United States, Colonial Times to 1957* (p. 511).

The utilization figure (either line 7 or 8) is markedly higher in 1954 than in either of the other 2 years: the 1954 ratio is 31 percent above 1929 and 38 percent above 1939. However, since 1954 was a recession year it is appropriate in any comparison with 1929 to extend the calculations to the year 1955, which was one of relatively full employment. The year 1929 was clearly one of very high output for manufacturing even though output started to move down in the second half of the year. Some reduction in capacity utilization was beginning to develop in 1929 although, according to The Brookings Institution, output for the year as a whole was estimated to be approximately 83 percent of "practical capacity"—a figure considered to be relatively high.[7]

Table 3.—Electric Motors, Power Consumption and Utilization Rate, All Manufacturing Industries Excluding Primary Metals, Chemicals, and Paper

	Unit	1929	1954
(1) Horsepower of electric motors.	Millions of horsepower.	20.9	52.1
(2) Kw.-hr. of motors available.[1]	Billions of kilowatt-hours.	151.7	378.2
(3) Total electric power consumed.	....do....	26.6	97.1
(4) Percent of total power consumed by motors.	Percent....	80.6	76.8
(5) Power consumed by motors.	Billions of kilowatt-hours.	21.4	74.6
(6) Percent utilization (5)÷(2).	Percent....	14.1	19.7
(7) Equivalent 40-hour weeks.	....	.59	.83

1. Includes constant adjustment for motor efficiency. See footnote (1) of table 2.

Source: U.S. Department of Commerce, Office of Business Economics.

Through the use of power consumption data for 1955 by 2-digit industries from the *Annual Survey of Manufactures* and the motor percentages shown in table 1, the overall change in power consumed by motors from 1954 to 1955 was estimated to be 12 percent. For a rough approximation of the change in motors in place from 1954 to 1955 the change in real net stocks of equipment in manufacturing was used—2.2 percent. This yielded a 9½ percent rise in the utilization rate—a figure that compares with a rise of 8½ percent as shown in the FRB capacity utilization index from 1954 to 1955. Thus the equipment utilization ratio from 1929 to an approximately comparable high employment year in the 1950's shows an increase of almost 45 percent.

7. The Brookings Institution, "America's Capacity to Produce," pp. 307-9.

Some partial checks of the overall results

In considering the overall changes shown in table 2, the 1939–1954 change is not unexpected insofar as 1939 was still a depression year while 1954 was a year of high output, despite the minor recession. On the other hand, the small difference between 1939 and 1929 comes as something of a surprise because 1929 was a year of generally high activity.

A limited check of the 1929–39 change, by individual industries, was conducted, in which attention was confined to those industries in which motors driven by purchased power in 1929 accounted for two-thirds or more of the total horsepower of all motors. By considering only motors run mainly by purchased power (and the corresponding consumption of purchased power) much of the error that might have crept into the 1929 estimates due to the possibly faulty estimation of power generated by plants for their own use should be eliminated.

There were 131 industries which had not changed in definition and which could thus be directly compared; for these there was a very slight increase in

Table 4.—Capacity utilization ratios, selected industries, 1929, 1939 and 1954

	1929	1939	1954
Steel ingots and castings	89	65	71
Refined copper, electrolytic	95	66	79
Cement	67	47	94
Paper	81	82	91
Flour milling, wheat	57	59	67
Cotton textiles	33	40	59
Woolen and worsted	19	24	32
Petroleum refining	78	82	88

Note: Because capacity in this table has been figured on differing bases, comparisons should be made only within industries over time and not among industries at a given point in time.

Steel, cement, paper, flour milling, and petroleum are from published trade sources. The flour milling reflects an adjustment to a 6-day basis for 1954, to provide comparability with 1929 and 1939. The paper figure reflects a 310 day year, which is the so-called "historical" basis for calculating capacity. The cotton and wool figures were derived by the author and are based on spindle and loom hours respectively, related to around-the-clock operations throughout the year.

the 1939 utilization ratio over 1929, measured by the median change. Over the 10-year period the durable goods ratio was a little lower while the nondurables ratio was somewhat higher, and a proper weighting system would probably yield a small overall decrease, approximately in line with the aggregate change shown in table 2.

For a second check primary metals, paper and chemicals were excluded from the calculations since these industries are very large power consumers and errors in any of the 1929 estimates could bias the 1929 results. The total after these exclusions, however, yielded a change of 40 percent from 1929 to 1954, or more than the change shown by the overall manufacturing totals. Results of these calculations appear in table 3, which is partly condensed.

As another crude kind of check of the calculations presented in tables 2 and 3, the few direct measures available on capacity utilization can be examined. They show rather large declines from 1929 to 1939 in steel, cement, and refined copper but are about unchanged or somewhat higher in nondurables. About all that can be said is that they do not point to uniformly higher capacity utilization rates in 1929 as against 1939. (table 4).

The changes from 1929 to 1954 yield a clearer picture. With the exception of copper and steel, all the capacity utilization rates are higher in 1954; if the comparison were shifted from 1954 to a high-level demand period, such as 1955, the steel industry also would show a higher utilization ratio than in 1929. It is of interest to note that in the case of cotton textiles the utilization ratio derived from spindles and spindle-hours increased 41 percent from 1939 to 1954, whereas the corresponding utilization ratio derived from the electric power and motor calculations increased 34 percent.

In considering the 1929–39 comparison, it should be kept in mind that capital formation in the decade of the 1930's was extremely low; OBE estimates of the net stock of equipment in manufacturing were actually a bit lower in 1939 than in 1929, and the ratio of stocks to output was essentially unchanged over the period.

Some qualifications

In using the change in electric motor utilization as outlined in this article to measure changes in equipment utilization, the assumption has been made that there has been no change in the technical efficiency of motors over the period under consideration. According to electrical engineers, the electric motor has not changed much in this respect, mainly because its efficiency—in the neighborhood of 90 percent—was already very high even as long as a generation ago. Obviously the results would be biased if more power were required to run a motor of a given horsepower rating a given length of time today as against the 1920's. If anything, there may be a bias in the opposite direction because there has been some increase in the efficiency of very large motors.

It has also been assumed that in a given 2-digit industry the proportion of total power consumed by motors has not changed from 1929 to 1954. Aside from the few industries that are very large consumers of power—aluminum, steel and certain chemicals—the main use of electric power other than motors in manufacturing industry has traditionally been for lighting. The little evidence that bears on this point would not invalidate the above assumption. In a study made for Westinghouse Electric Corporation in 1954, the authors estimated that the lighting share of power sales made to industrial users rose moderately from 1937 to the war years and very early postwar years,

Table 5.—Electric Motors, Electric Power Consumption and Utilization Ratios, Mineral Industries [1], 1929, 1939, and 1954

	Electric motors	Available kilowatt-hours of motors [2]	Total electric power consumed	Percent used for motors	Electric power consumed by motors	Utilization ratio (5)÷(2)	Equivalent 40-hour weeks (6×4.2
	(1) Millions of horsepower	(2) Billions	(3) Billions of kilowatt-hours	(4)	(5) Billions of kilowatt-hours	(6)	(7)
Total [1]							
1929	6.16	44.73	7.46	----	7.04	0.157	0.66
1939	7.07	51.33	7.56	----	7.13	.139	.58
1954	10.14	73.68	12.79	----	12.09	.164	.69
Bituminous coal and lignite							
1929	2.83	20.57	2.51	92.1	2.31	0.112	0.47
1939	3.07	22.29	2.57	92.1	2.37	.106	.45
1954	3.78	27.47	3.76	92.1	3.46	.126	.53
Pennsylvania anthracite							
1929	0.89	6.45	0.95	92.1	0.87	0.136	0.57
1939	.91	6.64	.95	92.1	.88	.132	.55
1954	.91	6.58	.84	92.1	.77	.118	.50
Iron ore							
1929	0.32	2.31	0.48	96.6	0.46	0.199	0.84
1939	.39	2.82	.37	96.6	.36	.127	.53
1954	1.02	7.44	1.17	96.6	1.13	.152	.64
Major nonferrous ores [3]							
1929	0.88	6.39	2.47	96.6	2.39	0.373	1.57
1939	1.21	8.79	2.46	96.6	2.38	.271	1.14
1954	1.68	12.22	3.06	96.6	2.96	.242	1.02
All other [4]							
1929	1.24	9.03	1.06	95.0	1.01	0.111	0.47
1939	1.49	10.86	1.23	95.0	1.15	.106	.45
1954	2.75	19.96	3.96	95.0	3.77	.189	.79

1. Excludes crude petroleum and natural gas extraction industries.
2. Includes constant adjustment for motor efficiency. See footnote (1) of table 2.
3. Gold, silver, copper, lead, and zinc.
4. Chiefly nonmetallic minerals.

Source: U.S. Department of Commerce, Office of Business Economics.

moved back to the 1937 proportion by 1950–51 and was projected to move moderately lower over the next decade.[8] While lighting standards underwent a very marked improvement as a result of the war, it should be kept in mind that the substitution of the fluorescent lamp for the incandescent lamp, starting in the early 1940's, meant a decline of 60 percent in power consumption for a given amount of light. There are no statistics available on electricity used for lighting in manufacturing going back to 1929.

Another factor that has been ignored has been the increased use of measuring, metering and control instruments, which have grown more rapidly than machinery generally. There was no way of taking account of this development in the present calculations. Some of the larger pieces of measuring and control equipment, no doubt, have motors attached to them and to this extent would not bias the results shown here.

As noted earlier, the figures presented here take no account of machinery directly powered by internal combustion engines, steam engines and turbines, etc. In 1929 prime movers not attached to generators—that is, directly tied to factory equipment—accounted for about 20 percent of horsepower in place and by 1954 the proportion had fallen to 12 percent. The problem here is to determine the change in the utilization rate of machinery powered by sources other than electric motors. In 1954 about two-thirds of the prime movers not driving generators were in chemicals, petroleum refining and blast furnaces, steel works and rolling mills. It would probably be fair to say that the relative use of such equipment increased somewhat less than the overall rise of 31 percent from 1929 to 1954 shown for all manufacturing. In petroleum refining, where the steam turbine is predominant, the industry's operating rate, according to published data, rose from 78 percent in 1929 to 88 percent in 1954, or by 13 percent. On the other hand, in an industry like steel, equipment directly driven by steam engines in 1954 was probably of rather ancient vintage, and probably represented high-cost, stand-by equipment that saw relatively little use as compared with the modern continuous rolling mills powered by electric motors.

Finally, the calculations have ignored completely equipment such as furnaces, ovens, storage bins, furniture, hand tools, as well as transport equipment of all types.[9] To the extent that furnaces and ovens are used continuously, their relative use over time has changed only to the extent that the proportion of idle to active equipment has changed. In the case of transport equipment, hand tools, etc., it would probably be reasonable to assume that the same factors leading to more intensive use of electric motor-driven equipment—the trend to multiple shift work, the rationalization of equipment use—have been operating here. As for office furniture and related items, a rather unimportant category for manufacturing as a whole, its use has probably declined to the extent that the workweek for office workers has declined.

Other Industries

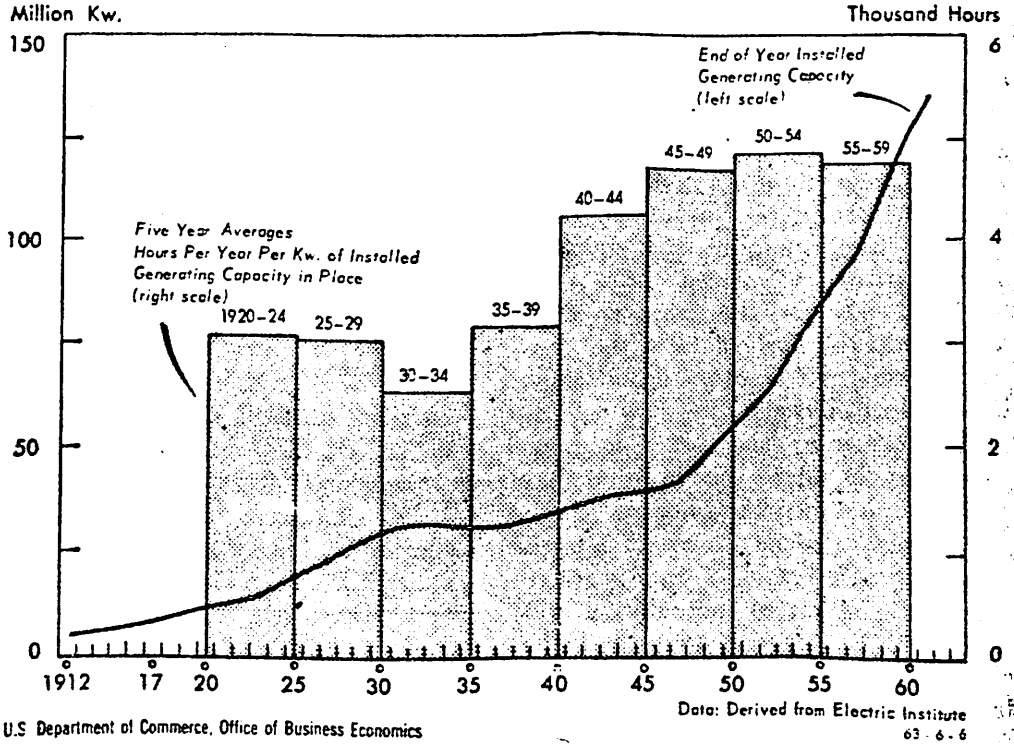
Mining

The data for mining are less comprehensive than for manufacturing. Although horsepower and electric power consumption statistics have been collected in each Census of Mineral Industries, statistics pertaining to the extraction of crude petroleum and natural gas were omitted from the 1929 Census. In addition, electric motors account for only two-thirds of the horsepower in place in mining, exclusive of petroleum and natural gas, and in the latter they are quite unimportant as a power source.

Table 5 presents the basic statistics on horsepower of electric motors and electricity consumption for all industries combined, excluding crude petroleum and natural gas, and for a few of the major industry groups for the years 1929, 1939 and 1954. According to the FPC study (table 1), about 95 percent

INSTALLED GENERATING CAPACITY OF PRIVATELY OWNED ELECTRIC UTILITIES

Annual Hours Per Unit of Installed Capacity Have Increased Since the 1920's



U.S Department of Commerce, Office of Business Economics

Data: Derived from Electric Institute

63-6-6

8. *The Lighting Market, a Report for Westinghouse Electric Corporation, Ebasco Services, Inc.*, April 1954, p. 6.

9. In 1947 purchases of new "production machinery and equipment" represented 87 percent of all purchases of new machinery and equipment by manufacturing plants, according to the Census of Manufactures. The remaining 13 percent covered office furniture, machines and fixtures, motor vehicles, cafeteria furnishings, etc. Of course, not all "production machinery and equipment" is run by electricity.

of all electricity consumed in mining is used to run motors.

For the group as a whole there was a rise in the utilization rate of only 4 percent from 1929 to 1954. Mining output, however, while comparatively high in 1929, was quite depressed in 1954 because of the recession, so that it seems quite appropriate to make some adjustment on this account. Mining output, exclusive of crude petroleum and natural gas, rose 22½ percent from 1954 to 1955–57, according to Federal Reserve data. If two-thirds of this rise were taken as a rough approximation of the increase in the relative operating rate, this would yield a 19 percent rise from 1929 to the mid-1950's. One explanation for the apparently smaller rise as compared with manufacturing is that multiple-shift operations have historically been common in many mining industries.

Electric utilities

Since electric utilities are required to furnish power to satisfy customer peak loads, generating capacity in place, which accounts for about 40 percent of gross depreciable assets of electric utilities, has characteristically been considerably in excess of average use. While the ratio of output to capacity for privately-owned utilities increased up to World War I, little progress was made during the 1920's when average usage was in the neighborhood of 3,000 hours per kilowatt of installed capacity, or about 35 percent of the 8,760 hour annual maximum. The ratio began to increase in the late 1930's until about 1948 and for the next decade fluctuated in the neighborhood of 55–58 percent.

An important factor in the 60 percent rise in the utilization factor from the 1920's to the 1950's has been the movement toward interconnection, by means of which plants within the same system and systems over wide geographical areas have been interconnected, so that the need for standby generating capacity in individual systems has been considerably reduced.

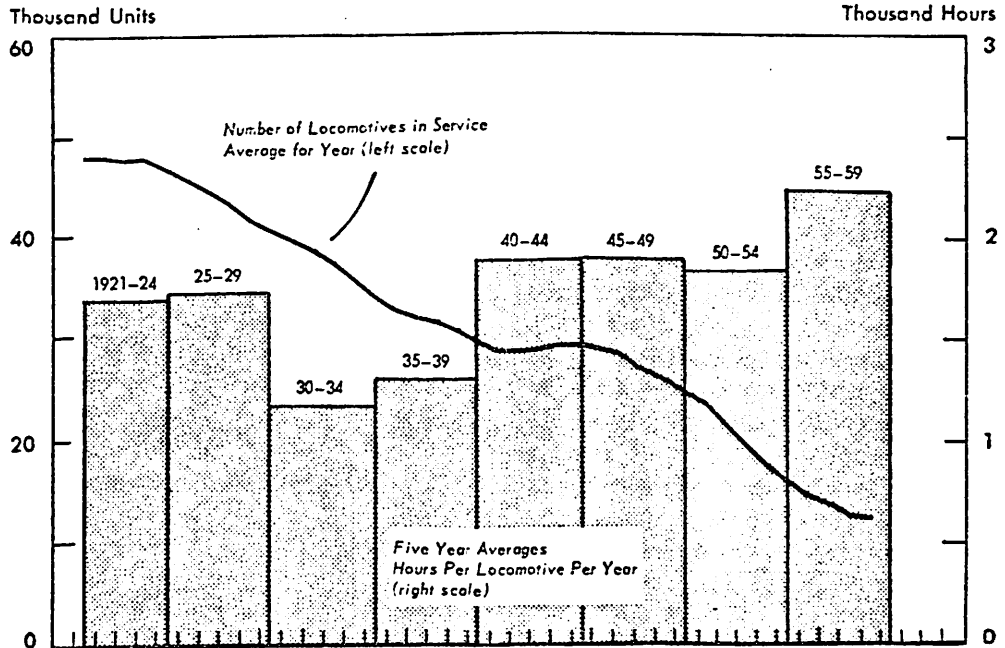
Table 6.—Hours per Year per Freight Car and Locomotive in Service, Class I Railroads

	Freight cars[1]	Locomotives		
		Freight	Passenger	Switching
1921–24	874	1,765	1,537	(2)
1925–29	969	1,811	1,524	(2)
1930–34	635	1,186	1,111	(2)
1934–39	754	1,320	1,239	(2)
1940–44	1,152	2,036	1,664	(2)
1945–49	1,102	1,937	1,743	4,779
1950–54	981	1,816	1,905	5,036
1955–59	928	2,174	2,498	5,576
1960	871	2,195	2,484	5,345
1961	852	2,115	2,420	5,018
1962	895	2,233	2,600	5,139

1. Time traveling, empty and loaded. Excludes time in terminals.
2. Not available.

Source: U.S. Department of Commerce, Office of Business Economics. Estimated from data in *Railroad Transportation*, Association of American Railroads.

Locomotives in Service and Average Hours Per Year, Freight and Passenger Service Combined, Class I Railroads



U.S. Department of Commerce, Office of Business Economics

63-6-7

Though firm data on this point are lacking.

Locomotive use is another matter. The shift from steam to diesel locomotives over the past generation has been accompanied by a clear-cut increase in relative utilization. Indeed, this change has come about mainly because of the superior operating performance of the diesel as compared with the steam engine, and, among other things, has taken the form of reduced time-out for maintenance and repairs. Hours per locomotive assigned to freight service in 1926, for example, averaged 1,896 in 1926 as against 2,288 in 1956, an increase of approximately 20 percent.

With passenger service falling to exceptionally low levels, locomotives assigned to passenger service have fallen by 80 percent from the mid-1920's to the mid-1950's. Hours per locomotive have risen, however, from about 1,500 to approximately 2,500 over this period.

Locomotives in yard switching service find their most intensive use. Data are not available back to the 1920's but the available statistics suggest a considerable increase over time, given the prevalence and relative inefficiency of the steam locomotive in the earlier period. (Table 6.)

Railroads

Changes in the intensity of utilization of railroad equipment show a mixed picture. The relative utilization of freight cars has undergone little change from the 1920's to date and has remained at a comparatively low level. Measured in terms of traveling time—both empty and loaded—the average freight car was used 1,000 hours in 1926 and 995 hours in 1956. It may well be that if time spent waiting for unloading and loading were taken into account, average usage might in fact show some decrease over this period,

Appendix

The availability of some limited information on employment by shift suggested the possibility of an alternative approach to the estimation of equipment hours of work in mining and manufacturing.

The 1939 Census of Mineral Industries published, by detailed industry, employment by shifts, average number of hours per shift, and the average number of equivalent full-days that operations were active in the year 1939. Table 7 presents a comparison of the equivalent number of 40-hour shifts worked by equipment as derived from the two approaches, for all mining industries (excluding crude petroleum and natural gas) and for a few of the larger industries in which shift work is important (coal, iron ore, certain nonferrous ores).

The calculations making use of the shift data are shown below for all mining industries. Employment is expressed in terms of man-shifts (one man working one shift per day). Average hours per shift in 1939 were 7.3.

	Man-shifts (millions)	Average daily hours	Total daily hours (millions)
First Shift	107.0	7.3	781.1
Second Shift	22.7	7.3	165.7
Third Shift	4.5	7.3	32.8
Total	134.2		979.6

On the assumption that machines used per shift vary directly with employment and that first shift machines represent the maximum available, we get an average utilization of machines of 9.16 hours per day. (979.6÷107.0). However, the Census also reported that mines and related plants were active 203 equivalent full-time days in 1939, that is, 55.6 percent of 365 days. Multiplying 9.16 by .556 gives 5.09 hours per day, which is 64 percent of one 8-hour day. This compares with a ratio of 58 percent as derived from the horsepower and electric power consumption data.

For manufacturing, production worker employment data by shifts are available on overall basis for the year ending June 30, 1960.[10] According to this study of the Bureau of Labor Statistics, which was confined to employment in metropolitan areas, 77.2 percent of all production workers were employed on the first shift, 16.4 on the second, and 6.4 on the third and other shifts. On the same assumption used for mining, we get from this calculation 51.8 hours per week for machinery $(0.772 \times 40 + 0.164 \times 40 + 0.064 \times 40) \div 0.772$. This figure was moved back from 1959–60 to 1954 through the use of some recently published data on manufacturing capacity utilization, making some allowance for the strike in the summer and fall of 1959. This rough adjustment of 5 percent yielded a figure of 49.1 hours.[11]

Since the motor calculations were made with respect to a theoretical 365 day capacity, a similar adjustment must be made for the employment calculations, though there is little information for such an adjustment. The fact that Saturday and Sunday are typically not workdays and the fact of part-time employment are already reflected in the average weekly hours figure. One downward adjustment of 5 percent was made to allow for hours paid for but not worked because of vacations, holidays, sick leave, etc. A second adjustment was necessary to allow for the fact that even on the first shift not all work stations could be considered occupied. Since 1954 followed a year of near-capacity operations, it was decided to measure this slack by the change in employment from May 1953, the cyclical peak in manufacturing employment, to the average level in 1954. This yielded a 10 percent decline. On this very crude basis we get an average of 41.7 hours per week as against 35 hours, the figure obtained from the aggregate calculations derived from the motor and power consumption computations shown in table 2.

There are at least two major shortcomings with these calculations for manufacturing. First of all it is probably not appropriate to assume that machine hours by shift would be proportional to employment by shift. For some industries, such as metal fabricating, employment on late-shifts tends to be overweighted with maintenance workers rather than machinery-operatives. In the case of continuous industries like petroleum and industrial chemicals, however, the reverse is true. In a 1952 study it was found that only one-third of "production" workers in refineries were employed on late shifts, even though refineries are run on a 24-hour basis through the year (aside from maintenance shut-downs). On balance, the employment shift data in manufacturing probably understate late-shift operations of equipment.[12]

Table 7.—Number of Equivalent 40-Hour Shifts Worked by Equipment in Selected Mining Industries as Estimated from Employment Data by Shifts and from Motor Utilization Data, 1939

	From employment by shifts	From motor utilization
All mining industries [1]	0.64	0.58
Bituminous coal and lignite	.54	.45
Pennsylvania anthracite	.59	.55
Iron ore	.84	.83
Copper ore	1.30	1.10
Lead and zinc ores	.93	.95
Gold ore	1.18	1.31

1. Includes industries not shown but excludes petroleum and natural gas.

Source: U.S. Department of Commerce, Office of Business Economics.

The second major difficulty concerns the assumption that all machines on the first shift represent total machines available and can be appropriately adjusted downward by the 10 percent figure based on the change in employment from the 1953 peak to 1954. Only fragmentary evidence is available on this point for scattered time periods. In some unpublished BLS studies made in early 1951 covering metalworking industries, it was found that actual employment on the first shift was approximately three-fourths of the maximum that could be employed on the first shift with the available equipment. In textiles, where 3-shift work is common, Census figures indicate that first shift looms active at the end of 1962 as a percent of looms in place were 97 percent for cotton mills, 87 percent for man-made fiber and silk mills, and 76 percent for woolen mills. The rough 10 percent adjustment used above for all manufacturing is probably too low, but the resultant of the two major data biases discussed in this Appendix cannot be determined.

10. "Supplementary Wage Benefits in Metropolitan Areas, 1959–60," *Monthly Labor Review*, April 1961, Table 2, page 382.

11. Estimates were prepared by Frank DeLeeuw of the Federal Reserve and appear on page 129 of "Measures of Productive Capacity" in *Hearings before the Subcommittee on Economic Statistics of the Joint Economic Committee*, 1962.

12. This is brought out by Alan Strout in an unpublished paper prepared for the Harvard Economic Research Project and Resources for the Future, Inc. (1961).

065 Plan A

Updates 1976-1997

pp 2, 8, 14, 32, 34, 36

~~for~~ :

K-stock: Current-$

K-stock: Real ?

Investment : ?

Sources for HS, Canada

Discuss Notes

IP F1- to F56-75

F135-152

F183-224

Data F1-13 ✓

F14-32

F33-44

F 47-55

F183-192

F 193-202

F 221-224 ✓

Notes & Data

J471-480 + . .

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160-171

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Canada

Constant 1986-$

TOTAL MANUFACTURING AND NON-MANUFACTURING INDUSTRIES

ENSEMBLE DES INDUSTRIES MANUFACTURIERES ET NON-MANUFACTURIERES

TOTAL ALL COMPONENTS -- ENSEMBLE DES ELEMENTS

YEAR / ANNEE	GROSS FIXED CAPITAL FORMATION -- FORMATION BRUTE DE CAPITAL FIXE	DISCARDS -- RETRAITS	END-YEAR GROSS STOCK -- STOCK BRUT DE FIN D'ANNEE	GEOMETRIC DEPRECIATION -- AMORTISSEMENT GEOMETRIQUE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	GEOMETRIC DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	STRAIGHT-LINE DEPRECIATION -- AMORTISSEMENT LINEAIRE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	STRAIGHT-LINE DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	DELAYED DEPRECIATION -- AMORTISSEMENT DIFFERE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	DELAYED DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE
MILLIONS OF CONSTANT 1986 DOLLARS -- EN MILLIONS DE DOLLARS CONSTANTS 1986									
1946	9,329.4	4,931.1	221,841.1	7,509.9	66,339.6	6,823.4	117,992.5	6,212.1	161,637.4
1947	12,336.6	5,033.8	229,144.4	8,051.1	70,626.6	7,096.3	123,233.3	6,405.1	167,569.3
1948	14,150.3	5,069.2	238,223.9	8,849.2	75,926.2	7,505.5	129,878.1	6,681.7	175,038.4
1949	14,899.5	5,164.9	247,958.1	9,675.2	81,149.8	7,979.5	136,797.5	7,016.2	182,919.7
1950	15,509.4	5,319.6	258,147.8	10,453.2	86,205.9	8,484.1	143,822.9	7,388.9	191,040.1
1951	17,364.8	5,514.3	269,997.7	11,256.8	92,314.0	9,036.2	152,151.2	7,809.0	200,596.3
1952	20,238.1	5,763.9	284,471.1	12,183.8	100,366.9	9,666.2	162,722.9	8,284.0	212,550.6
1953	21,108.5	6,070.9	299,509.0	13,177.0	108,298.5	10,348.7	173,482.5	8,796.7	224,862.4
1954	19,552.8	6,398.3	312,662.0	13,969.0	113,882.4	10,981.3	182,053.6	9,302.7	235,112.9
1955	20,700.2	6,761.4	326,600.9	14,630.7	119,951.9	11,574.1	191,179.7	9,800.9	246,011.0
1956	26,462.4	7,205.1	345,859.2	15,692.4	130,721.6	12,307.8	205,334.1	10,356.2	262,116.6
1957	29,384.9	7,694.1	367,549.1	17,024.3	143,081.6	13,150.4	221,566.9	10,939.4	280,560.6
1958	26,484.1	8,181.2	385,852.1	18,046.0	151,519.5	13,893.6	234,156.9	11,466.8	295,578.0
1959	26,127.0	8,659.7	403,319.2	18,791.1	158,856.1	14,533.4	245,750.4	11,947.0	309,758.6
1960	26,399.7	9,157.2	420,561.6	19,536.7	165,718.5	15,161.7	256,988.2	12,414.1	323,744.0
1961	26,146.9	9,625.8	437,083.0	20,200.8	171,664.6	15,755.3	267,379.8	12,848.1	337,042.0
1962	27,131.4	10,019.9	454,195.5	20,846.0	177,949.9	16,340.7	278,170.3	13,270.3	350,903.3
1963	28,432.3	10,348.9	472,278.7	21,639.6	184,741.7	16,988.2	289,614.3	13,731.2	365,603.7
1964	32,246.6	10,636.6	493,889.2	22,787.3	194,199.9	17,793.4	304,067.7	14,285.1	383,565.8
1965	36,490.0	10,920.8	519,457.8	24,384.7	206,305.2	18,823.6	321,733.1	14,978.3	405,077.6
1966	41,603.1	11,235.5	549,826.0	26,413.3	221,495.6	20,100.9	343,235.7	15,832.5	430,847.6
1967	40,503.9	11,620.3	578,710.9	28,396.4	233,604.0	21,462.5	362,277.9	16,788.9	454,563.2
1968	38,939.0	12,096.9	605,552.1	29,868.3	242,675.5	22,715.7	378,502.0	17,761.7	475,741.6
1969	39,532.8	12,672.6	632,412.5	31,102.6	251,106.0	23,913.4	394,122.4	18,760.7	496,513.3
1970	41,014.8	13,373.0	660,054.2	32,331.4	259,789.5	25,110.6	410,027.3	19,785.5	517,743.4
1971	42,706.1	14,127.9	688,631.9	33,592.5	268,901.7	26,318.6	426,414.6	20,821.8	539,626.8
1972	43,711.5	14,911.1	717,432.0	35,018.6	277,594.3	27,599.7	442,526.5	21,922.2	561,415.4

Canada
Constant 1986$

TOTAL MANUFACTURING AND NON-MANUFACTURING INDUSTRIES

ENSEMBLE DES INDUSTRIES MANUFACTURIERES ET NON-MANUFACTURIERES

TOTAL ALL COMPONENTS -- ENSEMBLE DES ELEMENTS

YEAR -- ANNEE	GROSS FIXED CAPITAL FORMATION -- FORMATION BRUTE DE CAPITAL FIXE	DISCARDS -- RETRAITS	END-YEAR GROSS STOCK -- STOCK BRUT DE FIN D'ANNEE	GEOMETRIC DEPRECIATION -- AMORTISSEMENT GEOMETRIQUE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	GEOMETRIC DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	STRAIGHT-LINE DEPRECIATION -- AMORTISSEMENT LINEAIRE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	STRAIGHT-LINE DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	DELAYED DEPRECIATION -- AMORTISSEMENT DIFFERE: CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	DELAYED DEPRECIATION: END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE
MILLIONS OF CONSTANT 1986 DOLLARS -- EN MILLIONS DE DOLLARS CONSTANTS 1986									
1973	47,731.6	15,794.9	749,368.8	36,944.8	288,379.8	29,113.8	461,143.6	23,178.0	585,968.8
1974	50,925.0	16,790.4	783,502.8	39,305.6	299,999.4	30,883.7	481,185.4	24,606.0	612,288.0
1975	54,584.6	17,801.5	820,286.8	41,782.5	312,801.0	32,828.1	502,940.5	26,182.2	640,688.5
1976	54,025.0	18,767.4	855,543.0	44,089.3	322,737.0	34,853.1	522,112.6	27,903.2	666,809.9
1977	54,947.9	19,775.7	890,715.5	46,063.1	331,621.4	36,866.7	540,194.5	29,750.1	692,008.0
1978	55,428.4	21,049.5	925,093.4	47,726.7	339,322.5	38,796.0	556,825.6	31,642.9	715,792.8
1979	61,270.5	22,638.1	963,726.5	49,855.9	350,738.2	40,873.4	577,222.2	33,628.6	743,434.5
1980	67,642.0	24,359.4	1,007,009.5	52,687.5	365,692.4	43,233.3	601,630.8	35,741.4	775,335.1
1981	75,193.4	26,157.1	1,056,046.2	56,036.6	384,849.8	45,850.8	630,973.7	37,995.9	812,533.5
1982	67,859.1	28,030.8	1,095,874.1	58,398.8	394,309.4	48,154.4	650,677.2	40,133.8	840,258.6
1983	62,884.1	29,978.7	1,128,778.7	59,459.2	397,734.0	49,911.4	663,648.6	42,025.4	861,116.1
1984	63,998.4	32,006.5	1,160,770.0	60,735.8	400,995.9	51,633.1	676,014.6	43,866.2	881,249.0
1985	70,474.7	34,049.3	1,197,194.7	62,774.6	408,695.2	53,616.2	692,871.1	45,764.8	905,958.6
1986	72,499.9	35,767.2	1,233,928.6	65,381.5	415,814.7	55,935.5	709,436.7	47,864.8	930,593.4
1987	77,291.5	37,038.2	1,274,182.2	68,334.4	424,771.1	58,650.2	728,077.6	50,386.4	957,498.8
1988	87,338.0	38,404.7	1,323,115.0	72,020.2	440,088.9	61,940.0	753,475.9	53,492.6	991,343.0
1989	91,803.7	40,497.5	1,374,420.8	75,850.0	456,043.2	65,519.2	779,762.6	57,016.6	1,026,130.7
1990	97,225.6	43,643.2	1,428,002.8	79,367.0	473,901.5	69,042.4	807,943.3	60,646.3	1,062,710.3

THE ESTIMATES FOR THE TWO MOST RECENT YEARS ARE BASED RESPECTIVELY ON PRELIMINARY AND EXPECTED INVESTMENT EXPENDITURES.
LES DONNEES RELATIVES AUX DEUX DERNIERES ANNEES SONT DERIVEES A PARTIR DE DEPENSES PROVISOIRES ET PROJETEES.

Investment and Capital Stock Division

Division de l'investissement et du stock de capital

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FIXED CAPITAL FLOWS AND STOCKS
FLUX ET STOCKS DE CAPITAL FIXE

Current $ Courants

CANADA

1946 - 1990

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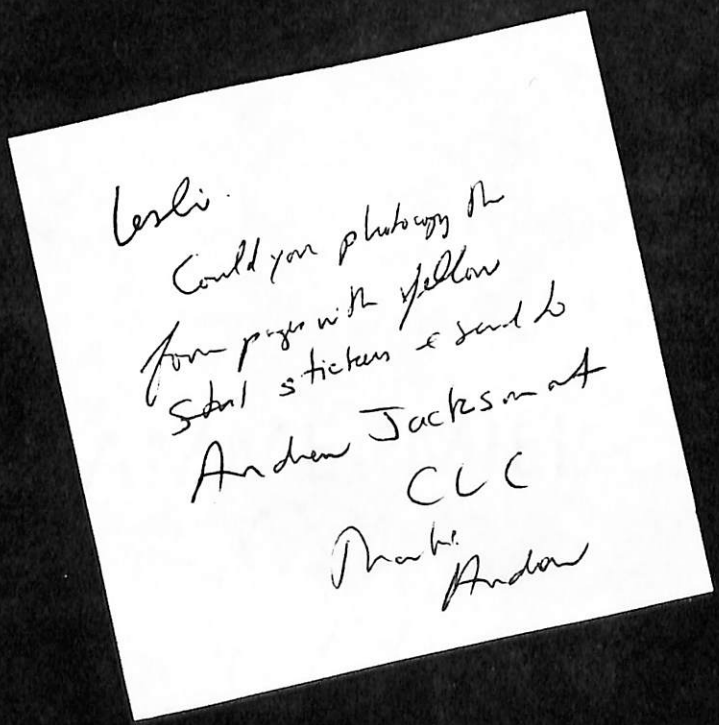

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TOTAL MANUFACTURING AND NON-MANUFACTURING INDUSTRIES

ENSEMBLE DES INDUSTRIES MANUFACTURIERES ET NON-MANUFACTURIERES

TOTAL ALL COMPONENTS -- ENSEMBLE DES ELEMENTS

YEAR -- ANNEE	GROSS FIXED CAPITAL FORMATION -- FORMATION BRUTE DE CAPITAL FIXE	DISCARDS -- RETRAITS	END-YEAR GROSS STOCK -- STOCK BRUT DE FIN D'ANNEE	GEOMETRIC DEPRECIATION -- AMORTISSEMENT GEOMETRIQUE		STRAIGHT-LINE DEPRECIATION -- AMORTISSEMENT LINEAIRE		DELAYED DEPRECIATION -- AMORTISSEMENT DIFFERE	
				CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE	CAPITAL CONSUMPTION ALLOWANCES -- PROVISIONS POUR CONSOMMATION DE CAPITAL	END-YEAR NET STOCK -- STOCK NET DE FIN D'ANNEE
MILLIONS OF CURRENT DOLLARS -- EN MILLIONS DE DOLLARS COURANTS									
1946	1,291.5	709.8	28,610.4	1,048.3	8,654.0	952.7	15,278.9	873.0	20,686.8
1947	1,937.4	806.7	33,464.3	1,255.0	10,439.6	1,106.7	18,085.3	1,003.4	24,328.9
1948	2,478.9	897.6	39,090.1	1,536.2	12,629.8	1,302.8	21,436.6	1,161.9	28,603.2
1949	2,755.6	960.9	42,835.2	1,784.4	14,251.2	1,468.1	23,811.4	1,292.2	31,486.7
1950	3,052.3	1,044.2	47,035.4	2,040.1	15,993.4	1,650.5	26,429.2	1,439.0	34,686.8
1951	3,845.0	1,196.6	55,424.8	2,468.8	19,418.2	1,969.3	31,633.4	1,697.3	41,174.9
1952	4,559.9	1,279.9	60,357.0	2,746.8	21,776.1	2,164.3	34,937.0	1,850.7	45,122.1
1953	4,843.8	1,378.9	64,393.2	3,013.5	23,726.3	2,352.8	37,660.6	2,000.8	48,303.4
1954	4,531.4	1,465.9	67,467.9	3,217.6	24,999.6	2,515.9	39,647.5	2,134.5	50,670.2
1955	4,890.9	1,582.3	72,517.1	3,467.1	27,130.0	2,719.5	42,909.3	2,301.5	54,629.9
1956	6,536.4	1,771.6	81,255.6	3,931.5	31,289.1	3,054.3	48,820.6	2,563.9	61,668.6
1957	7,336.5	1,965.9	87,930.3	4,384.8	34,629.9	3,372.7	53,468.1	2,811.1	67,034.4
1958	6,630.2	2,127.0	92,788.5	4,689.4	36,597.5	3,617.5	56,590.0	3,006.6	70,806.0
1959	6,727.7	2,288.2	98,362.1	4,948.9	38,764.8	3,853.5	60,103.7	3,201.5	75,137.3
1960	6,861.1	2,458.9	103,652.3	5,206.8	40,715.6	4,080.1	63,376.7	3,387.7	79,237.8
1961	6,793.0	2,640.7	108,026.1	5,431.2	41,976.2	4,304.2	65,836.6	3,582.2	82,415.8
1962	7,212.6	2,811.5	113,740.0	5,675.4	43,974.7	4,538.3	69,262.8	3,777.7	86,787.1
1963	7,744.0	2,962.6	121,025.4	6,009.3	46,751.2	4,811.1	73,784.9	3,989.6	92,536.1
1964	8,991.2	3,125.9	129,475.6	6,470.6	50,250.4	5,158.2	79,188.0	4,258.1	99,224.7
1965	10,714.1	3,339.3	142,906.7	7,225.2	56,280.6	5,676.1	88,099.8	4,637.6	110,138.1
1966	12,907.6	3,574.8	159,159.3	8,183.0	63,919.7	6,309.1	99,141.7	5,087.9	123,542.5
1967	12,969.4	3,836.0	172,844.5	9,088.8	69,594.7	6,943.0	107,976.0	5,556.9	134,532.0
1968	12,646.8	4,102.1	183,479.5	9,721.6	73,211.5	7,474.8	114,301.1	5,988.6	142,693.4
1969	13,542.9	4,531.1	202,206.4	10,667.2	79,953.9	8,279.3	125,603.4	6,647.1	157,187.5
1970	14,660.0	4,973.5	221,314.1	11,610.7	86,856.4	9,082.3	137,160.2	7,305.8	172,024.7
1971	16,159.0	5,507.7	246,352.5	12,793.0	95,966.8	10,071.3	152,280.9	8,101.7	191,585.4
1972	17,397.3	6,073.7	270,410.4	13,996.0	104,347.8	11,081.3	166,492.5	8,937.7	210,074.3

TOTAL MANUFACTURING AND NON-MANUFACTURING INDUSTRIES

Canada
current $

ENSEMBLE DES INDUSTRIES MANUFACTURIERES ET NON-MANUFACTURIERES

TOTAL ALL COMPONENTS -- ENSEMBLE DES ELEMENTS

YEAR / ANNEE	GROSS FIXED CAPITAL FORMATION / FORMATION BRUTE DE CAPITAL FIXE	DISCARDS / RETRAITS	END-YEAR GROSS STOCK / STOCK BRUT DE FIN D'ANNEE	GEOMETRIC DEPRECIATION -- AMORTISSEMENT GEOMETRIQUE: CAPITAL CONSUMPTION ALLOWANCES / PROVISIONS POUR CONSOMMATION DE CAPITAL	GEOMETRIC DEPRECIATION: END-YEAR NET STOCK / STOCK NET DE FIN D'ANNEE	STRAIGHT-LINE DEPRECIATION -- AMORTISSEMENT LINEAIRE: CAPITAL CONSUMPTION ALLOWANCES / PROVISIONS POUR CONSOMMATION DE CAPITAL	STRAIGHT-LINE DEPRECIATION: END-YEAR NET STOCK / STOCK NET DE FIN D'ANNEE	DELAYED DEPRECIATION -- AMORTISSEMENT DIFFERE: CAPITAL CONSUMPTION ALLOWANCES / PROVISIONS POUR CONSOMMATION DE CAPITAL	DELAYED DEPRECIATION: END-YEAR NET STOCK / STOCK NET DE FIN D'ANNEE
MILLIONS OF CURRENT DOLLARS -- EN MILLIONS DE DOLLARS COURANTS									
1973	20,640.5	6,841.9	309,019.0	15,931.7	119,010.6	12,573.6	190,203.5	10,114.7	240,502.0
1974	25,872.2	8,352.4	382,990.1	19,796.7	147,429.0	15,519.9	235,913.6	12,419.5	298,816.3
1975	31,102.3	9,931.4	450,634.8	23,663.5	172,790.9	18,537.4	277,133.9	14,839.7	351,331.0
1976	32,783.7	11,166.8	500,344.5	26,535.3	189,522.2	20,930.1	305,993.2	16,830.8	388,976.6
1977	35,532.7	12,639.9	555,128.7	29,614.5	207,227.6	23,673.4	337,067.2	19,211.9	429,776.3
1978	38,909.2	14,548.9	621,168.8	33,107.7	228,392.1	26,868.0	374,205.4	22,045.0	478,596.0
1979	46,736.1	17,092.9	707,953.9	37,778.3	258,222.6	30,892.1	424,353.0	25,547.3	543,863.2
1980	55,175.8	19,491.1	804,051.4	42,733.2	293,307.6	34,880.7	481,584.6	28,839.0	618,316.8
1981	66,465.8	22,555.7	922,191.8	49,149.6	338,216.9	39,968.2	553,083.8	33,004.0	710,725.9
1982	64,610.1	25,968.6	1,029,440.9	55,234.3	372,607.3	45,231.4	613,406.5	37,551.3	790,465.2
1983	60,424.2	28,153.1	1,069,262.7	56,660.6	378,080.6	47,348.0	629,942.4	39,784.6	816,023.9
1984	62,897.2	30,931.2	1,125,184.3	59,396.8	389,508.3	50,327.0	656,102.6	42,710.6	854,084.7
1985	69,732.9	33,060.1	1,179,366.1	61,888.6	403,389.8	52,646.7	683,420.4	44,806.2	893,355.6
1986	72,499.9	35,767.2	1,233,928.6	65,381.5	415,814.7	55,935.5	709,436.7	47,864.8	930,593.4
1987	78,432.4	37,561.0	1,305,407.7	69,375.8	435,764.0	59,545.7	746,511.5	51,082.0	982,431.8
1988	89,525.2	39,350.1	1,401,497.2	74,032.0	467,030.0	63,697.8	799,259.3	54,791.3	1,054,338.3
1989	97,189.3	42,585.1	1,507,308.0	80,105.1	501,885.1	69,185.5	857,143.2	59,924.6	1,131,233.6
1990	105,752.3	47,112.8	1,619,981.5	86,175.9	540,109.7	74,908.8	919,317.1	65,451.9	1,213,069.1

THE ESTIMATES FOR THE TWO MOST RECENT YEARS ARE BASED RESPECTIVELY ON PRELIMINARY AND EXPECTED INVESTMENT EXPENDITURES.
LES DONNEES RELATIVES AUX DEUX DERNIERES ANNEES SONT DERIVEES A PARTIR DE DEPENSES PROVISOIRES ET PROJETEES.

Series F183-192. Industry gross and net capital stock in 1971 prices, by structure and machinery and equipment, mid-year, 1926 to 1975

(millions of dollars)

Year	Gross stock					Net stock				
	Total	Construction		Machinery and equipment	Capital items charged to operating expenses	Total	Construction		Machinery and equipment	Capital items charged to operating expenses
		Building	Engineering				Building	Engineering		
	183	184	185	186	187	188	189	190	191	192
1975	225,426.4	53,640.0	73,322.0	96,357.4	2,107.0	145,739.8	36,272.8	50,682.2	57,674.6	1,110.2
1974	212,847.2	50,824.0	69,840.4	90,193.0	1,989.8	137,318.8	34,282.0	48,399.9	53,599.0	1,037.9
1973	201,185.0	48,228.5	66,666.6	84,419.8	1,870.1	129,695.3	32,467.2	46,406.5	49,851.9	969.7
1972	190,755.8	46,068.3	63,594.2	79,302.6	1,790.7	123,256.8	31,040.4	44,485.0	46,809.5	921.9
1971	181,434.2	44,212.7	60,484.5	74,979.9	1,757.1	117,670.6	29,865.6	42,411.2	44,495.5	898.3
1970	172,675.6	42,450.4	57,511.3	71,011.9	1,702.0	112,175.8	28,710.5	40,238.8	42,360.9	865.6
1969	164,548.3	40,768.9	55,060.4	67,097.9	1,621.1	106,875.9	27,571.6	38,305.9	40,165.5	832.9
1968	157,060.4	39,167.6	52,908.3	63,450.3	1,534.2	101,839.5	26,485.2	36,465.3	38,075.1	813.9
1967	149,635.0	37,525.4	50,850.4	59,834.3	1,424.9	96,498.4	25,292.2	34,583.4	35,846.6	776.2
1966	141,787.2	35,616.4	48,811.1	56,067.1	1,292.6	90,469.8	23,757.1	32,720.2	33,290.4	702.1
1965	134,514.0	33,690.9	46,840.9	52,798.6	1,183.6	84,824.9	22,196.1	30,959.6	31,042.5	626.7
1964	128,445.6	32,137.5	44,969.5	50,219.3	1,119.3	80,325.0	20,955.0	29,379.5	29,417.5	573.0
1963	123,529.7	30,964.7	43,279.2	48,208.4	1,077.4	76,849.4	19,955.2	28,030.0	28,319.7	544.5
1962	119,425.0	29,985.9	41,846.9	46,518.9	1,073.3	74,068.4	19,071.8	26,893.8	27,567.4	535.4
1961	115,229.1	29,022.2	40,307.2	44,798.1	1,101.6	71,422.7	18,228.9	25,691.5	26,962.3	540.0
1960	110,674.8	28,029.9	38,688.2	42,853.5	1,103.2	68,623.5	17,388.9	24,442.6	26,245.9	546.1
1959	105,934.2	26,989.7	37,066.9	40,803.6	1,074.0	65,598.8	16,524.1	23,188.1	25,342.6	544.0
1958	101,078.2	26,069.8	35,071.7	38,870.6	1,066.1	62,322.3	15,737.4	21,583.0	24,449.7	552.2
1957	95,596.9	25,204.5	32,612.3	36,733.4	1,046.7	58,193.6	14,892.6	19,534.1	23,223.6	543.3
1956	89,735.8	24,251.0	30,269.4	34,221.0	994.4	53,629.7	13,947.6	17,597.3	21,579.2	505.6
1955	84,794.6	23,347.7	28,560.5	31,936.7	949.7	50,141.9	13,178.2	16,276.7	20,202.8	484.2
1954	80,723.6	22,578.4	27,258.7	29,969.3	917.2	47,553.9	12,563.0	15,359.2	19,151.5	480.2
1953	76,526.1	21,879.5	26,002.0	27,765.5	879.1	44,691.0	11,935.5	14,456.4	17,836.6	462.5
1952	72,276.0	21,282.7	24,678.9	25,473.4	841.0	41,565.1	11,382.7	13,473.4	16,275.3	433.7
1951	68,389.1	20,717.0	23,486.1	23,384.2	801.8	38,727.5	10,893.2	12,642.7	14,783.7	407.9
1950	65,073.8	20,203.5	22,499.8	21,518.5	852.0	36,310.1	10,435.1	12,018.1	13,453.9	403.0
1949	62,194.7	19,797.6	21,591.5	19,850.1	955.5	34,125.1	10,057.7	11,451.2	12,191.2	425.0
1948	59,370.9	19,338.6	20,823.7	18,189.5	1,019.1	31,998.0	9,687.9	10,991.1	10,855.8	463.2
1947	56,867.8	18,851.3	20,259.8	16,606.4	1,150.3	30,088.0	9,320.3	10,712.2	9,538.4	517.1
1946	55,165.4	18,447.5	19,863.3	15,483.5	1,371.1	28,830.3	9,023.8	10,587.8	8,599.6	619.1
1945	54,250.3	18,192.9	19,622.4	14,943.7	1,491.3	28,338.1	8,904.3	10,600.7	8,148.7	684.4
1944	53,553.3	18,090.6	19,530.6	14,528.1	1,404.0	28,171.9	8,952.3	10,734.7	7,772.9	712.0
1943	52,884.0	18,065.5	19,404.3	14,180.5	1,233.7	28,022.5	9,045.0	10,813.8	7,410.6	753.1
1942	52,129.1	17,932.2	19,187.6	14,013.3	996.0	27,626.8	9,012.7	10,788.7	7,144.0	681.4
1941	51,128.7	17,661.6	18,989.2	13,803.9	674.0	26,913.5	8,855.6	10,765.8	6,814.8	477.3
1940	50,292.8	17,394.7	18,877.6	13,646.5	374.0	26,329.7	8,755.7	10,800.4	6,532.0	241.6
1939	50,059.7	17,220.3	18,946.2	13,659.0	234.2	26,227.8	8,776.0	10,880.4	6,443.6	127.8
1938	50,136.4	17,126.0	19,062.9	13,738.2	209.3	26,353.2	8,855.1	10,961.0	6,418.1	119.0
1937	50,006.1	17,002.2	19,059.7	13,763.8	180.4	26,377.9	8,906.9	11,017.3	6,352.4	101.3
1936	49,907.9	16,856.5	18,958.0	13,920.5	172.9	26,525.7	8,965.5	11,078.7	6,394.3	87.2
1935	50,164.8	16,764.4	18,803.0	14,397.2	200.2	26,965.7	9,094.4	11,168.2	6,618.8	84.3
1934	50,661.6	16,724.6	18,664.7	15,025.8	246.5	27,633.4	9,275.7	11,301.8	6,962.2	93.7
1933	51,290.0	16,719.1	18,561.5	15,710.4	299.0	28,524.2	9,484.9	11,486.7	7,432.0	120.6
1932	51,868.9	16,711.7	18,406.4	16,402.5	348.3	29,426.6	9,692.7	11,618.7	7,957.5	157.7
1931	51,811.0	16,604.1	18,019.3	16,813.2	374.4	29,850.6	9,818.5	11,492.2	8,352.1	187.8
1930	50,748.6	16,313.6	17,387.6	16,680.9	366.5	29,468.1	9,791.6	11,078.0	8,404.1	194.4
1929	48,988.0	15,787.7	16,649.9	16,201.9	348.8	28,380.3	9,544.9	10,536.5	8,114.1	184.8
1928	47,251.8	15,163.4	15,953.2	15,799.6	335.6	27,150.9	9,181.5	10,029.3	7,767.7	172.4
1927	45,985.9	14,643.5	15,440.6	15,588.2	313.6	26,319.6	8,909.3	9,697.4	7,552.5	160.4
1926	45,084.2	14,264.5	15,046.8	15,482.5	290.4	25,936.7	8,776.5	9,502.1	7,505.2	152.9

Series F193-202. Industry gross and net capital stock, at original cost, by structure and machinery and equipment, mid-year, 1926 to 1975

(millions of dollars)

Year	Gross stock					Net stock				
	Total	Construction		Machinery and equipment	Capital items charged to operating expenses	Total	Construction		Machinery and equipment	Capital items charged to operating expenses
		Building	Engineering				Building	Engineering		
	193	194	195	196	197	198	199	200	201	202
1975	190,390.7	42,130.7	56,186.3	89,701.6	2,372.1	134,791.1	31,739.2	43,647.7	58,081.4	1,322.8
1974	171,001.0	37,957.4	50,668.8	80,292.6	2,082.2	119,965.1	28,358.1	39,196.7	51,280.6	1,129.7
1973	155,058.8	34,488.5	46,252.0	72,466.6	1,851.7	108,171.2	25,600.4	35,758.7	45,827.8	984.3
1972	142,266.6	31,849.8	42,455.7	66,245.0	1,716.1	99,232.6	23,608.1	32,862.2	41,859.9	902.4
1971	131,438.1	29,699.3	38,939.9	61,145.8	1,653.1	91,908.6	22,049.4	30,158.7	38,843.8	856.7
1970	121,577.4	27,739.6	35,707.5	56,550.6	1,579.7	85,190.9	20,617.4	27,639.7	36,127.1	806.7
1969	112,585.9	25,941.8	32,967.2	52,193.3	1,483.6	79,079.8	19,299.3	25,511.7	33,504.7	764.1
1968	104,463.9	24,306.4	30,542.9	48,231.3	1,383.3	73,590.4	18,123.2	23,611.9	31,112.3	743.0
1967	96,505.0	22,666.4	28,236.5	44,344.0	1,258.1	67,998.1	16,906.1	21,763.6	28,624.5	703.9
1966	88,258.1	20,815.6	26,047.4	40,294.8	1,100.3	61,848.1	15,437.7	19,999.1	25,791.2	620.1
1965	80,779.6	19,058.1	24,065.4	36,698.9	957.2	56,220.3	14,035.2	18,411.4	23,248.1	525.6
1964	74,679.6	17,677.4	22,329.0	33,812.6	860.6	51,830.4	12,968.6	17,053.2	21,353.4	455.2
1963	69,717.9	16,570.5	20,832.5	31,518.6	796.3	48,446.1	12,118.9	15,914.9	19,999.0	413.3
1962	65,515.4	15,597.4	19,543.7	29,606.7	767.6	45,707.9	11,371.6	14,954.2	18,990.3	391.8
1961	61,505.5	14,663.5	18,244.2	27,834.7	763.1	43,152.2	10,657.1	13,968.5	18,144.2	382.4
1960	57,413.2	13,738.1	16,937.1	25,998.2	739.8	40,506.4	9,938.1	12,954.6	17,238.3	375.4
1959	53,248.9	12,811.6	15,654.3	24,086.6	696.4	37,693.6	9,203.9	11,939.1	16,187.6	363.0
1958	49,073.2	11,963.0	14,167.7	22,275.5	667.0	34,735.4	8,524.0	10,701.5	15,153.8	356.1
1957	44,480.0	11,101.3	12,413.7	20,332.7	632.3	31,211.5	7,797.0	9,177.6	13,899.9	337.0
1956	39,743.2	10,174.0	10,769.4	18,218.6	581.2	27,453.9	6,999.9	7,736.5	12,416.8	300.7
1955	35,913.5	9,364.5	9,587.5	16,422.6	538.9	24,571.4	6,335.4	6,731.5	11,225.3	279.2
1954	32,844.2	8,686.1	8,718.4	14,936.4	503.3	22,389.6	5,789.5	6,020.3	10,309.3	270.5
1953	29,704.6	8,017.7	7,885.2	13,340.5	461.2	20,052.2	5,229.9	5,328.1	9,240.9	253.3
1952	26,554.3	7,406.2	7,031.2	11,702.1	414.8	17,584.9	4,715.2	4,599.4	8,043.6	226.7
1951	23,734.6	6,852.7	6,310.6	10,206.4	364.9	15,353.9	4,256.6	3,993.8	6,905.5	198.0
1950	21,420.3	6,368.2	5,766.9	8,931.3	353.9	13,519.6	3,856.0	3,554.0	5,931.2	178.4
1949	19,540.4	5,979.1	5,302.9	7,883.5	374.9	12,009.4	3,543.2	3,183.2	5,108.6	174.4
1948	17,859.7	5,606.0	4,918.6	6,946.9	388.2	10,642.8	3,248.0	2,882.2	4,334.0	178.6
1947	16,490.1	5,263.2	4,646.3	6,148.2	432.4	9,516.1	2,979.9	2,685.6	3,657.7	192.9
1946	15,612.2	4,997.2	4,473.7	5,628.2	513.1	8,822.1	2,782.5	2,584.2	3,225.0	230.4
1945	15,124.4	4,822.7	4,371.4	5,378.5	551.8	8,512.1	2,677.7	2,549.6	3,028.0	256.8
1944	14,710.5	4,719.5	4,316.4	5,163.1	511.5	8,319.4	2,644.5	2,558.0	2,851.9	265.0
1943	14,286.8	4,639.8	4,248.1	4,955.9	443.0	8,128.5	2,629.2	2,548.7	2,675.4	275.2
1942	13,818.9	4,519.8	4,153.0	4,797.4	348.7	7,849.1	2,569.3	2,509.6	2,527.9	242.3
1941	13,269.9	4,362.1	4,067.3	4,614.5	226.0	7,469.1	2,472.9	2,478.5	2,355.2	162.5
1940	12,827.5	4,234.2	4,007.3	4,467.9	118.1	7,174.3	2,409.8	2,470.3	2,216.3	77.9
1939	12,605.3	4,152.6	3,980.4	4,402.9	69.4	7,073.0	2,393.3	2,477.2	2,163.6	38.9
1938	12,476.2	4,093.9	3,961.7	4,360.3	60.3	7,050.7	2,396.7	2,484.8	2,134.0	35.2
1937	12,296.4	4,023.6	3,929.7	4,294.1	49.0	6,994.0	2,389.1	2,487.7	2,088.8	28.4
1936	12,164.3	3,953.9	3,888.0	4,277.7	44.7	6,985.0	2,384.3	2,493.2	2,084.9	22.6
1935	12,163.7	3,907.5	3,842.4	4,362.7	51.1	7,079.3	2,404.7	2,506.1	2,147.2	21.3
1934	12,230.4	3,877.6	3,804.7	4,483.9	64.2	7,241.9	2,440.7	2,529.9	2,247.5	23.8
1933	12,331.4	3,856.5	3,776.8	4,617.7	80.4	7,467.1	2,483.9	2,565.4	2,386.5	31.3
1932	12,411.3	3,834.4	3,736.9	4,743.9	96.1	7,695.9	2,525.5	2,589.2	2,539.4	41.8
1931	12,311.1	3,782.3	3,640.7	4,783.0	105.1	7,789.9	2,539.9	2,555.2	2,646.2	51.6
1930	11,923.6	3,671.0	3,477.5	4,669.8	105.3	7,631.7	2,498.1	2,439.6	2,638.9	55.1
1929	11,291.9	3,476.7	3,278.5	4,435.0	101.7	7,219.0	2,373.4	2,284.9	2,507.5	53.2
1928	10,643.3	3,249.4	3,091.4	4,203.3	99.2	6,750.6	2,210.8	2,137.8	2,351.9	50.1
1927	10,146.4	3,065.5	2,956.4	4,030.8	93.7	6,412.2	2,086.4	2,038.7	2,239.7	47.4
1926	9,766.0	2,933.5	2,848.4	3,896.2	87.9	6,199.6	2,011.2	1,970.9	2,171.4	46.1

Series F221-224. Non-farm business inventories, year-end book value estimates, 1925 to 1976
(millions of dollars)

Year	Current dollars		Constant (1971) dollars	
	Total non-farm	Manufacturing	Total non-farm	Manufacturing
	221	222	223	224
1976	38,234	18,558	24,207	11,311
1975	35,144	17,161	23,464	11,058
1974	32,664	16,210	23,808	11,454
1973	24,672	11,883	21,079	10,054
1972	20,868	9,821	19,720	9,323
1971	19,045	9,084	18,885	9,048
1970	17,973	8,756	18,479	8,953
1969	17,522	8,603	18,251	8,982
1968	15,976	7,777	17,208	8,432
1967	15,155	7,496	16,593	8,179
1966	14,613	7,238	16,368	8,057
1965	13,252	6,488	15,203	7,370
1964	11,697	5,775	13,751	6,679
1963	10,834	5,312	12,886	6,169
1962	10,235	5,048	12,405	5,968
1961	9,705	4,817	11,878	5,751
1960	9,150	4,504	11,249	5,410
1959	8,781	4,352	10,830	5,252
1958	8,289	4,136	10,356	5,061
1957	8,485	4,260	10,634	5,226
1956	8,158	4,128	10,305	5,081
1955	7,163	3,592	9,375	4,548
1954	6,871	3,457	9,181	4,522
1953	7,071	3,604	9,338	4,672
1952	6,652	3,431	8,770	4,453
1951	6,698	3,456	8,670	4,353
1950	5,495	2,752	7,910	3,783
1949	4,723	2,413	7,299	3,620
1948	4,459	2,348	7,068	3,589
1947	3,859	2,111	6,960	3,654
1946	2,867	1,596	6,161	3,342
1945	2,249	1,352	5,314	3,084
1944	2,074	1,229	4,997	2,829
1943	2,024	1,186	4,988	2,772
1942	1,940	1,033	4,910	2,471
1941	2,037	1,059	5,364	2,660
1940	1,747	893	5,039	2,426
1939	1,537	753	4,800	2,199
1938	1,386	707	4,512	2,151
1937	1,463	725	4,567	2,093
1936	1,263	618	4,250	1,919
1935	1,161	577	4,048	1,861
1934	1,107	564	3,936	1,830
1933	1,051	540	3,884	1,821
1932	1,100	564	4,086	1,973
1931	1,331	676	4,483	2,128
1930	1,564	805	4,647	2,271
1929	1,716	835	4,567	2,056
1928	1,559	793	4,181	1,936
1927	1,435	721	3,887	1,758
1926	1,304	673	3,464	1,604
1925	1,191	646	3,073	1,475

Current indexes are published monthly and are available for other cities in Canada. Historical series of shorter duration also are available on request for other cities and separately for Saskatoon, Regina, Edmonton and Calgary. Indexes for major components of each city index are published currently and these as well as more detailed component indexes over varying historical periods are available on request from the Prices Division, Statistics Canada, Ottawa.

Wholesale Price Indexes (Series K33-55)

General note

The term wholesale price indexes may be ambiguous. The indexes include prices at various stages in the production and distribution of raw and processed materials, semi-finished goods and fully manufactured products. The prices relate to larger scale or bulk transactions. The indexe should not be interpreted therefore as relating to prices 'wholesalers' or the 'wholesale trade'. Rather, the indexe measure movements of prices of a very broad but ill-define mix of materials and products below the retail level.

The wholesale price indexes presented in this edition ar those presented in the 1965 edition are listed in the tab below, including the periods covered in each edition and th price reference base periods. The dash (-) in columns (and (2) indicates the series is not included in the editio specified in the column heading.

For index numbers in the 1965 edition not repeate herein, namely J1-14, J15-33, J45-61 and J62-69 and d scriptions of them, readers are referred to Section J: Pric Indexes (beginning page 281) in the 1965 edition. Note als that old series J73-74 have been continued in this edition a series K137 and 140, a later subsection (Construction Pric Indexes).

Series No.			Period covered		Price reference period = 100	
Current edition	1965 edition	Series title	Current edition	1965 edition	Current edition	19(editi
–	J1-14	Wholesale price indexes, by commodity groups (Mitchell)	–	1868-1925	–	19(
–	J15-33	Wholesale price indexes by commodity groups (Dept. of Labour)	–	1890-1924	–	1890-9
K33-43	J34-44	Wholesale price indexes, chief component material classification	1867-1975	1867-1960	1935-39	1935-3
–	J45-61	Wholesale price indexes, classified according to origin and degree of manufacture	–	1890-1948	–	192
–	J62-69	Wholesale price indexes, classified according to purpose	–	1890-1948	–	192
K44-46	J70-72	Wholesale price indexes, classified according to degree of manufacture, industrial materials	1890-1975	1890-1960	1935-39	1935-3
K137	J73-74 140	Wholesale price indexes, classified by residential, non-residential building materials	1926-75	1926-60	1971	1935-3 194
K47-55	J75-83	Wholesale price indexes of Canadian farm products	1890-1974	1890-1960	1935-39, 1913	1935-3 191

K33-43. General Wholesale Price Index, classified by chief component material, 1867 to 1975

SOURCE: *Historical Statistics of Canada,* (1965 edition), pp. 293-294 for period 1867 to 1960; *Prices and Price Indexes* (Catalogue 62-002), successive issues, for period 1961 to 1975; CANSIM, Matrix No. 262. Current indexes are published in the monthly *Industry Price Indexes,* (Catalogue 62-011).

The general wholesale price index is a linked series of five separate indexes, each covering a specific period within the longer term, and each having a unique weighting diagram representing an updating of weights to reflect the changed mix of materials and products of the successive index periods. The five period-indexes may be summarized as follows:

Index designation	Period covered	Weight base per	Price reference period = 100	Link ratio period	
(a)	1867-1889	none	1890		
(b)	1890-1912	around 1900	1890	1890	Net weight
(c)	1913-1925	1913	1913	1913	
(d)	1926-1934	1926	1926	1926	
(e)	1935-1975	1935-39	1935-39	Dec. 1934	

The description of the indexes and methods in constructing them given below have been condensed for the period 1867 to 1960 from the more detailed account provided in the 1965 edition of this publication (pp. 281-284).

The index numbers designated (a) in the above summary covering the period 1867 to 1889 were computed as unweighted geometric means of price relatives of 89 commodities. Prices were obtained from newspapers and trade journals. Indexes for components within the general (total) index were at best only approximate indicators of price movements for each group because of the small numbers of quotations, which were chiefly in the vegetable and animal product groups. The indexes were calculated retroactively on the price reference base 1890 = 100 and were linked to the (b) index using the link ratio between items for the year 1890.

For the (b) index of the period 1890 to 1912, a weighted Laspeyres index formula was introduced. Weights were 'net' quantities marketed in a period not later than 1900, that is, around 1900. The concept of 'net' marketings required that the quantities marketed of a commodity, for example wheat, be exclusive of quantities which were later used in domestic processing or production of another product, for example flour. This avoided over-weighting of the price of commodities at earlier stages of production which would be duplicated otherwise through prices of commodities at later stages. Prices were obtained from newspapers and trade journals, a major source being the Department of Labour's collection mainly from trade journals. The number of price series ranged between 203 and 247. As stated above, the (a) and (b) indexes were linked using the link ratio of 1890.

In the (c) index, for 1913 to 1925, a weighted Laspeyres-type index was continued with commodity weights updated to net marketings of the year 1913. The number of price series used in the index was 236. Lesser use was made of newspapers and trade journals for prices, with business firms and government agencies becoming an alternative source. This index was linked to the preceding (b) index using the link ratio for 1913.

The (d) index, for 1926 to 1934, was based on an updated weighting diagram, using net marketings of commodities in 1926. The number of price series was almost doubled to 502 and more use was made of mail surveys of business firms in price collection. The (d) index produced on the price reference base 1926 = 100, was linked with the linked series using the link ratio for 1926.

The (e) index, for 1935 to 1975 (1935-39 = 100), incorporates the last official updating of the weighting system for the general wholesale price index. The concept of the weights was changed to 'gross' marketings, that is, no adjustments were made to earlier-stage full marketings of a commodity for quantities used in domestic production of other products. Weights were based on marketings of the period 1935 to 1939. The weighting system included commodity, sub-group and group weights. The number of price series in the index was increased to 604. Specifications of transactions for pricing were improved and the principal source of prices were industrial firms and government agencies with direct market contacts. The majority of prices were collected by mail monthly, as of the 15th of the month. The (e) index was linked to the preceding linked series (1867 to 1934) using the ratio of the new to former series at December 1934. This automatically placed the entire series 1867 to 1975 on the 1935-39 = 100 price reference base.

Since 1960 index content and weighting has remained largely unchanged from that described in the 1965 edition of this volume. No changes have been made in the relative weights of major groups (K35-39, K41-43) in the index. Within major groups some changes were effected directly or implicitly. In the non-ferrous metals group, series K41, the relative weight for gold was reduced substantially in the early 1970s based on changes in production of minerals since 1961. Also, with development of the Industry Selling Price Indexes for manufacturing indexes (see below, series K68-107) commodity price series based on expanded price samples in that system of indexes became available. Where such new commodity series were appropriate in terms of item content and internal weighting, they were introduced into the General Wholesale Price Index by linking at the commodity level. This was done within the major group 'Iron and its products' in the earlier 1970s and implicitly altered the relative weightings of commodity content within the major group. By weight, only about 10 per cent of the General Wholesale Price Index was affected by such substitution of industry indexes. Most substitutions of this type have occurred in more recent years so that by the end of 1977 perhaps up to one-third of the General Wholesale Index, by weight, was represented by Industry Selling Price Indexes.

The General Wholesale Price Index is a commodity classified index. It is 'general', covering a heterogeneous mix of transactions rendering it incapable of association with any well-defined value aggregate. Its principal characteristic is its long historical continuity, an attribute useful for long-term cycle analyses. Its usefulness for shorter-term current analyses is doubtful and for this purpose it is being superseded by other specifically-defined indexes, for example, Industry Selling Price Indexes and Construction Price Indexes.

K44-46. General Wholesale Index, classified by degree of manufacture, 1890 to 1975

SOURCE: same as series K33-43.

These two series are merely regroupings of the major group indexes (K35-43) of the general wholesale price indexes described above, with grouping according to the two degrees of manufacturing specified in the column headings. Weights used in regrouping the indexes are those attached to component indexes in the general index, K34.

K46. Thirty industrial materials (price index), 1926 to 1975

SOURCE: CANSIM, Matrix No. 131. Current indexes are published monthly in the monthly *Industry Price Indexes*, (Catalogue 62-011).

This index was included in the 1965 edition of this volume as series J72 (p. 285), for the period 1926 to 1960.

The series was introduced in a reference paper published in 1939 (*Canadian Index Numbers of Industrial Material Prices*, Catalogue 62-D-71). Its purpose is to provide early and frequent (week-by-week) statistical measurement of price behavior in markets for basic materials required as inputs by industry. It was and still is an unweighted geometric mean of the price relatives of 30 selected commodities. The original selection, based on intensive testing of volatility, sensitivity to changing economic conditions and importance to industries, included 18 commodities sensitive to economic changes and 12 which exhibited a more stable price behavior. The commodities selected are listed on page 21 of the above reference paper (Catalogue 62-D-71). Of the 30, five are food and 25 are manufacturing materials.

grading, granular base course, and paving. Indexes are published currently at the all-item, major component and item levels.

Implicit Price Indexes of Gross Fixed Capital Stocks (Series K160-171)

General note

Price indexes of fixed capital stocks are presented in this publication for the first time in the current edition. No price indexes of capital stock were included in the 1965 edition.

The price indexes are termed implicit because they are derived indirectly as the percentage ratio of two value series, namely, the time series of annual current-dollar value of fixed stocks and the corresponding annual constant-dollar value series. Movements through time in the current-dollar series ($\geqq p_n q_n$) result from both price and quantity changes, whereas movements in the constant-dollar series ($\geqq p_o q_n$) result *theoretically* from quantity change only. The annual ratios between the two series thus implicitly reflect the price movements embedded in the current-dollar value series.

Algebraically, the implicit price indexes may be written

$$I^P = \frac{\Sigma p_n q_n}{\Sigma p_o q_n} \times 100$$

in which the p's and q's denote prices and quantities respectively and the subscripts '$_o$' and '$_n$', the price reference base year and any given year respectively. The symbol $\geqq$ indicates summation over the items included in the aggregate. The index (I^P) is a Paasche price index, the superscript denoting Paasche. In this current-weighted index, the weights (q_n) are the quantities of the given year and these are different for different given years. Thus, while the movement of this index between the base reference year '$_o$' and any given year results from price change only, index movements between any other years in the series result from price change and some quantity changes. This contrasts with the Laspeyres base-weighted price index (described earlier in this section) in which price index movements throughout the series arise from price change only because quantities (the basket) are kept constant.

A principal favourable attribute of the Paasche price index is that its use in deflation of value indexes yields Laspeyres quantity indexes. Again algebraically, in ratio form,

$$\frac{\Sigma p_n q_n}{\Sigma p_o q_o} \div \frac{\Sigma p_n q_n}{\Sigma p_o q_n} = \frac{\Sigma p_o q_n}{\Sigma p_o q_o}$$

in which the first ratio (index) is the value series, the second is the Paasche price index and the term on the right is the Laspeyres quantity index. For many uses, it is the Laspeyres quantity index that is appropriate, for example, in studies of productivity and growth. In these uses, however, it is often the constant-dollar series itself ($\geqq p_o q_n$) which is most useful and it can be derived directly by deflating (dividing) the current-dollar series by the price index, thus

$$\Sigma p_n q_n \div \frac{\Sigma p_n q_n}{\Sigma p_o q_n} = \Sigma p_o q_n$$

from this it is obvious that the price index is implicitly derivable given the current- and constant-dollar series.

Unfortunately, in practice, Paasche price indexes are seldom available and Laspeyres base-weighted price indexes are used. However, the deflation is carried out at as low a level of components of an aggregate as possible. The resulting constant-dollar values of the components are then summed in each period (a year, say) to higher levels of aggregations. The implicit price indexes derived by dividing the current-dollar series by the resultant constant-dollar series are (1) Laspeyres price indexes at the component level at which the initial deflation was carried out and (2) quasi-Paasche-type price indexes at the higher levels of aggregation. In the higher level indexes, the components are weighted implicitly by the relative current values of the components. In this sense they are partly base-weighted and partly current- weighted and, therefore, termed quasi-Paasche price indexes.

K160-171. Fixed Capital Stocks Price Indexes (implicit), by industry and type of stock, 1926 to 1975

SOURCE: for 1926 to 1975, *Fixed Capital Flows and Stock, 1926-1978*, (Catalogue 13-568). In addition to the implicit price indexes, this occasional publication includes the current- and constant-dollar capital stock series and the basic price indexes used in their derivation. Current indexes are available from the Construction Division, Statistics Canada on request.

Price indexes of gross fixed capital stocks are presented for major classes of stocks, namely, building construction, engineering construction, and machinery and equipment and for total stocks, within each of manufacturing industries, non-manufacturing industries and total industries categories in the Standard Industrial Classification. They are implicit price indexes calculated as percentage ratios of the current-dollar value to the constant-dollar value, annually, of gross fixed capital stocks at mid-year.

The current- and constant-dollar value series cover fixed tangible capital stocks produced by human effort. They exclude natural resources. The constant-dollar gross stock value series is derived on the basis of the 'perpetual inventory' method. In this method, the annual gross additions to stock (gross capital formation) for each detailed type of stock are revalued in prices of a selected price-base year. The revalued annual additions are then cumulated annually over time with deduction from the cumulative total in each year of previous additions whose estimated lifespans have expired. In the gross stock series no deductions are made for gradual depreciation, only the deduction for complete discard at the end of the expected life of the asset. The series by type of stock within industry groups are then summed to higher levels of aggregation.

The current-dollar series is derived from the constant-dollar series by inflating the latter to prices of the respective current years, using price indexes at the lowest component level possible within the series. The resulting annual current-dollar series for detailed components may then be summed to desired higher classes of aggregates.

The price indexes employed in deflation are primarily period price indexes of the Laspeyres base-weighted type. For construction, these deflators are primarily input indexes of materials and labour with weighting appropriate to type of structures, and deflation is undertaken at the level of type of structure. No adjustment is made for changes in profit margins (including the return to capital used in construction) or productivity in construction. In more recent periods, available in-place price indexes have been incorporated in the deflators. For machinery and equipment the deflators tend more to be output price indexes, particularly

in more recent years. The historical series of constant-dollar values is a linked series, each segment of which is deflated by price indexes with price reference bases appropriate to the respective time segments.

The basic source document on methods used in fixed capital stock estimating is *Fixed Capital Flows and Stocks, Manufacturing, Canada, 1926-1960: Methodology,* (Catalogue 13-522). Historical series of both current- and constant-dollar values, annually, may be obtained from CANSIM, by industry and industry groups. The Matrix numbers for each industry and group are specified in table 3, page XV of *Fixed Capital Flows and Stocks,* (Catalogue 13-211). See also the descriptive text and historical series F183-224 in this publication.

Implicit Price Indexes of Gross National Expenditures (Series K172-183)

General note

For a discussion of the concept, interpretation and methods in principle for 'implicit' price indexes, see the general note for series K160-171 above.

The series K172-183 presented in this edition correspond precisely to series J153-164 in the 1965 edition. They have been extended in time to cover the period 1926 to 1975 and have been placed on a 1971 = 100 price reference base. In the 1965 edition the reference base is 1949 = 100. Also, for series K176 and K177, the series is extended back from 1949 to 1926 in the current edition.

K172-183. Implicit Price Indexes of Gross National Expenditures, 1926 to 1975

SOURCE: CANSIM: Matrix No. 529, except for K173 and K175 (the latter two from files of National Income and Expenditure Division, Statistics Canada). Current indexes are published in *National Income and Expenditure Accounts,* (Catalogue 13-001), quarterly and (Catalogue 13-201) annually.

These indexes are derived as percentage ratios of annual current-dollar values and constant-dollar values (1971 dollars) of the respective categories of gross national expenditures in Canada. The concepts, scope and content of these two value series and the methods employed in constructing them are outlined elsewhere in this publication (see the descriptive text and tables for series E14-32 and E33-35).

The constant-dollar series (E33-35) is based on deflation of the current-dollar series using primarily Laspeyres base-weighted price indexes at detailed disaggregated component levels of expenditure. Deflation is done separately for five successive time segments of the historical series, the deflators and the resulting constant-dollar series for each segment having different price reference bases appropriate to the respective periods. These are arithmetically linked to form the historical constant-dollar value series. The implicit price indexes are then computed for each year by dividing the current-dollar series by the constant-dollar series (and multiplying by 100) at each level of aggregation for which a price index is required. The resulting historical series of price indexes may be said to be composed of the following time-segment price indexes: 1920 to 1946, 1947 to 1955, 1956 to 1960, 1961 to 1970 and 1971 to 1975.

A feature of the deflators used for non-residential construction (K180) since 1949 is an annual adjustment of the price indexes of material and labour inputs for estimated rates of change in labour productivity in construction. Similar adjustment is made to the input deflators for residential construction (K179) for the period 1949 to 1970, while for the period 1971 forward direct valuations in terms of 1971 dollars are employed. The implicit indexes for these two series can be expected to move differently from the building construction input price indexes recorded previously (above) as series K136 and K139.

Series K33-43. General Wholesale Price Index, classified by chief component material, 1867 to 1975

(1935-39 = 100)

Year	General index		Vegetable products	Animals and their products	Fibres, textiles, textile products	Wood, wood products, paper	Iron and its products	Non-ferrous metals and their products		Non-metallic minerals and their products	Chemicals and allied products
	Excluding gold	Including gold						Excluding gold	Including gold		
	33	34	35	36	37	38	39	40	41	42	43
1975	510.2	491.6	469.6	537.5	404.9	641.7	519.9	606.2	417.4	392.1	383.9
1974	480.2	461.3	485.6	493.0	423.1	563.1	447.7	607.5	417.7	331.2	325.3
1973	392.1	376.9	354.9	455.3	337.7	504.1	354.3	478.5	326.5	254.1	263.3
1972	322.9	310.3	249.2	371.8	278.3	436.0	325.0	388.4	262.9	233.6	245.5
1971	302.7	289.9	237.1	326.0	261.9	394.4	316.4	387.6	260.1	225.8	237.8
1970	300.6	286.4	238.4	326.0	257.0	377.5	305.1	422.9	281.0	215.8	225.7
1969	295.0	282.4	237.9	322.4	256.7	389.4	285.8	389.6	264.0	210.0	219.7
1968	281.4	269.9	230.8	294.6	256.5	367.9	276.8	365.8	250.8	206.0	213.7
1967	274.7	264.1	230.9	293.1	252.7	346.3	274.4	346.6	240.2	199.2	212.6
1966	269.4	259.5	225.9	296.2	251.5	337.8	268.0	328.2	229.9	193.7	207.1
1965	259.3	250.4	218.4	270.7	246.6	334.0	264.5	306.1	217.6	191.6	200.2
1964	253.3	245.4	223.3	250.8	248.4	330.9	256.4	284.9	205.9	190.9	191.2
1963	251.8	244.6	227.8	255.6	248.0	323.4	253.6	270.0	197.5	189.5	189.3
1962	246.9	240.0	211.6	262.5	241.2	315.9	256.2	260.8	192.1	189.1	190.5
1961	239.8	233.3	203.1	254.7	234.5	305.1	258.1	246.5	181.6	185.2	188.7
1960	237.4	230.9	203.0	247.6	229.8	303.8	256.2	242.9	177.8	185.6	188.2
1959	237.0	230.6	199.5	254.3	228.0	304.0	255.7	238.0	174.6	186.5	187.0
1958	233.5	227.8	198.1	250.7	229.0	298.5	252.6	224.1	167.3	188.5	183.0
1957	233.8	227.4	197.0	238.4	236.0	299.4	252.7	240.7	176.0	189.3	182.3
1956	233.7	225.6	197.3	227.7	230.2	303.7	239.8	280.2	199.2	180.8	180.1
1955	226.0	218.9	195.1	226.0	226.2	295.7	221.4	259.3	187.6	175.2	177.0
1954	222.7	217.0	196.8	236.0	231.1	286.8	213.4	224.1	167.5	177.0	176.4
1953	226.3	220.7	199.0	241.7	239.0	288.6	221.4	225.3	168.6	176.9	175.7
1952	232.0	226.0	210.3	248.2	251.5	291.0	219.0	233.5	172.9	173.9	180.1
1951	246.3	240.2	218.6	297.7	295.9	295.5	208.7	241.6	180.6	169.8	187.3
1950	215.4	211.2	202.0	251.3	246.7	258.3	183.6	200.8	159.5	164.8	157.8
1949	201.7	198.3	190.5	237.5	222.5	241.6	175.5	179.9	145.2	158.3	155.2
1948	197.2	193.4	185.7	236.7	216.3	238.3	161.4	185.1	146.9	150.8	152.2
1947	165.8	163.3	157.3	183.0	179.5	208.8	140.7	155.1	130.2	129.1	136.7
1946	139.2	138.9	134.2	160.2	137.9	172.1	127.4	111.1	108.0	114.5	120.3
1945	132.0	132.1	131.6	150.0	130.8	154.9	117.9	106.4	107.6	113.5	124.0
1944	130.5	130.6	129.1	146.6	130.7	151.6	117.8	106.8	107.8	114.3	124.9
1943	127.8	127.9	123.5	146.9	130.8	142.2	116.8	106.8	107.8	115.6	125.3
1942	122.8	123.0	114.9	137.1	131.2	132.3	116.0	105.8	107.2	114.5	127.9
1941	116.2	116.4	106.1	123.8	128.4	127.0	112.8	105.7	107.2	111.1	118.6
1940	107.8	108.0	98.1	106.1	118.1	119.0	108.7	105.2	106.9	106.7	108.5
1939	99.0	99.2	89.1	100.6	98.9	107.5	104.8	98.1	100.0	99.7	100.3
1938	101.9	102.0	100.5	102.6	95.5	106.9	105.8	98.3	98.9	101.5	100.4
1937	108.4	107.7	118.6	105.6	105.4	102.5	105.4	114.6	107.7	100.6	101.1
1936	96.7	96.8	98.8	96.0	101.4	93.6	92.6	96.3	97.6	98.2	98.4
1935	94.1	94.4	92.9	94.9	99.6	89.9	91.7	92.5	95.7	99.7	99.9
1934	93.4	92.0	91.5	89.5	102.2	90.7	91.2	87.5	92.1	100.9	102.3
1933	87.4	87.4	81.4	79.1	97.8	87.2	89.5	87.5	85.7	99.1	102.4
1932	86.9	85.7	75.3	79.5	97.8	95.9	90.5	80.2	75.7	100.3	105.7
1931	94.0	93.2	78.1	98.4	103.0	109.7	91.6	87.9	77.1	101.5	109.2
1930	112.9	111.5	106.6	132.0	114.8	123.1	95.5	109.7	91.0	107.2	116.9
1929	124.6	122.8	125.7	145.2	128.1	130.3	98.2	134.9	106.8	109.0	120.2
1928	125.6	123.9	127.6	144.0	132.6	137.0	97.7	125.1	100.7	108.6	120.1
1927	127.3	125.5	135.0	135.8	131.5	136.7	100.9	124.4	100.3	113.2	123.9
1926	130.3	128.5	137.3	133.2	140.3	138.7	104.8	136.0	107.5	117.3	126.0
1925	133.8	131.1	138.1	133.6	157.8	141.0	109.6	141.3	108.7	117.7	125.5
1924	129.5	126.9	122.5	122.3	165.4	147.0	116.4	129.0	104.4	122.2	129.2
1923	127.7	125.3	114.9	126.6	164.0	156.8	121.4	129.6	104.6	122.5	131.6
1922	126.8	124.5	118.4	127.8	142.7	147.5	109.7	132.4	105.6	125.6	132.8
1921	143.4	140.4	142.1	146.0	134.6	179.5	134.2	132.0	105.5	136.8	147.4
1920	203.2	198.2	229.2	193.2	247.6	214.2	176.5	184.3	123.5	131.6	178.3
1919	174.7	170.6	186.8	187.5	229.8	152.0	145.8	181.6	122.6	109.9	148.0
1918	166.0	162.3	175.6	169.3	220.4	123.7	164.5	193.0	126.5	96.6	149.5
1917	148.9	145.8	171.0	147.1	160.8	110.8	159.2	195.7	127.5	84.1	123.6
1916	109.8	108.1	119.5	113.2	108.9	88.8	109.7	183.8	123.3	68.0	98.3
1915	91.8	90.6	103.8	98.6	81.8	78.4	77.4	145.4	110.0	61.9	85.9
1914	85.4	84.5	88.9	96.7	79.8	83.7	70.6	128.8	104.3	63.0	82.2
1913	83.4	82.6	79.8	94.4	81.6	88.7	72.3	133.9	106.1	66.7	79.8
1912	85.2	84.5	93.4	90.1	73.6	86.3	67.1	136.0	107.1	66.6	78.0
1911	81.1	80.3	85.8	81.2	76.2	86.1	66.3	118.4	99.4	62.5	74.4

Series K33-43. General Wholesale Price Index, classified by chief component material, 1867 to 1975 (concluded)

(1935-39 = 100)

Year	General index		Vegetable products	Animals and their products	Fibres, textiles, textile products	Wood, wood products, paper	Iron and its products	Non-ferrous metals and their products		Non-metallic minerals and their products	Chemicals and allied products
	Excluding gold	Including gold						Excluding gold	Including gold		
	33	34	35	36	37	38	39	40	41	42	43
1910	78.5	77.8	81.0	84.0	78.3	81.2	65.3	119.5	100.0	63.5	69.0
1909	77.6	76.9	85.1	80.3	73.6	73.9	66.4	115.1	106.4	64.2	67.3
1908	76.3	75.6	84.7	75.2	71.3	75.5	69.9	118.2	99.4	65.2	72.4
1907	76.4	75.8	81.1	76.0	78.7	76.7	72.3	156.8	115.9	63.6	73.4
1906	70.7	70.2	71.7	70.9	76.3	73.0	69.0	147.4	111.9	61.2	64.0
1905	70.4	70.0	75.9	69.8	71.1	68.4	65.0	127.6	103.5	62.4	65.5
1904	68.3	67.8	75.0	64.2	71.6	66.6	66.0	115.8	98.4	64.2	65.1
1903	67.5	67.1	70.9	65.9	65.9	66.4	70.6	112.5	97.0	65.1	63.3
1902	66.6	66.2	68.7	68.2	65.4	59.1	71.0	114.7	97.8	62.9	62.9
1901	63.7	63.5	64.6	64.3	65.1	55.9	71.2	136.3	107.2	60.7	64.4
1900	62.4	62.1	58.9	64.6	67.9	56.3	78.7	139.3	108.5	57.0	61.8
1899	60.6	60.4	63.7	61.1	60.9	51.5	67.5	129.6	104.3	53.7	58.4
1898	59.4	59.3	66.6	58.1	60.3	50.0	58.9	99.2	91.3	53.5	58.7
1897	56.8	56.7	59.7	56.2	61.3	49.6	59.1	95.7	89.8	54.0	59.0
1896	55.9	55.9	58.0	53.1	62.5	49.8	64.6	102.6	92.7	55.0	60.4
1895	57.9	57.8	60.8	56.4	61.3	51.8	64.0	97.9	90.8	55.1	60.0
1894	59.1	58.9	60.7	58.1	61.6	54.9	66.3	99.4	91.4	56.2	60.8
1893	63.2	63.0	66.3	63.4	65.5	53.6	71.2	117.0	98.9	57.5	61.3
1892	62.3	62.1	65.7	60.3	65.7	53.8	72.9	126.2	102.8	58.0	61.6
1891	67.1	66.8	80.7	60.3	69.0	53.0	75.0	138.6	108.1	57.2	62.8
1890	67.1	66.8	76.2	60.6	75.5	53.4	81.6	148.9	112.5	58.7	62.5
1889	66.1	65.8	77.0	64.7	73.3	52.2	76.8	144.6	109.7	55.5	62.6
1888	66.2	65.7	79.8	63.3	70.7	50.8	76.5	156.6	117.6	53.5	63.4
1887	63.7	63.6	71.4	63.6	75.3	49.7	74.3	131.3	101.0	53.4	62.4
1886	62.3	62.2	70.3	62.5	68.6	47.1	73.0	128.2	99.0	55.1	62.5
1885	63.3	63.1	72.2	62.8	67.0	48.1	75.2	131.2	100.9	57.2	62.7
1884	67.0	66.8	74.6	71.5	68.3	48.9	79.6	141.5	107.7	62.1	66.1
1883	70.2	69.8	82.0	73.5	72.2	51.1	80.5	152.8	115.0	66.3	65.8
1882	72.5	72.0	90.6	74.5	79.6	48.4	83.3	160.8	120.2	63.9	68.4
1881	72.4	71.9	91.8	72.5	85.6	43.0	83.6	161.3	120.5	63.8	71.9
1880	71.8	71.3	88.5	68.1	95.1	34.7	99.1	167.4	124.4	57.1	75.8
1879	65.5	65.2	79.3	60.0	74.2	37.8	84.2	154.9	116.4	54.0	73.4
1878	68.0	67.6	81.0	60.4	78.5	41.2	83.9	163.6	121.3	57.4	74.6
1877	73.4	72.9	90.5	67.4	90.8	42.7	90.7	169.2	125.2	62.3	75.6
1876	77.6	76.9	86.6	71.9	91.1	44.0	100.4	177.5	129.5	75.7	78.6
1875	82.8	82.0	91.7	73.8	104.9	48.1	113.2	183.3	134.0	77.1	81.4
1874	86.4	85.4	96.6	74.5	116.0	49.0	128.3	189.9	137.9	76.2	82.9
1873	90.9	89.6	91.4	74.7	129.9	46.8	147.0	205.9	147.6	88.5	83.9
1872	90.6	89.3	92.6	72.7	155.7	41.1	142.1	207.1	148.3	87.9	81.9
1871	81.3	80.3	92.4	71.8	112.5	40.6	104.6	195.8	141.5	81.3	76.7
1870	79.8	78.7	88.2	74.8	105.0	35.5	105.8	203.1	145.9	79.9	78.4
1869	80.7	79.6	89.1	73.7	117.4	33.9	106.7	203.8	146.9	81.0	78.6
1868	80.0	79.0	96.4	70.8	108.4	31.7	106.8	197.6	143.2	87.3	78.4
1867	80.2	79.1	94.0	71.2	107.7	30.5	114.8	—	—	—	—

Series K44-46. Wholesale Price Indexes, classified by degree of manufacture, 1890 to 1975

(1935–39 = 100)

Year	General wholesale index		Thirty industrial materials
	Raw and partly manufactured[1]	Fully and chiefly manufactured	
	44	45	46
1975	469.6	503.8	484.4
1974	468.3	457.4	494.7
1973	367.5	382.1	390.9
1972	272.4	331.8	299.5
1971	255.6	309.2	266.9
1970	265.0	298.4	268.8
1969	260.0	294.9	267.7
1968	249.1	281.6	254.0
1967	246.1	274.2	253.1
1966	242.7	268.6	261.4
1965	231.2	261.3	258.7
1964	225.7	256.4	258.3
1963	226.9	254.2	253.5
1962	223.8	249.0	248.0
1961	212.6	244.5	243.2
1960	209.6	242.2	240.4
1959	210.9	241.6	240.2
1958	209.3	238.3	229.8
1957	209.4	237.9	240.3
1956	215.8	231.5	248.2
1955	209.7	224.5	236.0
1954	204.8	224.2	223.7
1953	207.0	228.8	232.3
1952	218.7	230.7	252.6
1951	237.9	242.4	296.1
1950	212.8	211.0	244.6
1949	197.1	199.2	218.0
1948	196.3	192.4	222.7
1947	164.3	162.4	187.0
1946	140.1	138.0	148.6
1945	136.2	129.8	143.2
1944	134.4	129.1	143.1
1943	131.1	126.9	140.0
1942	123.0	123.7	135.1
1941	114.4	118.8	125.2
1940	103.1	109.9	113.3
1939	94.9	101.9	99.0
1938	99.4	103.5	95.8
1937	113.7	104.4	116.3
1936	98.2	96.1	96.9
1935	93.8	94.7	90.3
1934	90.0	95.3	86.3
1933	79.3	91.2	78.3
1932	75.3	90.7	74.2
1931	82.7	97.2	86.8
1930	106.5	113.4	110.3
1929	124.7	120.8	132.8
1928	124.6	123.4	134.4
1927	127.5	125.3	139.6
1926	127.7	129.9	144.3
1925	128.8	134.8	–
1924	121.3	132.4	–
1923	116.7	133.9	–
1922	121.2	130.4	–
1921	136.7	150.8	–
1920	194.7	203.3	–
1919	165.2	171.6	–
1918	153.4	165.9	–
1917	144.5	147.4	–
1916	110.0	109.9	–
1915	93.7	92.4	–
1914	86.0	85.2	–
1913	83.0	84.2	–
1912	86.5	83.8	–
1911	80.7	80.8	–
1910	78.5	80.9	–
1909	79.9	81.2	–
1908	76.9	82.9	–
1907	76.3	82.6	–
1906	73.2	78.2	–
1905	69.9	79.2	–
1904	69.0	77.2	–
1903	68.4	76.8	–
1902	66.3	76.1	–
1901	63.8	74.9	–
1900	61.9	76.4	–
1899	59.3	73.0	–
1898	59.7	72.2	–
1897	55.7	70.1	–
1896	53.4	70.7	–
1895	55.5	72.3	–
1894	55.4	74.4	–
1893	59.7	78.3	–
1892	59.0	78.8	–
1891	64.6	83.5	–
1890	63.3	86.1	–

[1] Includes gold prices.

Series K160–171. Implicit Price Indexes of Gross Fixed Capital Stocks, by industry group and type 1926 to 1975

(1971 = 100)

Year	Total industries				Manufacturing industries				Non-manufacturing ind		
	Total stocks	Building construction	Engineering construction	Machinery and equipment	Total stocks	Building construction	Engineering construction	Machinery and equipment	Total stocks	Building construction	Engineering construction
	160	161	162	163	164	165	166	167	168	169	170
1975	143.8	135.0	155.1	140.9	144.2	133.3	144.2	146.6	143.8	135.2	155.9
1974	127.6	126.5	137.1	122.3	126.4	124.3	128.2	126.6	127.8	126.9	137.8
1973	111.0	112.5	116.4	107.1	109.5	109.5	115.0	108.7	111.4	113.0	116.5
1972	104.1	103.6	106.5	102.5	103.0	102.0	107.1	102.9	104.3	103.9	106.5
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1970	94.4	94.7	90.4	97.3	95.5	94.7	86.7	97.0	94.1	94.8	90.7
1969	90.3	90.3	85.9	93.4	91.6	89.1	82.7	93.6	89.9	90.5	86.1
1968	86.5	85.2	81.5	91.3	87.8	84.5	78.4	90.4	86.3	85.3	81.7
1967	86.3	85.1	80.8	91.2	89.0	84.9	77.9	91.2	85.7	85.1	80.9
1966	84.9	81.7	78.4	91.6	89.8	81.5	74.3	93.9	83.5	81.8	78.5
1965	80.9	76.5	74.2	89.1	86.7	76.3	70.6	91.4	79.4	76.5	74.3
1964	77.0	73.1	69.7	86.1	82.3	73.0	67.8	86.0	75.8	73.2	69.7
1963	74.9	71.8	68.3	83.3	78.0	72.0	67.0	80.8	74.2	71.8	68.3
1962	72.7	70.4	66.0	81.1	75.1	70.8	65.0	77.6	72.2	70.3	66.0
1961	71.3	70.7	64.8	78.7	73.5	71.2	64.5	75.0	70.8	70.7	64.8
1960	71.7	70.6	66.4	77.8	71.7	71.3	64.8	72.6	71.7	70.5	66.5
1959	71.0	69.8	66.0	77.1	69.6	70.5	64.2	70.2	71.3	69.7	66.1
1958	69.9	70.2	64.8	75.9	69.0	71.1	63.2	69.3	70.0	70.0	64.8
1957	69.6	69.9	65.4	74.1	67.6	70.6	63.2	67.2	70.1	69.7	65.5
1956	68.3	69.6	65.5	70.1	65.5	70.6	62.4	64.1	69.0	69.3	65.6
1955	65.0	67.7	61.0	66.7	62.2	69.0	59.4	60.5	65.7	67.4	61.2
1954	63.7	67.0	58.4	65.9	60.3	68.4	58.0	58.1	64.4	66.7	58.4
1953	63.4	67.9	58.5	64.6	60.4	69.6	58.8	57.8	64.1	67.5	58.4
1952	62.5	67.2	58.7	63.1	59.4	68.6	57.0	56.4	63.4	66.7	58.8
1951	61.0	64.2	56.1	62.6	58.0	65.9	53.5	55.3	61.8	63.7	56.2
1950	54.3	57.0	49.1	56.7	52.6	59.0	48.2	51.4	54.7	56.7	49.1
1949	51.3	54.6	46.8	52.8	49.3	57.0	45.8	47.6	51.8	54.1	46.8
1948	48.5	52.6	45.3	48.7	46.6	54.5	43.9	44.6	49.2	52.0	45.4
1947	43.6	46.3	40.4	44.2	42.2	48.5	38.8	40.5	44.2	45.4	40.6
1946	38.6	41.5	34.5	39.6	38.2	43.5	33.1	36.2	38.8	40.6	34.6
1945	38.3	39.9	32.4	40.5	37.7	41.2	31.5	37.3	38.5	39.4	32.5
1944	38.5	39.5	31.3	41.4	38.8	40.6	31.1	38.9	38.4	39.2	31.3
1943	37.7	39.2	30.7	42.8	38.6	40.1	30.3	38.6	37.5	39.0	30.7
1942	37.6	37.2	29.6	43.3	37.7	38.1	29.0	38.2	37.5	36.8	29.6
1941	36.0	34.6	28.4	41.3	36.0	36.2	27.2	36.6	35.9	34.0	28.4
1940	32.9	31.6	26.4	37.7	33.1	33.5	24.9	33.6	32.8	30.7	26.5
1939	31.1	29.8	26.6	35.7	31.7	33.2	24.7	31.7	31.0	29.0	26.7
1938	31.2	29.9	27.0	35.6	31.8	33.4	24.3	31.7	31.1	28.6	27.0
1937	31.1	30.7	27.2	34.9	31.8	33.6	25.0	31.5	30.9	29.0	27.2
1936	28.8	28.3	25.1	32.9	29.1	31.7	23.1	27.9	28.7	27.0	25.2
1935	27.6	27.2	24.4	31.8	27.9	31.5	22.9	27.0	27.5	26.2	24.4
1934	27.4	27.0	24.6	31.3	27.2	31.3	21.8	25.9	27.4	25.9	24.6
1933	26.4	27.2	23.3	29.9	26.5	31.4	21.3	24.3	26.3	26.0	23.4
1932	27.1	28.2	24.1	31.2	27.2	32.7	22.9	25.0	27.1	27.4	24.1
1931	27.9	30.8	24.6	31.4	27.4	34.2	23.4	24.6	28.0	30.0	24.6
1930	29.7	33.4	25.8	32.2	29.8	36.4	25.0	27.2	29.7	32.5	25.9
1929	31.3	34.7	26.6	33.6	32.4	37.4	26.2	29.2	31.0	33.4	26.6
1928	30.1	32.8	25.6	32.5	31.4	35.7	25.2	29.0	29.7	31.4	25.6
1927	30.1	32.0	25.6	32.7	31.2	35.4	25.2	29.1	29.8	30.4	25.6
1926	30.4	31.2	26.5	33.5	31.2	35.1	26.2	29.8	30.2	29.8	26.5

Series K172-183. Implicit Price Indexes of Gross National Expenditures, 1926 to 1975

(1971 = 100)

Year	Gross national expenditure at market prices		Personal expenditure on consumer goods and services	Government expenditure on goods and services			Business gross fixed capital formation				Exports of goods and services	Imports of goods and services
	Total	Excluding inventories		Total	Current expenditure	Gross fixed capital formation	Total	New residential construction	New non-residential construction	New machinery and equipment		
	172	173	174	175	176	177	178	179	180	181	182	183
1975	146.5	145.1	137.1	150.6	155.5	153.1	149.5	167.8	149.3	138.5	168.7	153.3
1974	131.7	131.2	123.9	133.1	134.6	138.0	132.3	147.7	133.1	121.4	152.2	134.7
1973	114.6	114.7	111.6	116.6	116.4	114.8	114.1	123.8	114.3	106.9	117.4	111.2
1972	105.0	105.0	104.0	107.2	107.2	105.2	104.9	107.1	105.7	102.6	103.9	103.1
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1970	96.9	96.9	97.7	94.4	94.2	95.3	95.3	94.1	94.2	97.4	99.7	98.2
1969	92.6	92.5	94.3	89.4	89.0	91.2	91.5	92.1	89.6	92.9	96.4	95.6
1968	88.7	88.6	90.8	83.1	82.2	87.0	87.9	87.9	84.9	90.8	94.3	93.0
1967	85.9	85.8	87.2	79.5	77.8	86.8	87.1	87.0	84.1	90.7	93.0	90.7
1966	82.6	82.5	84.3	75.4	72.8	85.9	85.1	82.2	80.8	91.2	91.1	89.2
1965	79.1	79.0	81.6	70.8	68.2	81.3	81.0	77.2	76.2	88.4	88.7	87.3
1964	76.6	76.6	80.0	67.3	65.2	76.3	77.2	73.0	72.2	85.1	87.1	86.6
1963	74.8	74.6	79.0	65.2	63.1	74.0	74.5	70.1	70.3	81.8	85.3	85.9
1962	73.4	73.2	77.8	62.7	60.6	71.4	72.5	68.6	68.4	79.6	84.5	84.0
1961	72.4	72.5	76.8	61.2	59.1	70.4	71.6	68.8	68.1	77.0	81.3	80.3
1960	72.1	72.0	76.3	60.2	57.3	72.8	71.4	68.2	68.3	76.5	80.3	78.2
1959	71.2	71.1	75.6	58.5	55.3	72.2	70.4	66.9	67.7	75.5	79.8	77.5
1958	69.8	70.0	74.7	56.7	53.5	71.9	69.7	67.0	67.3	73.8	78.7	78.0
1957	68.8	68.8	72.8	55.9	51.9	75.8	69.6	67.2	67.6	72.7	79.0	76.9
1956	67.4	66.9	70.6	53.7	49.4	80.3	67.8	65.3	67.7	69.0	79.4	75.0
1955	65.0	65.0	69.5	49.6	46.2	72.5	64.9	64.3	64.4	65.0	77.3	72.6
1954	64.6	64.7	69.5	47.7	44.7	67.4	63.6	63.1	62.9	63.9	74.3	71.4
1953	63.6	63.3	68.8	45.8	43.0	67.3	63.8	63.7	63.7	63.2	74.9	71.2
1952	63.7	63.2	69.0	45.3	42.0	71.5	63.0	63.1	63.2	62.1	76.7	71.3
1951	61.0	60.3	67.4	43.6	40.2	69.9	61.0	62.0	59.7	60.9	77.6	76.7
1950	54.8	54.4	61.2	39.2	35.9	58.9	53.8	53.8	52.8	54.0	69.8	69.4
1949	53.5	53.6	59.4	37.6	34.6	56.6	51.5	51.2	51.3	51.1	66.8	64.9
1948	51.3	51.2	57.3	35.5	32.3	54.4	49.1	49.1	49.7	48.0	63.6	62.8
1947	45.7	45.5	50.5	30.6	28.3	48.5	43.2	41.9	44.5	42.7	59.3	56.2
1946	42.0	41.9	46.2	27.7	26.3	44.1	39.1	37.2	39.9	38.2	52.9	56.2
1945	40.8	41.8	44.7	27.3	26.8	42.7	37.8	34.8	37.6	37.8	48.1	50.1
1944	39.8	40.2	44.2	25.6	25.4	43.5	37.7	34.5	37.4	38.7	46.6	47.1
1943	38.6	39.1	43.8	24.5	24.3	42.5	37.1	33.1	36.9	39.1	43.5	45.9
1942	37.3	36.8	42.6	23.7	23.5	40.2	35.2	31.2	35.2	36.9	41.4	44.3
1941	35.7	35.7	40.7	22.0	21.4	37.3	33.4	29.4	32.6	35.4	38.8	41.9
1940	33.1	32.7	38.1	21.3	20.6	35.0	31.0	26.6	30.9	32.8	37.3	38.4
1939	31.6	31.1	36.4	21.5	19.6	34.2	29.1	25.1	29.9	30.3	34.0	36.4
1938	31.9	31.8	36.6	21.9	19.6	35.0	29.3	24.9	30.3	30.5	35.0	32.9
1937	31.9	32.4	36.0	22.1	19.4	35.1	29.5	25.4	30.9	30.3	37.1	33.3
1936	31.1	31.6	35.0	20.6	18.8	33.3	27.4	23.5	28.7	28.2	34.0	35.0
1935	30.1	30.2	34.4	20.4	18.6	32.3	26.9	23.1	28.0	27.9	32.6	32.4
1934	30.0	29.9	34.2	20.0	18.3	32.1	26.6	23.0	27.5	27.5	32.0	31.5
1933	29.6	29.7	33.7	19.7	18.1	32.1	26.4	22.4	27.3	27.7	29.3	29.2
1932	30.1	30.2	35.1	20.3	18.4	33.1	27.1	23.5	27.8	28.4	28.9	30.1
1931	33.2	33.3	38.3	22.0	19.5	34.5	28.3	25.5	29.1	28.4	32.1	32.7
1930	35.4	35.4	42.0	23.3	20.0	36.1	29.9	27.5	31.5	29.3	38.3	37.2
1929	36.3	36.7	42.5	23.4	20.5	37.0	31.0	28.2	32.8	30.5	42.4	40.6
1928	35.9	35.8	42.1	23.0	20.3	36.0	30.1	26.9	31.8	29.9	43.3	41.1
1927	36.1	35.6	41.7	22.6	20.1	35.7	29.8	26.2	31.1	30.1	44.8	41.5
1926	36.5	36.6	42.3	22.4	20.3	36.1	30.2	26.2	31.0	31.1	45.8	42.8

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Income and Expenditure Accounts Division

System of National Accounts

National Income and expenditure accounts

Annual estimates

1976-1987

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TABLE 1. Gross Domestic Product

Income Based

No.	CANSIM matrix No. 006627	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Wages, salaries, and supplementary labour income (1)	111,884	124,021	134,933	151,736	171,424	197 91
2	Corporation profits before taxes	20,924	22,045	26,891	35,984	39,795	37 65
3	Interest and miscellaneous investment income	12,475	14,791	18,949	23,315	26,566	32,48
4	Accrued net income of farm operators from farm production.	3,378	2,646	3,281	3,676	3,690	3,75
5	Net income of non - farm unincorporated business, including rent.	9,105	9,942	11,139	11,885	12,908	14,10
6	Inventory valuation adjustment	-2,147	-3,661	-4,968	-7,679	-7,336	-7,21
7	**Net domestic income at factor cost**	155,619	169,784	190,225	218,917	247,047	278,687
8	Indirect taxes less subsidies	20,992	23,188	24,819	26,635	27,272	36,457
9	Capital consumption allowances	21,454	23,798	26,619	30,743	35,527	40,677
10	Statistical discrepancy	-141	1,109	-59	-199	45	173
11	**Gross Domestic Product at market prices**	197,924	217,879	241,604	276,096	309,891	355,994

See footnote(s) at end of statistical tables.

TABLE 2. Gross Domestic Product

Expenditure Based

No.	CANSIM matrix No. 006628	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Personal expenditure on consumer goods and services.	111,500	123,555	137,427	153,390	172,416	196,191
2	Durable goods	17,542	18,813	20,581	23,428	25,466	28,116
3	Semi - durable goods	13,136	14,319	15,635	17,875	19,706	21,947
4	Non - durable goods	33,082	36,165	40,446	45,053	51,180	59,423
5	Services	47,740	54,258	60,765	67,034	76,064	86,705
6	Government current expenditure on goods and services.(1)	38,274	43,411	47,386	52,286	59,250	68,792
	Government investment:						
7	Fixed capital	6,245	6,741	7,083	7,339	8,223	9,447
8	Residential construction	26	32	37	38	53	62
9	Non - residential construction	5,314	5,734	6,034	6,354	6,964	7,841
10	Machinery and equipment	905	975	1,012	947	1,206	1,544
11	Inventories	41	43	58	60	69	-205
	Business investment:						
12	Fixed capital	40,462	43,485	47,496	56,096	64,065	76,672
13	Residential construction	14,140	14,879	15,874	16,972	17,402	20,569
14	Non - residential construction	12,125	13,496	14,620	18,154	22,513	27,233
15	Machinery and equipment	14,197	15,110	17,002	20,970	24,150	28,870
16	Inventories	2,289	1,821	995	4,933	267	1,391
17	Non - farm	1,918	1,760	598	4,770	740	697
18	Farm and grain in commercial channels	371	61	397	163	-473	694
19	Exports of goods and services(2)	44,252	51,183	61,152	75,073	87,579	96,880
20	Merchandise	38,167	44,496	53,360	65,581	76,682	84,432
21	Non - merchandise	6,085	6,687	7,792	9,492	10,897	12,448
22	Deduct: Imports of goods and services	45,279	51,252	60,052	73,279	81,933	93,001
23	Merchandise	36,607	41,524	49,047	61,158	67,904	77,140
24	Non - merchandise	8,672	9,728	11,005	12,121	14,029	15,861
25	Statistical discrepancy	140	-1,108	59	198	-45	-173
26	**Gross Domestic Product at market prices**	197,924	217,879	241,604	276,096	309,891	355,994
27	*Final domestic demand (1 + 6 + 7 + 12)*	*196,481*	*217,192*	*239,392*	*269,111*	*303,954*	*351,102*

See footnote(s) at end of statistical tables

TABLE 6. Relation between Net National Income at Factor Cost, Personal Income, Personal Disposable Income and Personal Saving

No.	CANSIM matrix No. 006632	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	**Net National Income at factor cost**	**152,083**	**165,213**	**184,275**	**211,762**	**239,220**	**267,350**
	Add:						
2	Current transfers to persons from government and non - residents(1)	19,935	22,687	25,579	27,147	31,383	35,852
3	Interest on the public debt(1)	8,101	9,268	11,589	13,810	16,790	22,268
4	Interest on consumer debt(1,2)	1,570	1,670	1,918	2,855	3,713	5,362
	Deduct:						
5	Earnings not paid out to persons(3)	23,562	24,000	28,198	36,107	42,216	37,617
	Equals:						
6	**Personal Income**	**158,127**	**174,838**	**195,163**	**219,467**	**248,890**	**293,215**
	Deduct:						
7	Personal direct taxes	28,431	31,820	33,723	37,400	42,803	52,847
8	Other current transfers to government	1,457	1,644	1,974	2,215	2,434	2,686
	Equals:						
9	**Personal Disposable Income**	**128,239**	**141,374**	**159,466**	**179,852**	**203,653**	**237,682**
	Deduct:						
10	Personal expenditure on consumer goods and services	111,500	123,555	137,427	153,390	172,416	196,191
11	Current transfers to corporations	1,570	1,670	1,918	2,855	3,713	5,362
12	Current transfers to non - residents	269	292	294	347	364	385
	Equals:						
13	**Personal Saving**	**14,900**	**15,857**	**19,827**	**23,260**	**27,160**	**35,744**
14	*Personal saving as percentage of personal disposable income.*	*11.6*	*11.2*	*12.4*	*12.9*	*13.3*	*15.0*
15	Value of physical change in farm inventories	166	201	235	113	- 129	684
16	Personal saving excluding change in farm inventories	14,734	15,656	19,592	23,147	27,289	35,060

See footnote(s) at end of statistical tables.

TABLE 7. Implicit Price Indexes, Gross Domestic Product(1)

1981 = 100.0

No.	CANSIM matrix No. 006633	1976	1977	1978	1979	1980	1981
1	Personal expenditure on consumer goods and services	65.2	70.0	75.3	81.7	89.9	100.0
2	Durable goods	71.8	75.1	78.8	85.4	93.1	100.0
3	Semi - durable goods	69.2	73.2	76.4	83.8	92.1	100.0
4	Non - durable goods	58.6	63.6	70.1	77.5	86.9	100.0
5	Services	66.5	71.9	77.4	83.0	90.3	100.0
6	Government current expenditure on goods and services	62.7	68.0	73.0	80.1	88.3	100.0
7	Government investment in fixed capital	68.0	72.3	77.4	83.9	91.1	100.0
8	Non - residential construction	63.1	66.9	72.2	78.5	87.7	100.0
9	Machinery and equipment	86.5	92.5	95.4	99.9	99.3	100.0
10	Business investment in fixed capital	77.1	81.1	85.4	91.4	94.1	100.0
11	Residential construction	70.2	73.0	77.1	83.3	90.2	100.0
12	Non - residential construction	65.1	68.5	73.5	80.1	89.8	100.0
13	Machinery and equipment	88.8	94.2	98.0	104.0	98.8	100.0
14	Exports of goods and services	63.7	67.6	71.1	83.1	94.4	100.0
15	Merchandise	63.8	67.4	70.8	83.6	95.3	100.0
16	Non - merchandise	62.9	68.8	73.1	79.7	98.6	100.0
17	Imports of goods and services	67.5	75.1	81.9	89.7	95.6	100.0
18	Merchandise	71.0	78.3	84.3	91.7	96.9	100.0
19	Non - merchandise	53.6	61.6	71.0	80.2	99.0	100.0
20	**Gross Domestic Product**	**65.8**	**69.9**	**74.2**	**81.6**	**90.2**	**100.0**
21	*Final domestic demand*	*67.3*	*72.1*	*77.1*	*83.6*	*90.6*	*100.0*

See footnote(s) at end of statistical tables

TABLE 10. Consolidated Production Account

Primary Expenses Arising from Domestic Production

No.	CANSIM matrix No. 006634	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
	Wages, salaries, and supplementary labour income:						
1	Business (14.01)	80,950	89,618	97,463	110,502	125,538	144,882
	Government:						
2	On current account (14.02)(1)	26,660	29,602	32,254	35,482	39,413	45,671
3	On capital account (14.03)	219	259	290	299	306	324
4	Persons (14.04)	4,055	4,542	4,926	5,453	6,167	7,033
	Accrued net income of farm operators from farm production:						
5	Net income received by farm operators from farm production (14.05).	3,155	2,607	3,241	3,522	3,110	4,229
6	Adjustment on grain transactions (14.06)	223	39	40	154	580	-476
7	Net income of non-farm unincorporated business, including rent (14.07).	9,105	9,942	11,139	11,885	12,908	14,100
8	Profits and other investment income (22.01)	33,399	36,836	45,840	59,299	66,361	70,141
9	Inventory valuation adjustment (22.02)	-2,147	-3,661	-4,968	-7,679	-7,336	-7,217
10	Indirect taxes (18.08)	24,666	27,027	28,836	32,112	35,505	45,956
11	Deduct: Subsidies (19.07)	3,674	3,839	4,017	5,477	8,233	9,499
	Capital consumption allowances:						
12	Persons and unincorporated business (16.04)	6,709	7,261	8,052	9,094	10,221	11,525
13	Government (20.02)	2,795	3,158	3,523	4,009	4,553	5,311
14	Corporate and government business enterprises (24.05)	11,950	13,379	15,044	17,640	20,753	23,841
15	*(of which: Government business enterprises)*	*1,215*	*1,422*	*1,675*	*2,007*	*2,268*	*2,442*
16	Statistical discrepancy	-141	1,109	-59	-199	45	173
17	**Gross Domestic Product at market prices**	**197,924**	**217,879**	**241,604**	**276,096**	**309,891**	**355,994**

See footnote(s) at end of statistical tables.

TABLE 11. Consolidated Production Account

Revenue from Domestic Production

No.	CANSM matrix No. 006635	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
	Sales by business:						
1	To persons (15.01)	104,633	115,717	128,857	144,478	162,280	184,983
	To government:						
2	Current expenditure (19.01)	12,192	14,343	16,009	17,923	21,102	24,874
3	Deduct: Sales by government to business (19.02)	3,749	4,179	4,988	5,780	6,637	7,841
4	Capital expenditure (21.01)	6,026	6,482	6,793	7,040	7,917	9,123
5	Investment in inventories (21.03)	41	43	58	60	69	-205
	To corporate and government business enterprises:						
6	Investment in fixed capital (25.01)	25,126	27,495	30,218	36,353	43,689	53,182
7	Investment in non-farm inventories (25.02)(1)	1,918	1,760	598	4,770	740	697
	To unincorporated business:						
8	Investment in fixed capital (17.01)	15,336	15,990	17,278	19,743	20,376	23,490
9	Investment in farm inventories and grain in commercial channels (17.02).	371	61	397	163	-473	694
10	To non-residents (27.01)	44,252	51,183	61,152	75,073	87,579	96,880
11	Deduct: Purchases from non-residents (26.01)	42,044	47,416	55,762	69,106	77,077	87,974
12	Sales by persons to persons of direct labour services (15.02).	4,055	4,542	4,926	5,453	6,167	7,033
	Sales by government to government:						
	Direct labour services:						
13	On current account (19.03)	26,613	29,549	32,196	35,420	39,345	45,596
14	On capital account (21.02)	219	259	290	299	306	324
15	Consumption of capital (19.04)	2,795	3,158	3,523	4,009	4,553	5,311
16	Statistical discrepancy	140	-1,108	59	198	-45	-173
17	**Gross Domestic Product at market prices**	**197,924**	**217,879**	**241,604**	**276,096**	**309,891**	**355,994**

See footnote(s) at end of statistical tables.

TABLE 30. Wages, Salaries and Supplementary Labour Income, by Industry(1)

No.	CANSIM matrix No. 006655	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Agriculture	755	853	915	1,038	1,180	1,399
2	Forestry	1,092	1,227	1,420	1,672	1,759	1,838
3	Fishing and trapping	101	123	187	225	180	160
4	Mines, quarries, and oil wells	2,563	3,009	3,187	3,890	4,900	5,693
5	Manufacturing	25,076	27,313	30,386	34,420	37,862	43,094
6	Construction	9,064	10,198	9,641	10,268	11,782	14,613
7	Transportation	6,604	7,391	8,241	9,217	10,271	11,480
8	Storage	304	334	410	467	529	596
9	Communication	3,089	3,432	3,847	4,369	4,838	5,988
10	Electric power, gas, and water utilities	1,756	1,954	2,209	2,603	2,903	3,383
11	Wholesale trade	6,131	6,745	7,339	8,322	9,641	10,645
12	Retail trade	9,139	9,824	10,341	11,804	13,059	15,099
13	Finance, insurance and real estate	6,748	7,761	8,682	10,132	11,768	13,555
14	Public administration and defence	10,806	12,036	13,122	14,431	15,916	18,487
15	Community, business, and personal service	28,656	31,821	35,006	38,878	44,836	51,880
16	Total	111,884	124,021	134,933	151,736	171,424	197,910

See footnote(s) at end of statistical tables.

TABLE 31. Profits and Other Investment Income, by Industry

No.	CANSIM matrix No. 006656	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Agriculture	518	591	694	1,004	1,154	1,539
2	Forestry	59	76	116	216	190	158
3	Fishing and trapping	13	17	38	52	35	37
4	Mines, quarries, and oil wells	3,310	4,103	4,776	8,309	10,438	8,498
5	Manufacturing	8,051	8,523	10,966	15,568	16,772	17,096
6	Construction	1,576	1,289	1,392	1,762	2,232	2,947
7	Transportation	967	1,089	1,399	1,540	1,675	1,600
8	Storage	82	64	92	117	172	177
9	Communication	516	851	1,266	1,505	1,499	1,613
10	Electric power, gas, and water utilities	2,769	3,647	4,377	5,571	5,982	7,012
11	Wholesale trade	2,239	2,001	2,531	3,757	4,157	4,251
12	Retail trade	1,280	1,367	1,908	2,458	2,693	2,595
13	Finance, insurance and real estate	10,241	11,292	14,021	14,640	15,744	18,111
14	Community, business, and personal service	1,778	1,926	2,264	2,800	3,618	4,507
15	Total	33,399	36,836	45,840	59,299	66,361	70,141

TABLE 32. Net Income of Unincorporated Business, by Industry

No.	CANSIM matrix No. 006657	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Agriculture	3,448	2,716	3,353	3,759	3,795	3,897
2	Forestry	40	46	59	65	61	63
3	Fishing and trapping	139	173	259	351	270	285
4	Mines, quarries, and oil wells	35	15	24	14	27	16
5	Manufacturing	128	132	136	167	168	190
6	Construction	1,222	1,282	1,355	1,398	1,449	1,499
7	Transportation	332	360	425	484	490	497
8	Storage	-	-	-	-	-	-
9	Communication	-	-	-	-	-	-
10	Wholesale trade	308	319	307	289	299	313
11	Retail trade	1,165	1,205	1,232	1,319	1,360	1,290
12	Finance, insurance and real estate	1,623	1,961	2,506	2,492	2,909	3,369
13	Community, business, and personal service	4,043	4,379	4,764	5,223	5,770	6,434
14	**Total**	**12,483**	**12,588**	**14,420**	**15,561**	**16,598**	**17,853**

TABLE 33. Investment in Fixed Capital, by Industry(1)

No.	CANSIM matrix No. 006659	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
	Business:						
1	Agriculture, fishing and trapping	2,837	2,962	3,438	4,313	4,402	4,784
2	Forestry	187	220	241	301	343	282
3	Mines, quarries, and oil wells	3,397	3,846	3,859	5,607	8,380	9,405
4	Manufacturing	5,260	5,851	5,881	7,148	9,428	12,385
5	Construction	759	820	875	985	1,108	1,305
6	Transportation and storage	1,672	1,823	1,970	2,512	3,182	4,893
7	Communication	2,091	2,138	2,200	2,393	2,830	3,290
8	Electric power, gas, and water utilities	4,416	5,104	6,222	6,667	6,546	7,821
9	Trade	1,009	1,022	1,178	1,546	1,700	1,965
10	Finance, insurance and real estate(2)	16,345	17,256	18,676	20,552	21,445	25,443
11	Community, business, and personal service	2,489	2,443	2,956	4,072	4,701	5,099
12	**Total business**	**40,462**	**43,485**	**47,496**	**56,096**	**64,065**	**76,672**
	Government:						
13	Water systems	314	376	487	528	579	564
14	Real estate (residential construction)	26	32	37	38	53	62
15	Communication and community service	1,120	1,137	1,166	1,223	1,556	1,839
16	Public administration(3)	4,785	5,196	5,393	5,550	6,035	6,982
17	**Total government**	**6,245**	**6,741**	**7,083**	**7,339**	**8,223**	**9,447**
18	**Total**	**46,707**	**50,226**	**54,579**	**63,435**	**72,288**	**86,119**

See footnote(s) at end of statistical tables.

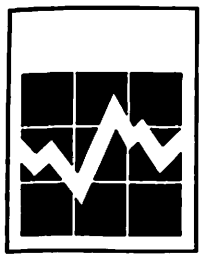
TABLE 34. Investment in Inventories, by Industry

No.	CANSIM matrix No. 006660	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Agriculture	315	313	319	58	-372	509
2	Forestry	-71	-74	-70	-119	168	-32
3	Mines, quarries, and oil wells	192	259	-382	-284	196	262
4	Manufacturing	437	196	-92	1,916	245	1,400
5	Construction	-39	-20	-93	-6	-10	48
6	Transportation, storage and communication	8	10	-58	11	18	-109
7	Electric power, gas, and water utilities	10	100	18	194	117	-26
	Trade:						
8	Grain in commercial channels	56	-252	78	105	-101	185
9	Wholesale	588	397	465	1,234	-14	234
10	Retail	783	870	719	1,339	-518	-672
11	Finance, community, business and personal service	10	22	91	485	538	-408
12	**Total business (Sum: lines 1 to 11)**	**2,289**	**1,821**	**995**	**4,933**	**267**	**1,391**
13	**Government**	**41**	**43**	**58**	**60**	**69**	**-205**
14	**Total**	**2,330**	**1,864**	**1,053**	**4,993**	**336**	**1,186**

TABLE 35. Corporation Profits before Taxes, by Industry(1)

No.	CANSIM matrix No. 006661	1976	1977	1978	1979	1980	1981
		millions of dollars - millions de dollars					
1	Agriculture	47	51	50	123	88	130
2	Forestry	26	42	71	139	85	15
3	Fishing and trapping	3	6	24	27	1	-17
4	Mines, quarries, and oil wells	2,882	3,650	4,185	7,302	8,834	6,024
5	Manufacturing	6,955	7,240	9,629	13,485	13,885	12,818
6	Construction	1,075	757	787	764	921	975
7	Transportation	645	769	859	1,119	1,182	933
8	Storage	74	48	78	94	146	154
9	Communication	702	756	1,045	1,136	1,183	1,466
10	Electric power, gas, and water utilities	259	328	408	450	455	537
11	Wholesale trade	1,699	1,453	1,907	2,761	2,971	2,561
12	Retail trade	1,009	1,082	1,575	1,918	2,012	1,646
13	Finance, insurance and real estate	3,804	3,905	4,121	3,416	3,990	3,530
14	Community, business, and personal service	994	1,071	1,320	1,650	2,074	2,233
15	**Total**	**20,174**	**21,158**	**26,059**	**34,384**	**37,827**	**33,005**

See footnote(s) at end of statistical tables.



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Note of Appreciation

Canada owes the success of its statistical system to a long-standing cooperation involving Statistics Canada, the citizens of Canada, its businesses and governments. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Note de reconnaissance

Le succès du système statistique du Canada repose sur un partenariat bien établi entre Statistique Canada et la population, les entreprises et les administrations canadiennes. Sans cette collaboration et cette bonne volonté, il serait impossible de produire des statistiques précises et actuelles.

Current Period, 1989-1992

Impact of the Revisions on GDP

As can be seen in columns 4 and 11 of Table 1, the revised annual estimates of GDP for 1989 to 1992 have increased over the previous[1] estimates in all years in both current and 1986 prices. However, the cumulative revision to the initial annual estimates is larger than the most recent revision and negative in 1990 and 1991. The quarterly revisions show greater variability with the largest one being -1.3% of GDP in current prices, in the fourth quarter of 1990.

The annual growth rate of GDP in current prices in Table 2 shows little change from the previous estimate for 1989 and 1992. For 1990, it has been revised moderately upward, while for 1991, GDP in current prices grew less than was previously indicated. The annual growth rate in 1986 prices has been revised upward in 1989 and 1990, remained almost unchanged in 1991 and revised downward in 1992. The quarterly revisions are slightly more variable, with the largest one being the cumulative revision in the first quarter of 1991.

Viewed in an historical perspective, these latest revisions to GDP in current and constant prices and their growth rates are comparatively small, as will be discussed in the second half of this article. However, it should be noted that a small or zero revision does not necessarily indicate the quality of a data series. Rather, it may denote that there is only one data source which is not revised over time.

Chart 1 compares the previous and revised seasonally adjusted quarterly estimates of GDP at 1986 prices. The general pattern of the downturn in 1990 and 1991 has not changed, although the level of GDP throughout the period is higher than previously estimated. Real GDP reached its lowest point in the first quarter of 1991, rebounded in the second quarter and from that point was essentially flat until the fourth quarter of 1992 when growth resumed. Chart 2 shows the revisions to growth rates.

The sub-sections that follow highlight the revisions having a significant impact on GDP. The largest revisions affected wages, salaries and supplementary labour income, corporation profits before taxes, interest and miscellaneous investment income, personal expenditure on consumer goods and services and government current expenditure.

1. *For 1989, 1990 and 1991, the previous estimate is the one released with the first quarter of 1992, while for 1992 the previous estimate is from the fourth quarter of 1992.*

Période courante, 1989-1992

Incidence des révisions sur le PIB

Comme on peut le voir aux colonnes 4 et 11 du tableau 1, les estimations annuelles révisées du PIB pour la période de 1989 à 1992 sont plus élevées que les estimations antérieures[1] à toutes les années, tant en prix courants qu'aux prix de 1986. Toutefois, la révision cumulative aux estimations annuelles initiales est plus grande que la toute dernière révision et elle est négative en 1990 et 1991. Les révisions trimestrielles font voir davantage de fluctuations, et la plus forte, au quatrième trimestre de 1990, représente -1,3% du PIB en prix courants.

Le taux de croissance annuel du PIB en prix courants, au tableau 2, est presque inchangé pour 1989 et 1992 par rapport à l'estimation antérieure. Il est révisé modérément à la hausse pour 1990, tandis que pour 1991, le PIB en prix courants augmente moins qu'on ne l'avait indiqué auparavant. Le taux de croissance annuel aux prix de 1986 est révisé en hausse en 1989 et 1990, demeure presque inchangé en 1991 et est révisé en baisse en 1992. Les révisions trimestrielles sont un peu plus erratiques, la plus forte étant la révision cumulative au premier trimestre de 1991.

Dans une perspective historique, ces dernières révisions au PIB en prix courants et en prix constants ainsi qu'aux taux de croissance sont relativement faibles, comme on le verra dans la deuxième partie de cet article. Il convient toutefois de préciser qu'une révision faible ou nulle ne révèle pas nécessairement la qualité d'une série chronologique. Elle indique peut-être l'existence d'une seule source de données qui n'est pas révisée dans le temps.

Le graphique 1 compare les estimations antérieures et les estimations révisées du PIB aux prix de 1986 en version trimestrielle désaisonnalisée. La courbe du déclin en 1990 et 1991 reste la même, quoique le niveau du PIB soit plus élevé qu'on ne l'avait estimé auparavant durant toute la période. Le PIB réel atteint son point le plus bas au premier trimestre de 1991, rebondit au deuxième trimestre et demeure essentiellement stagnant jusqu'au quatrième trimestre de 1992 lorsque la croissance reprend. Le graphique 2 montre les révisions aux taux de croissance.

Les sous-sections qui suivent mettent l'accent sur les révisions ayant une incidence marquée sur le PIB. Les révisions les plus importantes touchent la rémunération des salariés, les bénéfices des sociétés avant impôts, les intérêts et revenus divers de placements, les dépenses personnelles en biens et services de consommation et les dépenses publiques courantes.

1. *Pour 1989, 1990 et 1991, l'estimation antérieure est celle diffusée avec les chiffres du premier trimestre de 1992, et pour 1992, il s'agit de celle diffusée avec ceux du quatrième trimestre de 1992.*

Table 1 - Gross Domestic Product
Tableau 1 - Produit intérieur brut

At current prices - Aux prix courants

Year / Année		Initial estimate[1] / Estimation initiale[1]	Previous estimate[2] / Estimation antérieure[2]	Revised estimate[3] / Estimation révisée[3]	Current revision[4] / Révision courante[4]	Cumulative revision[5] / Révision cumulative[5]	Current revision[6] / Révision courante[6]	Cumulative revision[7] / Révision cumulative[7]
		millions of dollars - millions de dollars					percentage - pourcentage	
1989		648,537	649,916	650,748	832	2211	0.1	0.3
1990		677,900	667,843	670,952	3,109	-6,948	0.5	-1.0
1991		679,203	674,388	675,928	1,540	-3,275	0.2	-0.5
1992		687,334	687,334	688,541	1,207	1,207	0.2	0.2
1989	I	634,916	637,376	636,276	-1,100	1,360	-0.2	0.2
	II	643,712	647,676	647,892	216	4,180	0.0	0.6
	III	650,476	654,888	656,780	1,892	6,304	0.3	1.0
	IV	662,744	659,724	662,044	2,320	-700	0.4	-0.1
1990	I	673,828	667,180	668,732	1,552	-5,096	0.2	-0.8
	II	676,752	667,692	671,352	3,660	-5,400	0.5	-0.8
	III	680,000	669,296	673,000	3,704	-7,000	0.6	-1.0
	IV	679,300	667,204	670,724	3,520	-8,576	0.5	-1.3
1991	I	674,040	664,076	667,372	3,296	-6,668	0.5	-1.0
	II	683,640	675,816	676,868	1,052	-6,772	0.2	-1.0
	III	687,220	678,244	678,844	600	-8,376	0.1	-1.2
	IV	683,356	679,416	680,628	1,212	-2,728	0.2	-0.4
1992	I	680,740	681,896	683,872	1,976	3,132	0.3	0.5
	II	684,344	683,652	685,388	1,736	1,044	0.3	0.2
	III	689,612	689,476	688,428	-1,048	-1,184	-0.2	-0.2
	IV	694,312	694,312	696,476	2,164	2,164	0.3	0.3

At 1986 prices - Aux prix de 1986

Year / Année		Initial estimate[8] / Estimation initiale[8]	Previous estimate[9] / Estimation antérieure[9]	Revised estimate[10] / Estimation révisée[10]	Current revision[11] / Révision courante[11]	Cumulative revision[12] / Révision cumulative[12]	Current revision[13] / Révision courante[13]	Cumulative revision[14] / Révision cumulative[14]
		millions of dollars - millions de dollars					percentage - pourcentage	
1989		565,657	565,779	566,486	707	829	0.1	0.1
1990		570,743	563,060	565,576	2,516	-5,167	0.4	-0.9
1991		558,862	553,457	556,029	2,572	-2,833	0.5	-0.5
1992		558,372	558,372	560,048	1,676	1,676	0.3	0.3
1989	I	561,288	564,368	564,664	296	3,376	0.1	0.6
	II	563,192	565,456	565,456	0	2,264	0.0	0.4
	III	567,508	566,168	567,484	1,316	-24	0.2	0.0
	IV	570,640	567,124	568,340	1,216	-2,300	0.2	-0.4
1990	I	573,724	568,516	569,936	1,420	-3,788	0.2	-0.7
	II	571,328	565,772	567,744	1,972	-3,584	0.3	-0.6
	III	570,536	562,136	565,156	3,020	-5,380	0.5	-0.9
	IV	565,176	555,816	559,468	3,652	-5,708	0.7	-1.0
1991	I	554,644	547,792	550,844	3,052	-3,800	0.6	-0.7
	II	561,296	554,796	556,556	1,760	-4,740	0.3	-0.8
	III	563,612	555,544	557,940	2,396	-5,672	0.4	-1.0
	IV	560,116	555,696	558,776	3,080	-1,340	0.6	-0.2
1992	I	557,980	556,080	558,796	2,716	816	0.5	0.1
	II	558,160	556,544	559,024	2,480	864	0.4	0.2
	III	559,548	558,004	559,368	1,364	-180	0.2	0.0
	IV	562,860	562,860	563,004	144	144	0.0	0.0

The revised estimates for **indirect taxes less subsidies** in 1989 and 1990 were based on the latest Input-Output tables which incorporate the final 1989 local government estimates, and 1990-91 provincial Public Accounts. Most of the increase to 1990 is due to more recent estimates of municipal property taxes. Revisions to 1991 and 1992 reflect the inclusion of the latest financial statements and survey results for provincial and local governments and of the 1991-92 federal Public Accounts. The decrease in 1991 and 1992 is mostly from the estimation of Goods and Services Tax accruals.

Revisions to Expenditure Aggregates

A summary of the revisions to the expenditure aggregates appears in Table 4.

The largest revisions to **personal expenditure on consumer goods and services** were for 1989 and 1990. The revisions reflected the results of the revised 1989 and preliminary 1990 Input-Output tables and the 1990 Family Expenditure Survey.

In addition, for personal expenditure on goods, more recent data came from the 1990 Annual Retail Trade Survey. Spending on motor fuels and lubricants was revised upward in 1989 and 1990. Estimates of spending on sports and recreation equipment were increased for 1989 and decreased for 1990.

For personal expenditure on services, in addition to the Input-Output and Family Expenditure Survey data, more up-to-date information was taken from annual reports of lottery corporations, surveys of transportation and service industries and expenditure statistics on health and education. Personal expenditure on medical services was revised upward for 1989 and 1990.

Government current expenditure on goods and services was revised upward for all four years. The changes for 1989 and 1990 came from the latest Input-Output tables incorporating the final 1989 local government estimates and 1990-91 provincial Public Accounts. Revisions to 1991 and 1992 reflected the new benchmark data for 1990, more recent financial statements and survey results for provincial and local governments, and the 1991-92 federal Public Accounts.

Estimates for **residential construction investment** were decreased for 1991 and 1992 on account of revised data on real estate commission rates. As well, spending on home alterations and improvements for 1992 was revised downward on the basis of the preliminary results of the Survey on Homeowner Repair and Renovation Expenditures.

Les estimations révisées des **impôts indirects moins subventions** pour 1989 et 1990 sont basées sur les derniers tableaux d'entrées-sorties qui incorporent les estimations définitives des administrations locales pour 1989 et les comptes publics provinciaux de 1990-91. L'essentiel de la hausse en 1990 provient d'estimations plus récentes des impôts fonciers locaux. Les révisions en 1991 et 1992 traduisent la prise en compte des derniers états financiers et résultats d'enquête pour les administrations provinciales et locales et des comptes publics fédéraux de 1991-92. La baisse en 1991 et 1992 provient surtout de l'estimation de la taxe sur les produits et services sur une base d'exercice.

Révisions aux agrégats des dépenses

Un résumé des révisions apportées aux agrégats des dépenses figure au tableau 4.

Les plus fortes révisions aux **dépenses personnelles en biens et services de consommation** touchent 1989 et 1990. Les révisions découlent des résultats des tableaux d'entrées-sorties révisés pour 1989 et préliminaires pour 1990 et de l'enquête de 1990 sur les dépenses des familles.

En outre, dans le cas des dépenses en biens, des données plus récentes ont été tirées de l'enquête annuelle de 1990 sur le commerce de détail. Les dépenses en carburants et lubrifiants sont révisées en hausse en 1989 et 1990. Les estimations des dépenses au titre du matériel de sport et de loisirs sont rehaussées pour 1989 et diminuées pour 1990.

Dans le cas des dépenses personnelles en services, outre les tableaux d'entrées-sorties et l'enquête sur les dépenses des familles, on a eu recours à de l'information plus à jour provenant des rapports annuels des sociétés de loteries, des enquêtes sur les branches des transports et des services et des statistiques sur les dépenses en matière de santé et d'éducation. Les dépenses en soins médicaux sont révisées en hausse en 1989 et 1990.

Les **dépenses publiques courantes en biens et services** sont révisées en hausse pour les quatre années. Les changements pour 1989 et 1990 viennent des derniers tableaux d'entrées-sorties qui incorporent les estimations définitives des administrations locales pour 1989 et les comptes publics provinciaux de 1990-91. Les révisions pour 1991 et 1992 traduisent la prise en compte des nouveaux repères de 1990, des derniers états financiers et résultats d'enquêtes pour les administrations provinciales et locales et des comptes publics fédéraux de 1991-92.

Les estimations de l'**investissement en construction résidentielle** sont diminuées en 1991 et 1992 à partir de données révisées sur les taux des commissions immobilières. Les dépenses au titre des améliorations et modifications sont révisées en baisse en 1992 d'après les résultats préliminaires de l'enquête sur les dépenses en réparations et rénovations effectuées par les propriétaires de logements.

TABLE 1. Gross Domestic Product
Income based

No	CANSIM matrix No 006627	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
1	Wages, salaries and supplementary labour income[1]	197,910	211,604	221,800	238,849	257,518	274,801
2	Corporation profits before taxes	37,654	26,848	37,072	45,855	49,490	45,355
3	Interest and miscellaneous investment income	32,487	35,337	36,433	40,888	40,302	39,289
4	Accrued net income of farm operators from farm production[2]	3,753	3,455	2,568	3,380	2,808	3,946
5	Net income of non-farm unincorporated business, including rent	14,100	16,860	21,061	23,927	26,447	28,856
6	Inventory valuation adjustment	-7,217	-3,276	-2,659	-2,625	-1,760	-1,812
7	**Net Domestic Income at factor cost**	**278,687**	**290,828**	**316,275**	**350,274**	**374,805**	**390,435**
8	Indirect taxes less subsidies	36,457	38,908	40,135	42,714	47,212	53,827
9	Capital consumption allowances	40,677	44,356	47,060	50,884	55,926	60,595
10	Statistical discrepancy	173	350	2,247	863	45	809
11	**Gross Domestic Product at market prices**	**355,994**	**374,442**	**405,717**	**444,735**	**477,988**	**505,666**

See footnote(s) at end of statistical tables.

TABLE 2. Gross Domestic Product
Expenditure based

No	CANSIM matrix No 006628	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
1	Personal expenditure on consumer goods and services	196,191	210,509	231,452	251,645	274,503	297,478
2	Durable goods	28,116	26,021	30,032	34,699	40,278	44,628
3	Semi-durable goods	21,947	22,359	24,131	26,082	28,147	30,604
4	Non-durable goods	59,423	65,483	69,688	74,632	79,959	83,597
5	Services	86,705	96,646	107,601	116,232	126,119	138,649
6	Government current expenditure on goods and services[1]	68,792	78,655	84,571	89,089	95,519	100,129
	Government Investment:						
7	Fixed capital	9,447	10,519	10,395	11,390	12,886	12,567
8	Residential construction	62	61	111	20	16	17
9	Non-residential construction	7,841	8,899	8,561	8,883	10,480	10,040
10	Machinery and equipment	1,544	1,559	1,723	2,487	2,390	2,510
11	Inventories	-205	69	-45	20	-64	-35
	Business investment:						
12	Fixed capital	76,672	70,808	70,832	73,309	81,312	88,993
13	Residential construction	20,569	17,587	21,312	22,328	25,222	30,806
14	Non-residential construction	27,233	26,685	24,271	24,675	26,747	25,626
15	Machinery and equipment	28,870	26,536	25,249	26,306	29,343	32,561
16	Inventories	1,391	-9,822	-2,853	4,741	2,345	2,592
17	Non-farm	697	-9,885	-2,106	5,768	1,997	1,745
18	Farm and grain in commercial channels	694	63	-747	-1,027	348	847
19	Exports of goods and services	96,880	96,651	103,444	126,035	134,919	138,119
20	Merchandise	84,432	84,394	90,556	111,329	119,061	120,318
21	Non-merchandise	12,448	12,257	12,888	14,706	15,858	17,801
22	Deduct: Imports of goods and services	93,001	82,598	89,832	110,632	123,388	133,369
23	Merchandise	77,140	66,738	73,098	91,492	102,670	110,374
24	Non-merchandise	15,861	15,860	16,734	19,140	20,718	22,995
25	Statistical discrepancy	-173	-349	-2,247	-862	-44	-808
26	**Gross Domestic Product at market prices**	**355,994**	**374,442**	**405,717**	**444,735**	**477,988**	**505,666**
27	*Final domestic demand (1 + 6 + 7 + 12)*	*351,102*	*370,491*	*397,250*	*425,433*	*464,220*	*499,167*

See footnote(s) at end of statistical tables.

TABLE 6. Relation between Net National Income at Factor Cost, Personal Income, Personal Disposable Income and Personal Saving

No	CANSIM matrix No 006632	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
1	**Net National Income at factor cost**	**267,350**	**278,158**	**304,672**	**336,788**	**360,473**	**374,033**
	Add:						
2	Current transfers to persons from government and non-residents[1]	35,852	45,053	51,863	54,809	59,196	62,620
3	Interest on the public debt[1]	22,268	27,072	29,419	34,752	40,183	42,754
4	Interest on consumer debt[1,2]	5,362	5,132	3,785	3,791	4,233	4,496
	Deduct.						
5	Earnings not paid out to persons[3]	37,617	30,578	46,687	57,901	63,886	56,641
	Equals:						
6	**Personal income**	**293,215**	**324,837**	**343,052**	**372,239**	**400,199**	**427,262**
	Deduct:						
7	Personal direct taxes	52,847	58,943	63,605	68,223	75,115	85,176
8	Other current transfers to government	2,686	3,033	3,434	3,670	3,747	3,993
	Equals:						
9	**Personal disposable income**	**237,682**	**262,861**	**276,013**	**300,346**	**321,337**	**338,093**
	Deduct:						
10	Personal expenditure on consumer goods and services	196,191	210,509	231,452	251,645	274,503	297,478
11	Current transfers to corporations	5,362	5,132	3,785	3,791	4,233	4,496
12	Current transfers to non-residents	385	443	473	500	554	602
	Equals:						
13	**Personal saving**	**35,744**	**46,777**	**40,303**	**44,410**	**42,047**	**35,517**
14	*Personal saving as percentage of personal disposable income*	*15.0*	*17.8*	*14.6*	*14.8*	*13.1*	*10.5*
15	Value of physical change in farm inventories	684	-63	-646	-922	340	547
16	Personal saving excluding change in farm inventories	35,060	46,840	40,949	45,332	41,707	34,970

See footnote(s) at end of statistical tables.

TABLE 7. Implicit Price Indexes Gross Domestic Product[1]

1986 = 100.0

No	CANSIM matrix No 006841	1981	1982	1983	1984	1985	1986
1	Personal expenditure on consumer goods and services	76.3	84.1	89.4	92.9	96.3	100.0
2	Durable goods	84.6	89.6	92.4	94.3	96.0	100.0
3	Semi-durable goods	80.8	86.9	91.3	93.8	96.9	100.0
4	Non-durable goods	73.7	82.6	87.9	93.0	97.1	100.0
5	Services	74.2	82.2	88.4	91.8	95.7	100.0
6	Government current expenditure on goods and services	75.7	84.5	89.6	93.2	96.9	100.0
7	Government investment in fixed capital	87.8	94.0	96.3	99.0	100.9	100.0
8	Non-residential construction	85.1	91.4	94.3	97.0	98.9	100.0
9	Machinery and equipment	98.3	103.9	103.4	107.2	107.8	100.0
10	Business investment in fixed capital	89.1	94.5	94.8	96.6	98.1	100.0
11	Residential construction	81.8	83.6	86.6	90.2	92.8	100.0
12	Non-residential construction	86.4	93.0	92.4	95.7	98.6	100.0
13	Machinery and equipment	98.3	105.0	104.2	102.9	102.3	100.0
14	Exports of goods and services	95.1	97.0	97.6	101.0	102.0	100.0
15	Merchandise	98.4	98.8	98.8	102.4	102.9	100.0
16	Non-merchandise	73.0	83.1	88.4	91.2	96.9	100.0
17	Imports of goods and services	88.3	92.5	92.2	97.0	99.6	100.0
18	Merchandise	92.5	95.8	94.5	98.9	100.5	100.0
19	Non-merchandise	68.3	74.8	79.0	86.4	94.4	100.0
20	**Gross Domestic Product**	**80.9**	**87.9**	**92.3**	**95.2**	**97.7**	**100.0**
21	*Final domestic demand*	*78.8*	*86.3*	*90.7*	*93.9*	*97.0*	*100.0*

See footnote(s) at end of statistical tables.

TABLE 11. Consolidated Production Account
Primary Expenses Arising from Domestic Production

No	CANSIM matrix No 006634	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
	Wages, salaries and supplementary labour income:						
1	Business (15.01)	144,882	151,139	156,668	169,881	185,091	198,267
	Government:						
2	On current account (15.02)[1]	45,671	52,073	55,979	58,973	61,319	64,755
3	On capital account (15.03)	324	349	334	364	687	636
4	Persons (15.04)	7,033	8,043	8,819	9,631	10,421	11,143
	Accrued net income of farm operators from farm production[2]						
5	Net income received by farm operators from farm production (15.05)	4,229	3,302	2,599	3,159	2,366	3,717
6	Adjustment to farm income (15.06)	-476	153	-31	221	442	229
7	Net income of non-farm unincorporated business, including rent (15.07)	14,100	16,860	21,061	23,927	26,447	28,856
8	Profits and other investment income (23.01)	70,141	62,185	73,505	86,743	89,792	84,644
9	Inventory valuation adjustment (23.02)	-7,217	-3,276	-2,659	-2,625	-1,760	-1,812
10	Indirect taxes (19.08)	45,956	48,248	50,150	54,957	58,789	64,338
11	Deduct: Subsidies (20.07)	9,499	9,340	10,015	12,243	11,577	10,511
	Capital consumption allowances:						
12	Persons and unincorporated business (17.04)	11,525	12,519	13,104	14,224	15,313	16,445
13	Government (21.02)	5,311	5,881	6,297	6,773	7,092	7,371
14	Corporate and government business enterprises (25.05)	23,841	25,956	27,659	29,887	33,521	36,779
15	*(of which: Government business enterprises)*	*2,442*	*2,892*	*3,329*	*3,863*	*4,268*	*4,433*
16	Statistical discrepancy	173	350	2,247	863	45	809
17	**Gross Domestic Product at market prices**	**355,994**	**374,442**	**405,717**	**444,735**	**477,988**	**505,666**

See footnote(s) at end of statistical tables.

TABLE 12. Consolidated Production Account
Revenue from Domestic Production

No	CANSIM matrix No 006635	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
	Sales by business:						
1	To persons (16.01)	184,983	198,127	217,347	236,336	257,959	279,883
	To government:						
2	Current expenditure (20.01)	24,874	28,924	31,279	33,321	37,895	39,937
3	Deduct: Sales by government to business (20.02)	7,841	9,112	9,868	10,922	11,746	12,781
4	Capital expenditure (22.01)	9,123	10,170	10,061	11,026	12,199	11,931
5	Investment in inventories (22.03)	-205	69	-45	20	-64	-35
	To corporate and government business enterprises:						
6	Investment in fixed capital (26.01)	53,182	51,129	47,076	48,287	54,385	57,210
7	Investment in non-farm inventories (26.02)[1]	697	-9,885	-2,106	5,768	1,997	1,745
	To unincorporated business:						
8	Investment in fixed capital (18.01)	23,490	19,679	23,756	25,022	26,927	31,783
9	Investment in farm inventories and grain in commercial channels (18.02)	694	63	-747	-1,027	348	847
10	To non-residents (28.01)	96,880	96,651	103,444	126,035	134,919	138,119
11	Deduct: Purchases from non-residents (27.01)	87,974	77,283	83,568	103,908	116,202	125,961
12	Sales by persons to persons of direct labour services (16.02)	7,033	8,043	8,819	9,631	10,421	11,143
	Sales by government to government:						
	Direct labour services:						
13	On current account (20.03)	45,596	51,986	55,885	58,871	61,215	64,646
14	On capital account (22.02)	324	349	334	364	687	636
15	Consumption of capital (20.04)	5,311	5,881	6,297	6,773	7,092	7,371
16	Statistical discrepancy	-173	-349	-2,247	-862	-44	-808
17	**Gross Domestic Product at market prices**	**355,994**	**374,442**	**405,717**	**444,735**	**477,988**	**505,666**

See footnote(s) at end of statistical tables.

TABLE 33. Investment in Fixed Capital, by Industry[1]

No	CANSIM matrix No 006659	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
	Business:						
1	Agriculture, fishing and trapping	4,784	4,270	4,010	4,108	3,313	3,170
2	Forestry	282	148	155	200	205	231
3	Mines, quarries and oil wells	9,405	10,240	9,522	9,740	10,707	7,449
4	Manufacturing	12,385	11,147	8,494	8,554	11,168	13,387
5	Construction	1,305	1,293	1,285	1,299	1,351	1,444
6	Transportation and storage	4,893	4,960	4,148	4,159	3,959	2,897
7	Communications	3,290	3,315	2,707	2,821	2,972	3,359
8	Electric power, gas and water utilities	7,821	9,003	8,340	6,987	6,412	6,332
9	Trade	1,965	1,469	1,992	2,453	2,434	2,592
10	Finance, insurance and real estate[2]	25,443	21,050	25,576	26,915	31,329	38,364
11	Community, business and personal services	5,099	3,913	4,603	6,073	7,462	9,768
12	**Total, business**	**76,672**	**70,808**	**70,832**	**73,309**	**81,312**	**88,993**
	Government:						
13	Water systems	564	591	588	655	1,093	850
14	Real estate (residential construction)	62	61	111	20	16	17
15	Communications and community services	1,839	2,220	2,202	2,077	2,142	2,519
16	Public administration[3]	6,982	7,647	7,494	8,638	9,635	9,181
17	**Total, government**	**9,447**	**10,519**	**10,395**	**11,390**	**12,886**	**12,567**
18	**Total**	**86,119**	**81,327**	**81,227**	**84,699**	**94,198**	**101,560**

See footnote(s) at end of statistical tables.

TABLE 34. Investment in Inventories, by Industry

No	CANSIM matrix No 006660	1981	1982	1983	1984	1985	1986
		millions of dollars – millions de dollars					
1	Agriculture	509	54	-777	-876	636	612
2	Forestry	-32	-136	-99	74	-75	-97
3	Mines, quarries and oil wells	262	-205	-273	-60	147	-73
4	Manufacturing	1,400	-3,967	-1,504	2,286	86	-680
5	Construction	48	-232	-72	86	45	80
6	Transportation, storage and communications	-109	-96	-170	88	64	-42
7	Electric power, gas and water utilities	-26	238	-234	303	-144	129
	Trade:						
8	Grain in commercial channels	185	9	30	-151	-288	235
9	Wholesale	234	-2,946	117	2,042	-115	1,413
10	Retail	-672	-2,641	-340	1,083	1,986	1,180
11	Finance, community, business and personal services	-408	100	469	-134	3	-165
12	**Total, business**	**1,391**	**-9,822**	**-2,853**	**4,741**	**2,345**	**2,592**
13	**Government**	**-205**	**69**	**-45**	**20**	**-64**	**-35**
14	**Total**	**1,186**	**-9,753**	**-2,898**	**4,761**	**2,281**	**2,557**

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National Income and Expenditure and Related Aggregates (Series F1-152)

F1-13. National income and gross national product, by components, 1926 to 1976

SOURCE: for 1971 to 1976, *National Income and Expenditure Accounts, 1962-1977*, (Catalogue 13-201); for 1926 to 1970, Statistics Canada, *National Income and Expenditure Accounts, Volume 1, The Annual Estimates, 1926-1974*, (Catalogue 13-531).

For methods of estimation, see the general note to series F1-152.

F1. Wages and salaries cover all of the earnings from employment of Canadian residents paid for work performed, including payments in kind such as free board and lodging. Also included are such payments as commissions, directors' fees, tips and bonuses, and taxable allowances such as cost-of-living allowances and allowances in respect of holidays and sick leave. The estimates do not include earnings from self-employment or partnership, income from independent professional practice, income of farmers from farming operations, or military pay and allowances. Wages and salaries are estimated before tax deductions and before contributions of employees to unemployment insurance, pensions and other social insurance schemes. Bonuses, commissions and retroactive wage increases are included in the period in which they are paid because of statistical difficulties of allocating these items to the period in which they were earned.

Supplementary labour income consists of other expenditures by employers on labour account that can be regarded as payment for employees' services. Included here are employers' contributions to pension funds, employee welfare funds, unemployment insurance and workmen's compensation.

F2. Military pay and allowances consist of payments to members of the Canadian forces in Canada and overseas and are treated as compensation for services rendered. Under this heading are included military pay, various types of allowances and employer contributions to the Canadian Armed Forces Pension Fund. War service gratuities and all post-discharge re-establishment benefits are excluded and treated as transfer payments. Prior to 1966, the estimated value of food and clothing issued in kind is also included. Since 1966, the amounts involved have been small.

F3. The estimates of corporation profits before taxes used in the national accounts are closely based on business accounting practice as reflected in business 'book profits'. However, a number of adjustments are needed to convert data drawn from business accounting records to a basis compatible with national accounts concepts and definitions. For the most part, these adjustments relate to the treatment of items which are charged as operating expenses by business but which are not regarded as a charge against production as measured by the national income. Thus, depletion charges, which are treated as an operating expense on the books of business, are added back to net profits in these accounts. Discoveries of new natural resources are not capitalized in the accounts (they are not counted as a part of gross fixed capital formation) and the exhaustion of natural resources is not therefore regarded as a charge against national income. Provincial mining and logging taxes, which are treated as an operating expense by business, are also added back to profits in these estimates. They are defined in the accounts as direct taxes. Similarly, appropriations for losses of chartered banks are added back to profits and national income since they are not considered a charge against current production. Bad debts owed by persons to corporations and written off on company books are treated in these accounts as a transfer payment from corporations to persons. An adjustment is therefore made to add back to net profits the amounts applicable. Charitable contributions made by corporations, also deducted as an expense by business, are added back on the grounds that they are not a direct cost of production but merely a distribution of earnings and, therefore, a transfer payment. All capital gains or losses of corporations are excluded, since these have no counterpart in current productive activity.

Mining development and exploration costs, which involve the acquisition of durable tangible assets, and construction and drilling costs, are included in the accounts as gross fixed capital formation. In some cases such costs are treated by business as current operating expenses and where this occurs the amounts must be added back to profits in the accounts. In other instances, costs such as geological and geophysical survey costs, which are not regarded as gross fixed capital formation in the accounts, are charged to capital account by business. In such cases, profits as reported by business must be reduced by these amounts before inclusion in the national income.

A variety of other adjustments are made to business book profits. All profit figures are adjusted from a fiscal to calendar year basis, insofar as this is possible. The profits of incorporated co-operatives are included as a part of corporation profits in these estimates. In addition, corporate losses are deducted from estimated total profits in order to bring the figures to a 'profits less losses' basis. It should be noted also that business accounting records include in book profits the dividends received from other Canadian corporations. An adjustment is therefore necessary to eliminate the double counting which this involves. Profits of government business enterprises are not included here but are included in series F5.

The profits of corporations as given in series F3 reflect income from interest on their holdings of the public debt and from consumer financing. Since these payments are treated as transfer payments, they must be eliminated in arriving at a total of national income. For the way in which this adjustment is made, see the note to series F5.

F4. Dividends paid to non-residents are deducted here in order to eliminate from corporate profits, and the national income, the earnings of non-resident factors of production. This deduction is required because the national income is defined to include only the earnings of Canadian factors of production. In principle, *all* earnings of non-residents, both distributed and undistributed earnings, should be eliminated from the national income. In practice, because of statistical problems, only that portion of profits which is actually distributed to non-residents, that is dividends, is eliminated. The undistributed profits of corporations which accrue to foreign owners are thus included as a part of the national income of Canada.

F5. Interest and miscellaneous investment income consists of the interest income of persons, and government investment income. These items are measured before deduction of direct taxes and cover the earnings of Canadian

esidents only. The component also includes a major adjustment needed to eliminate from the national income all interest on the public debt as well as the transfer portion of nterest on consumer debt.

Interest income of persons includes the interest received by or accruing to persons (includes individuals, private nonommercial institutions, estates and trust funds); the interest income of life insurance companies, fraternal and mutual benefit societies and trusteed pension plans, accruing on behalf of persons; and small amounts of miscellaneous income. Interest paid to corporations and government business enterprises is automatically included in the profits of these institutions and is not counted here. Interest paid to government is included in government investment income.

Interest income of persons is thus made up of the following items: Canadian bond and mortgage interest received by or accruing to persons; paid and imputed interest on deposits with chartered banks and similar financial institutions, received by or accruing to persons; investment income received on behalf of persons by life insurance companies, fraternal and mutual benefit societies and trusteed pension plans (all of which are treated as associations of individuals for this purpose); interest and dividends received by persons from non-residents; and some smaller categories of income, namely, royalties received by persons, the interest credited to persons from federal government annuities accounts and the profits and interest of mutual non-life insurance companies.

Government investment income includes the profits of government business enterprises, royalties, interest on government loans and advances, interest on publicly held funds such as government pension and social insurance funds, and imputed interest. Profits of government business enterprises consist of profits, less losses, of those government agencies which conduct their activities on an essentially commercial basis, setting a price for their services which is calculated to cover costs. Included here are profits of the Canadian National Railways and other Crown corporations, and provincial and local public utilities such as hydroelectric systems, telephone systems, transit systems and so forth. The profits of the federal Post Office Department are included here, its gross expenditures being offset against its gross revenues to arrive at an estimate of profits. Interest on government loans and advances includes interest on loans to government agencies, such as various public utilities and interest on loans to foreign and domestic governments.

Interest on the public debt is made up of two parts. One part is paid to Canadian residents and is regarded as a transfer payment rather than as a payment to a factor of production for a productive service, and which is therefore excluded from the national income. In this instance, an explicit deduction is made in the interest and miscellaneous investment income component to exclude from the national income that portion of the interest received by Canadian residents. Not all interest on the public debt received by Canadians accrues to persons and governments but the full adjustment is nevertheless made in this component of the accounts. If it were statistically possible to identify the amounts, corporation profits as well as the interest income of persons and governments would each be reduced by their relevant share of the debt interest received.

The other portion requires special treatment. Such interest payments represent a direct claim by non-residents on the pool of goods and services produced domestically. Accordingly, an explicit subtraction is made to reduce the national income, an adjustment which reflects the charge against domestic production which must be paid to non-residents. This adjustment is balanced on the expenditure side of the accounts by an entry under 'Imports of goods and services'.

Part of the interest on consumer debt is also treated as a transfer payment and is excluded from the national income by an explicit deduction in the interest and miscellaneous investment income component. All consumer outlay is regarded as current consumption in these accounts, except outlay on housing which is regarded as capital expenditure. Since consumer goods, except housing, cannot give rise to investment income, it is necessary to exclude interest on the debt which finances such goods. The administrative expenses which are incurred in rendering services to borrowers are, however, included in personal expenditure and also in the gross national product.

F6. Accrued net income of farm operators from farm production includes the net income that could properly be attributed to unincorporated farm operators for their own contribution of labour and entrepreneurial inputs, for labour provided by unpaid family workers and for the services of farm capital, land, structures and equipment owned by farm operators, except housing. It covers sales of farm products, *plus* the imputed value of farm output consumed by the farmer and his family, *plus* the value of the physical change in farm inventory, *less* farm operating expenses and capital consumption allowances on farm buildings and equipment. Farm production includes the sale of logs cut from forests on farm lots and income from fur farming. It excludes, however, other forms of income of farmers such as net rental or interest receipts and inputed net rent of owner-occupied houses. These are included in series F5 and F7. It also excludes transfer payments such as payments under the Prairie Farm Assistance Act since these are not in exchange for goods or services and are therefore excluded from national income. Since the national income attempts to measure earnings arising out of current production rather than cash receipts, the accrued earnings of farm operators arising out of the operations of the Canadian Wheat Board are included as is the accrued income represented by inventories held on the farm.

The estimates given here do not include profits of incorporated farms, which are treated like any corporation, wages and income in kind paid hired labour, rent paid others for farm lands, buildings and other facilities and rents on housing. Also excluded is any outside income such as property income from ownership of outside property or labour income for services provided to others outside the operator's own farm.

The total given here, therefore, is much less than gross domestic product originating on farms, series F56, even after allowing for the fact that capital consumption allowances are included in the latter. Nor is it a measure of income available to farmers because it excludes rental income and other receipts of outside income.

F7. Net income of non-farm unincorporated business consists of the earnings of working proprietors from their own businesses. Such businesses are 'unincorporated' as distinct from the corporate form of organization. The estimates cover a heterogeneous range of industries which includes unincorporated retail stores, unincorporated operators in construction and in transportation and communication, unincorporated manufacturing establishments and many types of unincorporated service establishments. It also

includes the net income of independent professional practitioners such as doctors, dentists, lawyers and engineers.

As in the case of accrued net income of farm operators from farm production, net income of non-farm unincorporated business represents a mixture of both labour income and investment income which cannot be segregated on anything but an arbitrary basis. To the extent that working proprietors supply their own labour, they earn wages and salaries; to the extent that they supply their own capital, they earn profits, interest and rents. These elements are inextricably mixed in the estimates of the net income field.

Net rental income of persons acting in a landlord capacity is included in these estimates. Such rental income covers net rents, either paid or imputed, received from the ownership of residential property, and also net paid rents from the ownership of non-residential property. In each case, the *net* rent received by persons is equivalent to gross rents received *less* landlord expenses such as heating costs, property taxes, capital consumption allowances, mortgage interest, insurance and repairs. The inclusion of net rental income of persons in this component of the national income consolidates all forms of income from non-farm unincorporated business activity in a single category.

F8. Inventory valuation adjustment is to correct for the fact that corporation profits and the net income of those non-farm unincorporated businesses that deal in commodities contain an element of capital gain or loss which arises from the method by which business firms record the value of their inventories. Production in the national income and expenditure accounts must be measured at the current market prices of the period in question. This means that net investment, or disinvestment, in inventories, represented by the change in inventories from one period to the next, should be valued at the average prices of the period in question. However, the principles of inventory valuation used in business accounting are usually quite different from those required for the accounts. In periods of rising prices, changes in recorded business inventory book values will frequently include an element of capital gain which simply reflects the fact that beginning-of-period inventories and withdrawals have been recorded at original cost, while purchases and end-of-period inventories are recorded at a higher price. In other words, the recorded money value of the 'book change' in inventories will have increased by more than the physical change in inventories valued at current, or replacement cost, prices.

In these circumstances, corporation profits and net incomes of non-farm unincorporated businesses included in national income will contain an element of capital gain, stock appreciation, which is not related to the measurement of current production and which is not consistent with the way in which other flows and transactions in the national accounts system are valued. The inventory valuation adjustment is thus designed to remove from the national income any such capital gains, or losses, resulting from the inventory accounting procedures of business firms.

The method of carrying out the inventory valuation adjustment is described in detail in *Volume 3*, Chapter 7. The adjustment represents the difference between the 'change in book values' as recorded on the books of business firms and the 'value of physical change', valued at the prices prevailing in the current period.

F9. Net national income at factor cost is the sum of all factor remunerations received by or accruing to Canadian residents from the contributions of services of the factors production. It is the sum of the entries in series F1-8.

F10. Indirect taxes represent a part of the market p of goods and services which is not received by factors production. They are, therefore, not included in the tional income but must be added to factor costs to arrive total costs entering into market prices. Business accoun procedures provide a guide as to whether a tax is to be garded as direct or indirect. Thus, all taxes which repres a business cost and which are likely to be partly or f reflected in final or market prices paid by the purcha such as sales and excise taxes, import duties, and prop taxes, are taken as indirect. Such taxes make up a par the producers' costs but they do not form a part of the come of the factors of production. In effect, they are ta on expenditure, not on income. Taxes which are levied rectly on the net incomes of the factors of producti whether of individuals or corporations, are regarded as rect taxes.

Indirect taxes include: customs import duties, federal cise duties and excise (sales) taxes, and miscellaneous s other federal indirect taxes; provincial government am ment taxes, corporation taxes (not on profits), gasoline retail sales taxes, revenue from licences, permits and f the business share of motor-vehicle licences and pern miscellaneous taxes on natural resources and small amo of other miscellaneous indirect taxes; municipal real personal property taxes, retail sales taxes, and misc neous other indirect taxes and licences, permits and fees

Subsidies represent amounts contributed by governm toward current costs of production. For this reason, t must be deducted from factor costs to arrive at gross tional product at market prices. The larger part of subsidy figure consists of federal production and consu tion subsidies. There are a variety of purposes, some them inter-related, behind the payment of subsidies. I ducer subsidies are usually made to encourage certain t of economic production (Emergency Gold Mines A tance), to assist producers in areas of special difficulty (r way subsidies under the National Transportation Act) protect the producer against a decline in the price of product (Canadian Dairy Commission payments), or to s port activities which are regarded as socially desir (broadcasting activities of the Canadian Broadcasting C poration). Consumer subsidies are usually paid in order t the consumer may benefit from lower prices, as in the c of many of the subsidies paid on agricultural products c ing World War II.

F11. Capital consumption allowances represent the ing up or 'consumption' of capital through the depreciat wear, tear and obsolescence associated with the processe economic production. Since productive assets in the form capital goods such as machinery and equipment and bu ings are for the most part highly durable products, this ing up' of productive assets, or loss in value, is a grad process occurring over periods of time often covering m years. Businesses therefore customarily charge to e year's operating expenses a 'depreciation charge' or 'cap consumption cost' designed to cover the cost of the wea out of capital assets which has occurred during the acco ing period in question. Thus, depreciation or capital c sumption charges represent business costs which are imp itly included in the market price of goods and services to final users.

n these accounts there are three major types of produc- assets for which depreciation charges are calculated: iness plant and equipment, housing, and government d assets. Depreciation on business plant and equipment quantitatively the most important of the three sets of imates. The estimates of depreciation in this area, except agriculture, are based on the original cost of the assets. the case of housing and government fixed assets, the es- ates of depreciation are based on replacement cost and original cost.

harges for the depletion of exhaustible natural resources not included in the consumption of fixed capital in se accounts, even through they are charged by business operating costs. The discovery of such natural resources ot regarded as gross fixed capital formation.

The definition of gross fixed capital formation for the ional accounts is framed in terms of the tangibility and rability of the goods in question. Certain durable items h as furniture, office equipment, tools and so forth are netimes not capitalized by business but are charged as a rent operating expense. In order to include depreciation all durable equipment defined as fixed capital in these ounts, these *capital outlays charged to current expense* included in capital consumption allowances in the gross ional product. In other words, the assumption is made t these items are all used up in the year in which they purchased.

ncluded under the category of miscellaneous valuation justments are two adjustments which are needed to bring ormation based on business accounting records into con- mity with the definitions employed in the national in- ne and expenditure accounts, or to maintain balance tween the income and expenditure side of the accounts. e first of these adjustments concerns *non-capital outlays rged to capital account* by business. In some instances, n-tangible items such as brokerage fees on the purchase d sale of stocks and bonds are capitalized by business. In ping with the tangibility criterion used in the accounts, h items are excluded from gross fixed capital formation the expenditure side. In order to keep the accounts in lance, however, a negative adjustment must be made on income side to offset the overstatement of business net ome inherent in the income figures.

The second adjustment relates to the *claim portion of siness and residential insurance* paid out to compensate fire and other types of losses. These are treated in the ounts as a form of capital consumption and an explicit try is made to account for them.

F12. Residual error of estimate is an allowance for inac- racies of the statistical estimates of series F1-11. Concep- ally, gross national product and gross national expendi- re should be exactly equal. In the calculations, owing to ortcomings in the accuracy of estimates of the compo- nts of gross national product and gross national expendi- re, the components of each do not add to exactly the me totals. The totals are made equal by adding half the fference to the lower unadjusted total and subtracting lf the difference from the higher unadjusted total. Thus, ries F13 is made equal in absolute value to series F32.

F13. Gross national product at market prices is the sum series F9-13.

14-32. Gross national expenditure, by mponents, 1926 to 1976

SOURCE: same as series F1-13.

The items of series F14-30 are components of total gross expenditure by Canadian residents on final goods and services and on inventories. In this 'sum of expenditures' approach, the measurement of economic production is arrived at by tracing the disposition of final output through the various channels in which it is used. Series F29, exports of goods and services, is the value of goods and services sold to residents of other countries. Because of the fact that sales to final purchasers, both domestic and foreign, ordinarily include elements of imports of goods and services, foreign production, as well as of national production, and because it is not feasible to eliminate imports separately from each of the individual expenditure categories, the deduction to eliminate imports of goods and services is made in total as a single adjustment in series F30. Gross national expenditure at market prices is the total of gross expenditure on goods and services measured at the prices that are actually paid in the market.

F14. Personal expenditure on consumer goods and services is the largest single component of gross national expenditure. Around 60 per cent of the nation's total production is purchased in final markets for consumer use. Such outlays include personal expenditure for durable goods, such as automobiles, and household appliances and furniture; expenditure for semi-durable goods, such as clothing and footwear; expenditure for non-durable goods, such as food, alcoholic beverages and tobacco; expenditure for a wide variety of services, covering such outlays as gross rents, including the rental value of owner-occupied housing, recreation, railway, air and urban transportation costs, laundry, cleaning and personal care service costs.

Free board and lodging and other income in kind for which an imputation is made are also included in personal expenditure, as if persons received income equal to the value of such goods and services and then purchased these items. Purchases of houses are regarded as business gross fixed capital formation but an imputed space rent on owner-occupied houses is included in both rental income of persons and in personal expenditure. The operating costs of private non-commercial institutions which provide their services to the community collectively, and which are treated as 'associations of individuals' in these accounts, are also included in personal expenditure. In addition, the operating costs and profits, premiums less claims, of life insurance companies are included to reflect the value of the services rendered by such companies. The estimates also cover expenditures of Canadian residents temporarily abroad, that is, tourists and members of the Canadian forces; these expenditures are offset by a negative entry under imports of goods and services, so that gross national expenditure as a whole is not affected, as no Canadian production is involved. To avoid double counting, an adjustment is made to the total estimate of personal expenditure to deduct expenditures of foreign residents temporarily in Canada, since this expenditure is already included as a positive entry in exports of goods and services. The value of used goods sold to persons is excluded from these estimates but the dealer's commission and other factor incomes generated by the transaction are included as current production, to maintain balance with the income side.

F15. Government current expenditure on goods and services consists of the current, non-capital outlays for goods

There are three main types of inventories for which estimates of the value of physical change are computed: government inventories, series F26; business non-farm inventories, series F27; and farm inventories and grain in commercial channels, series F28. The latter are also a part of total business inventories. Government inventory holdings are a relatively small and insignificant part of total inventory holdings and exercise little leverage in the total change in inventory stocks. They include inventories held by government commodity agencies such as the Agricultural Commodities Stabilization Board, the Canadian Dairy Commission and some uranium stocks.

Business non-farm inventory stocks represent by far the largest part of total inventory holdings in the economy. They include all inventories of raw materials, goods-in-process, and finished products held by corporations, non-farm unincorporated businesses, and government business enterprises. By industry, the major part of non-farm business inventory stocks is held in manufacturing and in wholesale and retail trade.

Farm inventories and grain in commercial channels consists mainly of grain and livestock held on farms and grain in the hands of the Canadian Wheat Board. This category also includes some grain inventories held privately by commercial dealers. It may be noted that in the case of grain and livestock inventories held on farms, and grain held by the Canadian Wheat Board, the value of the physical change in inventories, and the corresponding estimates of net income on the income side, is computed directly, and no inventory valuation adjustment is necessary.

The inventory valuation adjustment in these accounts applies only to business non-farm inventory stocks and grain in the hands of private dealers, areas where the primary data entering into the accounts on the income side are based on book values.

Due to space limitations, the box heading in the table where series F28 appears, has been condensed to read 'Farm'. The full heading should read 'Farm and grain in commercial channels'.

F29-30. Because a part of Canada's current production of goods and services is sold to non-residents, it is necessary to add the value of exports of goods and services to arrive at a final accounting of current production through final sales, series F29. Conversely, because sales to persons, governments, business and non-residents, as enumerated in series F14-29, include goods and services produced by non-residents, that is, imports of goods and services, series F30, it is necessary to subtract these in order to arrive at a correct summation of the value of Canadian output.

Exports of goods and services, series F29, as defined in the accounts include current receipts from exports of merchandise, freight and shippimg credits earned on Canadian account, travel expenditures of non-residents in Canada, interest and dividends received from abroad, gold production available for export, and other current earnings, including receipts from business services rendered to non-residents. Imports of goods and services, series F30, include current payments for imports of merchandise, freight and shipping charges incurred by Canada on foreign account, travel expenditures of Canadians abroad, interest and dividends paid to non-residents, and other current payments, including payments for business services rendered by non-residents. Entries corresponding to the interest and dividend payments to and receipts from non-residents are made on the income side of the accounts in keeping with the concept of 'national' production expressed in the gross national product and expenditure measurements.

The figures of exports and imports of goods and services appearing in the gross national expenditure table are those published by Statistics Canada in *The Canadian Balance of International Payments*, (Catalogue 67-201), subject to certain modifications and adjustments in the earlier years. The relationship between transactions in goods and services and the current account of the balance of payments is described in *Volume 3*, pp. 244-249. Basically, current account receipts and current account payments as per the balance of payments reflect, in addition to exports and imports of goods and services, current transfers and transfers of inheritances and migrants' funds. Current transfers such as personal and institutional remittances and pensions paid to or received from abroad are not included with exports and imports of goods and services in gross national expenditure since they are not considered to represent current earnings of Canadian or foreign factors of production. Inheritances and migrants' funds paid to or received from abroad are transfers of a capital nature and for this reason do not appear in the gross national expenditure.

Until fairly recently the links between balance of payments data and the national income and expenditure accounts were not fully articulated in the balance of payments reports. Users of historical balance of payments reports will find it necessary to make a number of adjustments to move to the national accounts basis of presentation shown here. In recent balance of payments publications, however, the figures are fully reconciled.

In some earlier years in the balance of payments reports there appears in both current receipts and current payments an entry for mutual aid to NATO countries. These entries have to be eliminated for use in the national income and expenditure accounts since the amounts represent provision of goods and services which have already been counted as Canadian production in government defence expenditure for goods and services, either in the current period or in some previous period. The adjustments are self-cancelling since they reduce both exports of goods and services and imports of goods and services by identical amounts, and gross national expenditure is not affected.

In earlier years, and particularly in the war and early post-war period, a number of special adjustments have been made to the basic balance of payments data for national income and expenditure accounts purposes. These and other aspects of transactions with non-residents are described more fully in *Volume 3*, Chapter 8. A complete reconciliation between the national accounts presentation and the balance of payments presentation is given in table 60 of *National Income and Expenditure Accounts, 1962-1976.*

F31. Residual error of estimate is an adjustment for inaccuracies and imperfections in the basic statistics required to bring the gross national product and gross national expenditure into arithmetical balance. (See note to series F12).

F33-55. Gross national expenditure in constant (1971) dollars, by components, 1926 to 1976

SOURCE: same as series F1-13.

The data of series F33-45 differ from those of series F14-32 only in that these expenditures are measured in constant (1971) dollars rather than current dollars and that there are adjusting entries, described below, not present in series

and services of the federal, provincial and local governments, including locally administered elementary and secondary school systems and government administered hospital care services. It does not include government purchases on capital account, gross fixed capital formation, or inventories, or any of the activities of government business enterprises. The outlays cover all current purchases of goods and services for general operating expenses of government departments and agencies, including wages and salaries of government employees, office supplies, and maintenance and repair costs. The estimates also include defence expenditures. An imputation for the capital consumption or depreciation of government fixed assets is included here.

It needs to be emphasized that these expenditures relate to government current purchases of goods and services only. They do not include such current expenditures of government as transfer payments to persons, interest on the public debt, subsidies to producers, capital assistance to producers, or transfers to non-residents. These latter items, together with government gross fixed capital formation, must be added to government current expenditure on goods and services to arrive at figures of total government spending for all purposes.

F16. This series is the sum of series F17-24, gross fixed capital formation by government and gross fixed capital formation by business. Gross fixed capital formation is defined to include outlays on durable tangible assets with a lifetime use of one year or more. Only new construction, both residential and non-residential, and new machinery and equipment are included. Outlays on used buildings and second-hand machinery and equipment are excluded, since such goods do not represent a part of the nation's current production. They have been counted in gross national expenditure in the period in which they were produced. An exception relates to imports of used machinery and equipment which are included in gross fixed capital formation and are deducted as an import of goods and services, leaving gross national expenditure unaffected.

Outlays for land, mineral deposits and timber tracts are also excluded from gross fixed capital formation since such assets do not represent current production of goods and services. However, capital costs involved in the preparation of sites, land improvements, mining development and exploration costs, involving the acquisition of tangible assets, and construction and drilling costs are included in gross fixed capital formation. Such costs represent stages in the process through which natural resources are discovered, developed and brought into use. The value of the resources themselves is not capitalized in these accounts.

Replacements and major alterations of capital installations are included as part of gross fixed capital formation but ordinary repairs and maintenance expenses are not. Also included are various associated expenses which are capitalized along with the cost of the fixed assets acquired, such as architectural, legal and engineering fees. Outlays on construction works which are to be used primarily for military purposes, and purchases of military equipment are not included in the estimates of gross fixed capital formation.

The estimates of fixed capital formation in these accounts are on a 'gross' basis, before any deduction to allow for the depreciation or capital consumption of existing assets. The calculation of 'net' fixed capital formation is not possible on the basis of the estimates of depreciation as presently prepared, since the bulk of the depreciation figures are calculated on an original cost rather than a replacement cost basis of valuation.

F17-20. Government gross fixed capital form sists mainly of construction-type expenditures, s for schools, hospitals, waterworks, sewerage syste harbours, airports and various other capital instal also includes outlays for machinery and equipme F20, and a small amount of housing, series F18 provincial and local levels of government are inc the investment spending of government business e is not covered here. The decision to capitalize g investment spending in this revised set of acc made on the basis that such assets add to the stock of capital and yield a flow of economic servi period of years into the future. The gradual 'us government fixed capital is reflected in the i which is made for depreciation on government ass accounts.

F21-24. Business gross fixed capital formatio of outlays for residential construction, series F2 for non-residential construction, series F23, and new machinery and equipment, series F24. Outlay dential construction cover all expenditures for ne except a small amount shown with government c mation. The estimates include single units, mult and apartment dwellings, as well as garages and provements and alterations. The term 'business' here to include individual home-owners who are the accounts as businessmen renting to themselve sonal purchases of housing for owner use are th cluded in these estimates, as well as commercial struction undertaken for rent.

Business gross fixed capital outlays for non- construction and machinery and equipment cov ment in all forms of productive assets by busin are used to produce a future flow of goods an Included here are all plant and equipment exper corporations, unincorporated business enterprises, farm operators, and government business enter example, buildings of all kinds, engineering co such as railway road beds, dams, power transmis oil pipelines, industrial machinery, generating transportation equipment, office and store equipm ture, small tools and like items. The capital outla commercial institutions include universities, chu charitable and welfare agencies.

F25-28. The value of the physical change in held by businesses and governments must be i the gross national expenditure in order to allo portion of current production which has not yet (a positive change in inventories) or to eliminate tion of previous years' production which is includ of the current year (a negative change in invent change in the value of inventories relevant to gro expenditure should reflect the change in physic valued at the average market prices of the pe change is referred to as the value of the physical inventories. Because the value of inventories re businessmen reflects 'book values' based on acco cedures which are not consistent with national requirements, an inventory valuation adjustmen made to produce an appropriate figure. This inve ation adjustment is described in the earlier di national income and gross national product.

F14-32. The content of each of the series given here is the same, therefore, as that given under the same heading in series F14-32.

In principle, the conversion of the current value figures to constant dollar estimates involves the breakdown of changes in current value estimates into the price and quantity constituents. This is accomplished by constructing appropriate price indexes which are then used to 'deflate' the value data and to reveal the underlying change in physical volume.

The estimation of constant dollar expenditure from current dollar expenditure was done in two steps, common to all the main categories given here with the exception of inventories. First, the individual subcomponents of the expenditure categories of series F14-32 were deflated in rather fine detail by, for the most part, Laspeyres-type price indexes. For example, 140 subcomponents of personal expenditure on consumer goods and services were deflated separately; government and business gross capital formation were deflated in considerable but somewhat less detail. Exports and imports were deflated in fine detail, about 35 subcomponents each, using mainly unit value price indexes for the period up to 1961, and specially constructed price deflators based on specific pricing procedures in the more recent period.

Once the deflation of the subcomponent detail was completed, the second step was to add all of this deflated subcomponent detail to derive the constant dollar aggregates given here.

The procedure used for converting the value of the physical change in inventories into constant dollar estimates is somewhat different. For farm inventories and grain in commercial channels, the constant dollar series is derived by valuing, in prices relevant to the base period chosen, the physical quantities of stocks. Data on prices, physical quantities of grain stocks held in inventory, and numbers of poultry and livestock are obtained from the Agriculture Division of Statistics Canada. The procedures in this area are therefore quite straightforward.

The procedure for the conversion of non-farm inventories differs from the above because detail on physical quantities is not available. The information given consists of current dollar book values only, from which it is necessary to remove the effect of price changes relevant to the base period. The first step is to estimate the book values of inventory stocks. This process is carried out in considerable detail for a large number of industry groups. The second step is to construct a weighted price index for deflating industry book values. This step involves knowledge of the commodity composition of inventory book values, the change in the price of these commodities and the time period over which the stocks have been acquired based on the rate of turnover of inventory holdings. The third step involves calculating the constant dollar book values in terms of base-period prices. The final step is to calculate the year-to-year change in the physical volume of inventories expressed as the change in these constant dollar book values.

The grand total of gross national expenditure in constant dollars is the sum of all the components measured in constant dollars plus the adjusting entries.

When constant dollar estimates are put on a new time reference base, such as 1971 in the present series, the entire constant dollar series from 1926 is not reweighted on the basis of 1971 prices. Although 1971 is the current time reference base for the entire span of years, five different sets of price weights are incorporated in the series, covering five different time segments. The results are linked together mechanically at the overlap years. The five weigh reflect the prices of 1935 to 1939 for the period 1 1947; 1949 for the period 1947-56; 1957 for the peric to 1961; 1961 for the period 1961 to 1971; and 1971 period 1971 to 1975. The retention of the earl weights in the rebased constant dollar series is requ order that the price-weight base will best reflect t terns of relative prices in the period for which it is u

As a result of the mechanical linking process, c dollar gross national expenditure and its component the same year-to-year volume movements as was sh each original series. However, the linking process gi to adjusting entries, as the individually linked com will not add exactly to the gross national expenditur which are independently linked. These adjusting ent primarily a function of differences in the structure price-weight base at the year of overlap.

Implicit price deflators may be obtained for each nent, for each subtotal and for gross national expe by dividing each series in current dollars by the corre ing series in constant dollars. These implicit price i are given in Section K. It should be noted that in eff implicit deflators are currently weighted Paasche-t dexes at the aggregate level but in corporate fixed we of the Laspeyres type of index at the detailed sub nent level.

A full description of the deflation procedure is g the basic reference document, *Volume 3*, Chapter 9.

F56-75. Gross domestic product at factor c by industry, 1926 to 1976

SOURCE: same as series F1-13.

Gross domestic product at factor cost measures th of production arising within the geographical bounda Canada irrespective of whether the factors of prod involved are resident or non-resident. It differs fro national product at market prices in two ways: first. cludes net income earned by and paid to non-resid originating in Canada (see adjustment series F73); sec excludes indirect taxes less subsidies (see adjustmen F72). The adjustments required to move from gross tic product at factor cost to gross national product a ket prices are shown in series F72-74.

Gross domestic product at factor cost, by industry, the industrial origin of economic production. In eff reveals the 'value' added by each industry to the v the country's total production. For the assembly and sis of industrial statistics, the domestic product con preferable to the national product concept since it with production originating within the country's geo cal boundaries, and also avoids the statistical prob having to allocate net interest and dividends paid t residents by industrial origin. In addition, the 'facto concept is more appropriate for this purpose than the ket price' concept, since indirect taxes levied by g ments with respect to purchases and sales of goods a vices bear much more heavily on some industries th others. The relative share of an industry's contribut production in terms of factor use is therefore more depicted if indirect taxes less subsidies are exclude the calculations.

The contribution to production of each industry, t the net value added, is the sum of factor payments o ing in the industry. These are wages, salaries, supp tary labour income, profits and other forms of inve

shows whether the government sector has been a net contributor to, or a net demander of, funds for the finance of investment.

F121-134. Finance of saving and investment, 1926 to 1976

SOURCE: same as series F1-13.

This table is designed to show total gross fixed capital formation in the economy and the sources from which these capital outlays were financed. In effect, the right hand side of the table shows the demand for saving required to finance investment; and the left hand side of the table shows the sources from which this saving was provided, in the form of national saving by persons, business and governments, and in the form of saving provided by non-residents, that is, net borrowing by Canada from abroad.

F121. This total is the sum of series F122-127.

F122. Personal saving is described in the note to series F90.

F123. The adjustment on grain transactions is essentially an allocation of earnings arising out of the operations of the Canadian Wheat Board and, in earlier years, the Canadian Cooperative Wheat Producers, to place the earnings of farmers arising out of these operations on an accrual basis.

F124. Government saving is described in the note to series F117.

F125. Undistributed profits of corporations and government business enterprises consist of the amount of earnings retained after payment of taxes, distribution of dividends to Canadian residents and to abroad, payment of various transfer payments and, in the case of government business enterprises, after profits remitted to governments.

F126. The inventory valuation adjustment is described in the note to series F8.

F127. Capital assistance is described in the note to series F113.

F128. Capital consumption allowances are described in the note to series F11.

F129. The surplus (-) or deficit (+) of Canada on current transactions with non-residents is simply a measure of the degree to which Canada has been required to draw upon foreign resources from abroad to help finance its capital investment program. In this table, a positive sign (+) means that Canada has drawn upon foreign resources or foreign savings, that is, has incurred a deficit on transactions in goods and services with non-residents. A negative sign (-) means that Canada has run a surplus on transactions in goods and services with non-residents and has thereby contributed to the savings resource requirements of the rest of the world. The net figures shown here are equal to the difference between exports of goods and services and imports of goods and services, series F29 and F30, plus or minus a small amount of net current transfers paid to or received from abroad. The full reconciliation with series F29 and F30 may be obtained from table 60 of *National Income and Expenditure Accounts, 1962-1976.*

F130. The residual error of estimate is described in the note to series F12 and F31.

F131. This total is the sum of the subtotal series F121 plus series F128-130 inclusive. It is also equal to the sum of series F132-134.

F132. Gross fixed capital formation is described in the notes to series F16 and F17-24.

F133. Value of physical change in inventories is described in the notes to series F25-28.

F134. The residual error of estimate is described in the note to series F12 and F31.

F135-152. Gross fixed capital formation, by industry, 1926 to 1976

SOURCE: same as series F1-13.

The industrial breakdown of gross fixed capital formation is based on the industrial classification of capital expenditures set out in the regular series of Statistics Canada reports, *Private and Public Investment in Canada, Outlook,* (Catalogue 61-205), and similar reports for earlier years from Statistics Canada and the Department of Industry, Trade and Commerce. The basis of classification is the Standard Industrial Classification in which the establishment is the key unit of reporting. The classification by industry refers to the industry of ownership.

A number of adjustments are required to move from the private and public investment figures which form the basic source data to the figures given here on the national accounts basis or presentation. *Volume 3,* provides a summary view of these adjustments, on pages 231 and 233.

F135. Total gross fixed capital formation in current dollars is the sum of series F136, business gross fixed capital formation, and series F148, government gross fixed capital formation.

F136. This series covers business outlays for non-residential construction, machinery and equipment, and housing. It corresponds to series F21 discussed earlier. The reader is referred to the notes to series F21-24 for a more complete description of concepts and coverage.

F137-147. This group of series shows the industrial breakdown of business outlays for plant and equipment and for housing. The housing estimates, except for a small amount of government housing, are included with finance, insurance and real estate.

F137. Excludes investment of government experimental farms. Also excludes government-owned fish hatcheries and fishing inspection and protection services.

F142. Includes air, railway and water transport services; motor transport; urban transit systems; pipelines; grain elevators; toll highways and bridges; and warehousing.

F143. Includes broadcasting, and telephone and telegraph services.

F145. Includes wholesale and retail trade.

F146. Includes capital outlays by banks, insurance, trust and loan companies, real estate establishments primarily engaged in owning and operating real estate, or in developing and improving real estate. Estimates for residential housing are included in this industry, except for residential housing by government.

F147. Includes investment by laundries and dry cleaners, motion picture theatres, hotels and other commercial services. In recent years this last category has reflected an increase in the leasing of machinery and equipment.

F148. This series covers government outlays for non-residential construction, machinery and equipment, and a small amount of housing. It corresponds to series F17-20 discussed earlier.

F149. Includes investment by municipal water systems which are treated as a part of general government and are not included with series F144.

F150. Includes investment in residential construction by the federal government.

F151. Communication and community service has been reduced to only community service since the year 1959 with the transfer of the Canadian Broadcasting Corporation from government to the business sector in the national accounts classification system. It now contains only investment by hospitals and provincial and municipal schools.

F152. Includes estimates of gross fixed capital investment by federal, provincial and municipal government departments.

Income Produced and Capital Formation before 1926 (Series F153-182)

General note

Many of the sources of data for national income used for the period from 1926 onward were also available for earlier years. For example, fairly comprehensive data on annual production in agriculture began in 1908. Fisheries production was available annually, in improved form, from 1911. The annual census of manufactures and of electrical stations began in 1917, mineral production was available from 1886, the census of mining from 1920 and collection of employment data began in 1921. Many of the data on banks, insurance and other financial companies; on railways, telegraphs and telephones; and on governments, were available annually as were the data on foreign trade. During this period, improved annual data on wage rates and prices were emerging. A census of manufacturing was taken with each decennial census until 1911 and 'postal' censuses for 1905 and 1915. An incomplete census of trade was taken for 1923.

In addition, some material was available for Ontario from an annual census of manufactures from 1900 to 1914.

These data form much of the basis for the estimates of national income from 1919 to 1926 and the estimates of capital formation from 1901 to 1930 given in this subsection.

F153-165. Net domestic income, by industry, 1919 to 1926

SOURCE: *Estimates of Net Domestic Income at Factor Cost and Labour Income by Industry, 1919-1926*, (a private, unpublished, mimeographed memorandum prepared by D.H. Jones, of Statistics Canada).

These estimates of net domestic income, 1919 to 1926, correspond to those appearing for gross domestic product, by industry, in series F56-75 for 1926 to 1976, with the exception that the latter measures product at factor costs plus capital consumption allowances and miscellaneous valuation adjustments while the former includes only factor incomes. The difference between the two totals in 1926, the year of overlap, is equal to the capital consumption allow adjustments.

The concepts of the two sets of series are ide methods of measurement are quite different. Es national income and related aggregates, prepared tics Canada before it began publication of the n counts at the end of World War II had been '...c the most part by subtracting estimates of materia vices used and depreciation from the value of gr industry by industry, using for this purpose a fa sive body of economic statistics collected annually nially by the Dominion Bureau of Statistics', see 2. The worksheets underlying the earlier estimate the main basis for the estimates given here. Un revisions of the original data were used and in a the data were traced back to the primary sources. were rearranged and adjusted to fit the later con industry classification.

The levels of the estimates were adjusted, in industry, by linking them with the official series a a check, estimates of net domestic income were ex 1927, 1928 and 1929, excluding agriculture, public tration and defence. The estimates of the projec were 99.2 per cent of the sum of the same comp the official series in 1927, 99.2 per cent in 1928 an cent in 1929. Agriculture, public administration an were calculated by exactly the same methods fo 1926 as for the later official series.

The relation of the industry groups given here t series F56-75 is apparent from the headings. T need attention. No inventory valuation adjustment made for wholesale and retail trade; the net imp of government buildings is included with finance, and real estate and not with service.

F166-178. Labour income, by industry, 1926

SOURCE: same as series F153-165.

Wages and salaries were estimated for 1919 to 1 far as possible, by methods identical to those u 1926 onward. (see the general note to series F1-15 in construction were based on the value of constru its implied labour content from material in Buckl *tal Formation in Canada, 1896-1930*. The resul mates were then adjusted upwards to take accoun plementary labour income, industry by industry proportion that it had to wages and salaries in 192

A check made by comparing the change in labo as derived from earnings of wage earners in the 1931 censuses with that obtained from the nationa data between the two periods suggested, on the bas sonable assumptions, that the estimating techniq quite good.

F179-182. Gross domestic capital formati quinquennial periods, 1901 to 1930

SOURCE: Buckley, *Capital Formation in Canada 1930*.

Conceptually, Buckley's estimates cover the same in the national accounts from 1926 onward and F135-152. Government fixed capital formation is in well as private capital formation. All commercial

and 20 per cent of outlay on passenger automobiles are included as belonging to government or business capital formation. Housing is included but consumer durables are not. The estimate of inventory investment is the value of the physical change in inventories.

Buckley's estimates of fixed capital formation were built up, in the main, from annual flows of construction materials and machinery and equipment. Imports are added to production and exports are subtracted to estimate the flows. The derivation of the construction estimates is described in Section S. The values of flows of machinery and equipment at producers' prices were adjusted for taxes, freight and mark-ups.

The main sources of the machinery and equipment data were annual reports of external trade, the federal censuses of manufactures for 1900, 1905, 1910, 1915 and annually from 1917 to 1930 and the Ontario census of manufactures for 1900 to 1914. In addition, annual direct estimates of outlay on railway rolling stock, for the whole period, were calculated from railway and government accounts; on shipbuilding from shipping reports of the Department of National Revenue; on motor vehicle sales from registration of motor vehicles for 1904 to 1916. Freight costs were estimated by data provided by Statistics Canada as far back as 1913, or before that, from estimates in Viner, *Canada's Balance,* (see Section G). Sales and excise taxes were calculated by applying rates of tax to the values at producers' prices, including import duties, and mark-up margins from material provided by Statistics Canada. The data for 1926 to 1930 are mainly from estimates in *Public Investment and Capital Formation,* which were based on the same methods, (see Section S).

Investment in inventories was calculated from various official annual data for livestock on farms from 1907, grain on farms from 1909 and grain in commercial channels from 1910; for earlier years some data were obtained from censuses and some were estimated on the basis of production. Manufacturing inventories were obtained from Statistics Canada for the postal census of 1915 and the annual census of manufactures. For 1900, 1905 and 1910 they were taken as 50 per cent of the working capital, the ratio being based on the 1915 data. Trade inventories were estimated as a constant proportion of the sum of exports and imports, the proportion being based on the same ratios that existed in 1925 to 1930. All trade inventory investment in 1901 to 1925 and manufacturing investment in 1901 to 1915 were estimated by the five-year periods given here. Price indexes used for deflating inventory investment in livestock and grain were mainly based on official sources. For manufacturing and trade, the wholesale price index of Statistics Canada, *Prices and Price Indexes,* was used, (see Section K).

The years 1926 to 1930 are given to provide an overlap with the official data.

The source also contains annual estimates of the flow of five categories of machinery and equipment at producers' prices and quinquennial estimates of capital formation for the same categories.

Stock of Business and Social Capital at Mid-year, and Inventories at Year-end, (Series F183-224)

General note

The concept of capital used here corresponds very closely to that underlying the estimates of fixed capital formation given in earlier tables of this section. The estimates cover fixed tangible capital stocks with the capacity to produce goods and services into the future and that have themselves been produced by human effort. They do not include gifts of nature such as the value of natural resources, land, forest stands, mineral and oil deposits and the like, or intangible assets such as goodwill and the accumulated training, skills and knowledge of people. Residential housing is included in capital but other consumer durables are not. Inventories in the usual sense of the term are not included.

Gross capital is valued at its monetary cost. Most of the estimates reproduced here are valued at cost expressed in terms of constant (1971) dollars. Thus, they provide a means of measuring the growth or decline in the real gross physical stock of fixed capital assets. In addition, estimates of 'industry' capital are also provided here in terms of their original cost at the time of purchase. In these estimates, each item of capital in the stock is measured in the prices that prevailed at the time it was actually produced.

The net capital stock is measured by subtraction from the gross stock of an estimate of the service capacity of the gross stock which has been used up in depreciation, obsolescence, fire destruction and other damage. For the estimates of the net capital stock in constant dollars, depreciation and the like are measured in constant dollars, just as the gross stock was. For the estimates of the net capital stock at original cost, the depreciation and like items are valued in prices of the years in which the capital was produced.

Industry capital covers a slightly different part of the economy than that covered in the national accounts by business gross fixed capital formation in non-residential construction and machinery and equipment. The latter includes churches, universities and other non-commercial institutions; in the capital stock figures, these institutions are covered in social capital. Government business enterprises, however, remain in the industry group.

In the calculation of the size of the capital stock, the 'perpetual inventory' method was used. The estimation of capital stock in any one year requires a knowledge of the length of life of capital goods and the amount of gross capital formation in them for each year before the date for which the stock is being measured, as far back as the average length of life of the capital. The gross stock, at the required date, is then estimated as the sum of capital formation in these preceding years. For example, if the length of life of a capital item is 10 years and if the gross stock at the end of 1969 were to be measured, it would be obtained by adding together gross capital formation for the item from 1960 to 1969. The estimation of the gross capital stock at the end of 1970 would be obtained by subtracting from the 1969 year-end stock the gross capital formation in 1960 and adding to it that in 1970.

The net capital stock is obtained by accumulating the annual capital consumption of the capital goods still covered in the gross stock and by subtracting this accumulated amount from the gross stock. This involves calculating depreciation and like costs on a straight-line basis over the life of the capital good. A capital good with a 10-year life would be depreciated at 10 per cent per year.

When the capital formation, on which the stock estimates are based, was first estimated in current dollars, it was calculated in constant dollars by deflation of the current dollar

estimates of capital formation by an index of the cost per unit of the capital formed. Similarly, for the constant dollar net capital formation estimates, it was necessary to adjust the depreciation on the capital item to the constant dollar basis.

The above methods of calculating the capital stock require estimates of capital formation of the length of life of capital goods and of the movements of prices (costs) of the capital goods. In some instances, for long-lived capital, it was necessary to go back as far as 1870 to obtain the 1926 stock estimate.

Capital formation was obtained by somewhat different methods for 1926 to 1975 and for the period before 1926. For 1926 to 1945, the capital formation estimates were, with slight modification, taken from Department of Trade and Commerce, *Private and Public Investment in Canada, 1926-1951;* for 1945 to 1975, they are based on the reports of actual expenditure obtained in the preparation of the annual report, *Private and Public Investment in Canada, Outlook.* (See Section S for a discussion of the construction component obtained in these two sources.) For the period prior to 1926, the main source for capital formation estimates was Buckley's, *Capital Formation in Canada, 1896-1930* (see Section S); and some rough estimates for this earlier period from other data. The capital formation estimates, and their accumulation, were in fairly fine detail for 1926 to 1975; they were in much broader aggregates for the preceding period.

Detail on the length of life of capital goods was obtained, mainly, from studies by engineers and accountants in Canada, the United States and the United Kingdom in the 1930s, to determine appropriate depreciation allowances for income tax purposes. The results were available in bulletins published by internal revenue services. Greatest use was made of Bulletin F prepared in the United States. Few provisions were made for changing the length of life of specific types of capital. An exception was in urban transport systems where the change from streetcars to buses resulted in a shorter life for equipment.

Price indexes came from a variety of sources. Some were based on indexes used for deflating capital expenditure in the national accounts, from 1926 onward; some were from United States indexes, adjusted for duties, transportation and the like; some were constructed from data on material prices and indexes on wages. In some cases before 1926, Buckley's implicit price index of construction costs and wholesale indexes of prices for machinery were used.

The data for earlier years, on which capital formation and price indexes were based, were frequently sketchy. Fortunately, the seriousness of this shortcoming is mitigated by the fact that when capital formation is growing rapidly, the capital stock is largely made up of capital formed in the years immediately preceding its date of measurement.

F183-192. Industry gross and net capital stock, in 1971 prices, by structure and machinery and equipment, mid-year, 1926 to 1975

SOURCE: for 1972 to 1975, Statistics Canada, *Fixed Capital Flows and Stocks, 1972-1976,* (Catalogue 13-211); for 1970 and 1971, same title, 1970-1974; for 1926 to 1969, same title, 1926-1973.

F183-187. See general note for a description of the industry gross stock estimates in constant (1971) dollars. Series F187, capital items charged to operating expenses, consists of certain durable items such as furniture, office equipment, tools and so forth, which are sometimes not capitalized by business but are charged off as a current operating expense. To ensure the inclusion of these items in the capital stock, they are added here.

F188-192. See general note for a description of the industry net stock estimates in constant (1971) dollars. For series F192, see note to series F187.

F193-202. Industry gross and net capital stock, at original cost, by structure and machinery and equipment, mid-year, 1926 to 1975

SOURCE: same as series F183-192.

F193-197. See general note for a description of industry gross stock estimates at original cost. For series F197, see note to series F187.

F198-202. See general note for a description of industry net stock estimates at original cost. For series F202, see note to series F187.

F203-209. Gross stock of social capital, in 1971 prices, public and private, by type, mid-year, 1926 to 1975

SOURCE: for 1972 to 1975, Statistics Canada, *Fixed Capital Flows and Stocks, 1972-1976,* (Catalogue 13-211); for 1970 and 1971, same title, 1970-1974; for 1926 to 1969, same title, 1926-1973; housing estimates for all years were obtained from the Construction Division, Statistics Canada.

F203-206. Government social capital consists of schools, hospitals, waterworks, sewerage systems, bridges, roads, harbours, airports and various other publicly financed capital installations. See general note for a description of gross stock in constant (1971) dollars.

F207-208. Privately owned social capital consists of housing, universities, churches and various types of privately financed institutional capital of a non-commercial nature. Estimates were not available for the gross stock of housing expressed in constant (1971) dollars, the basic source material being collected on a net basis only.

F209. The sum of gross stock of government and privately owned social capital in constant (1971) dollars is available only for machinery and equipment. The construction component is not available because gross stock of housing cannot be estimated at the present time. For the net stock of housing, see series F215.

F210-220. Net stock of social capital, in 1971 prices, public and private, by type, mid-year, 1926 to 1975

SOURCE: same as series F203-209.

F210-213. See note to series F203-206. The difference between these two groups of series is that the one is on a gross basis, the other on a net basis.

F214-217. See note to series F207-208. The difference between these two groups of series is that one is on a gross basis, the other on a net basis. In addition, estimates of privately owned housing stocks are included here on a net basis.

F218-220. The sum of net stocks of government and privately owned social capital in constant (1971) dollars.

Series F1-13. National income and gross national product, by components, 1926 to 1976
(millions of dollars)

Year	Wages, salaries, and supplementary labour income	Military pay and allowances	Corporation profits before taxes	Deduct: dividends paid to non-residents	Interest and miscellaneous investment income	Accrued net income of farm operators from farm production	Net income of non-farm unincorporated business, including rent	Inventory valuation adjustment	Net national income at factor cost	Indirect taxes less subsidies	Capital consumption allowances and miscellaneous valuation adjustments	Residual error of estimate	Gross national product at market prices
	1	2	3	4	5	6	7	8	9	10	11	12	13
1976	107,922	1,453	19,985	-1,719	11,175	3,317	8,438	-2,064	148,507	21,520	20,738	266	191,031
1975	93,289	1,336	19,663	-1,835	8,661	3,944	7,669	-2,938	129,789	17,584	18,270	-300	165,343
1974	80,086	1,203	20,062	-1,645	7,632	3,859	6,901	-4,244	113,854	18,257	16,046	-629	147,528
1973	66,757	1,092	15,417	-1,277	5,359	3,009	6,656	-2,362	94,651	15,598	13,355	-44	123,560
1972	57,570	979	10,799	-1,031	4,577	1,662	6,170	-1,032	79,694	13,876	11,474	190	105,234
1971	51,528	908	8,681	-1,079	3,906	1,576	5,928	-665	70,783	12,276	10,500	891	94,450
1970	46,706	914	7,699	-952	3,428	1,211	5,424	-195	64,235	11,299	9,806	345	85,685
1969	43,065	884	8,294	-854	3,082	1,435	5,187	-576	60,517	10,722	9,019	-443	79,815
1968	38,444	874	7,742	-835	2,623	1,321	4,778	-341	54,606	9,662	8,308	10	72,586
1967	35,303	857	6,823	-874	2,362	1,239	4,355	-327	49,738	8,852	7,786	33	66,409
1966	31,878	751	6,714	-850	2,070	1,950	4,116	-335	46,294	8,030	7,322	182	61,828
1965	28,201	677	6,318	-828	1,891	1,389	3,893	-322	41,219	7,284	6,655	206	55,364
1964	25,367	667	5,841	-787	1,724	1,307	3,705	-144	37,680	6,441	6,108	51	50,280
1963	23,262	670	4,932	-652	1,563	1,562	3,576	-213	34,700	5,714	5,603	-39	45,978
1962	21,816	652	4,450	-621	1,416	1,377	3,380	-100	32,370	5,446	5,236	-125	42,927
1961	20,399	610	4,066	-622	1,284	826	3,261	-41	29,783	4,838	4,883	142	39,646
1960	19,582	559	3,870	-495	1,129	1,026	3,192	-26	28,837	4,587	4,739	196	38,359
1959	18,596	553	3,966	-527	1,062	1,008	3,207	-108	27,757	4,401	4,461	227	36,846
1958	17,435	547	3,669	-486	1,063	1,116	3,133	-41	26,436	4,036	4,135	170	34,777
1957	16,988	531	3,554	-505	977	908	2,962	-59	25,356	3,975	4,159	23	33,513
1956	15,696	475	3,928	-450	869	1,283	2,827	-245	24,383	3,731	3,814	130	32,058
1955	13,930	439	3,485	-396	764	1,120	2,748	-182	21,908	3,321	3,337	-38	28,528
1954	13,043	408	2,755	-339	628	918	2,498	87	19,998	3,042	2,930	-52	25,918
1953	12,714	348	2,985	-328	583	1,462	2,359	2	20,125	2,994	2,634	80	25,833
1952	11,768	305	3,071	-346	523	1,878	2,155	114	19,468	2,799	2,333	-12	24,588
1951	10,538	232	3,144	-379	463	1,868	1,976	-643	17,199	2,548	2,098	-205	21,640
1950	8,998	154	2,608	-412	396	1,301	1,882	-374	14,553	2,065	1,876	-3	18,491
1949	8,349	128	2,009	-326	291	1,211	1,773	-112	13,323	1,878	1,644	-45	16,800
1948	7,754	95	2,041	-257	243	1,360	1,604	-506	12,334	1,832	1,449	-106	15,509
1947	6,662	92	1,854	-255	194	1,100	1,506	-571	10,582	1,678	1,227	-14	13,473
1946	5,487	340	1,474	-205	170	1,031	1,320	-254	9,363	1,371	1,071	80	11,885
1945	5,037	1,117	1,244	-138	227	890	1,166	-37	9,506	1,084	1,042	231	11,863
1944	4,998	1,068	1,234	-153	220	1,073	1,065	-52	9,453	1,167	1,077	151	11,848
1943	4,812	910	1,281	-156	227	707	980	-83	8,678	1,170	1,099	106	11,053
1942	4,282	641	1,305	-170	185	917	939	-122	7,977	1,133	1,091	64	10,265
1941	3,608	386	1,119	-168	148	454	815	-156	6,206	1,090	934	52	8,282
1940	2,959	193	849	-182	115	473	699	-121	4,985	859	786	83	6,713
1939	2,601	32	698	-177	80	362	632	-56	4,172	759	671	19	5,621
1938	2,515	9	509	-175	68	353	596	67	3,942	661	639	30	5,272
1937	2,538	9	598	-166	94	280	564	-87	3,830	727	624	60	5,241
1936	2,241	9	475	-161	85	199	502	-36	3,314	680	575	65	4,634
1935	2,079	9	357	-120	94	218	434	-20	3,051	601	550	99	4,301
1934	1,939	8	295	-104	74	167	392	-39	2,732	591	536	110	3,969
1933	1,788	8	171	-98	55	66	360	-22	2,328	547	532	85	3,492
1932	1,975	8	32	-130	77	104	422	109	2,597	552	578	87	3,814
1931	2,408	8	163	-150	88	94	548	172	3,331	578	649	135	4,693
1930	2,786	8	321	-177	135	343	688	239	4,343	619	719	39	5,720
1929	2,940	8	554	-158	160	393	770	-15	4,652	711	726	50	6,139
1928	2,715	7	548	-115	143	633	746	1	4,678	707	676	-11	6,050
1927	2,506	7	474	-106	109	600	691	29	4,310	653	618	-20	5,561
1926	2,366	7	420	-95	94	607	641	46	4,086	627	572	-139	5,146

Series F14-32. Gross national expenditure, by components, 1926 to 1976
(millions of dollars)

Year	Personal expenditure on consumer goods and services	Government current expenditure on goods and services	Gross fixed capital formation									Value of physical change in inventories				Exports of goods and services	Imports of goods and services	Residual error of estimate	Gross national expenditure at market prices
			Total	Government				Business				Total	Government	Business					
				Total	Residential construction	Non-residential construction	Machinery and equipment	Total	Residential construction	Non-residential construction	Machinery and equipment			Non-farm	Farm				
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1976	110,886	38,325	44,895	6,318	26	5,334	958	38,577	12,321	12,105	14,151	1,563	41	1,049	473	45,601	-49,973	-266	191,031
1975	96,955	33,380	40,044	6,323	25	5,374	924	33,721	9,232	11,691	12,798	-239	31	-511	241	40,452	-45,589	300	165,343
1974	83,388	27,816	34,260	5,462	23	4,650	789	28,798	8,776	9,128	10,844	3,451	26	3,730	-305	38,992	-41,009	630	147,528
1973	71,278	23,037	27,848	4,305	24	3,697	584	23,543	7,387	7,327	8,829	1,588	-15	1,484	119	30,718	-30,954	45	123,560
1972	62,208	20,291	23,051	3,968	24	3,475	469	19,083	5,820	6,205	7,058	544	16	801	-273	24,580	-25,250	-190	105,234
1971	55,616	18,368	20,800	3,754	18	3,310	426	17,046	4,816	5,952	6,278	392	-40	406	26	22,181	-22,016	-891	94,450
1970	50,327	16,630	18,015	3,173	15	2,823	335	14,842	3,500	5,385	5,957	105	-13	255	-137	21,167	-20,214	-345	85,685
1969	47,492	14,241	17,232	3,055	14	2,706	335	14,177	3,845	4,772	5,560	1,467	6	969	492	18,761	-19,821	443	79,815
1968	43,704	12,684	15,754	2,983	15	2,591	377	12,771	3,253	4,553	4,965	745	30	479	236	16,719	-17,010	-10	72,586
1967	39,972	11,153	15,628	2,954	13	2,584	357	12,674	2,809	4,548	5,317	260	28	218	14	14,663	-15,234	-33	66,409
1966	36,890	9,748	15,361	2,841	13	2,469	359	12,520	2,605	4,664	5,251	1,225	1	1,026	198	13,045	-14,259	-182	61,828
1965	33,947	8,358	13,179	2,440	8	2,149	283	10,739	2,634	3,840	4,265	1,244	-10	1,233	21	11,182	-12,341	-205	55,364
1964	31,389	7,593	11,205	2,023	7	1,769	247	9,182	2,382	3,298	3,502	553	-55	718	-110	10,503	-10,913	-50	50,280
1963	29,225	6,982	9,556	1,985	7	1,758	220	7,571	1,959	2,760	2,852	669	-12	387	294	9,068	-9,561	39	45,978
1962	27,452	6,608	8,885	1,903	9	1,683	211	6,982	1,854	2,568	2,560	667	-3	429	241	8,234	-9,045	126	42,927
1961	25,930	6,206	8,392	1,674	9	1,479	186	6,718	1,789	2,611	2,318	116	8	518*	-410	7,624	-8,480	-142	39,646
1960	25,479	5,281	8,473	1,560	5	1,416	139	6,913	1,794	2,594	2,525	409	-49	342	116	7,004	-8,092	-195	38,359
1959	24,390	4,976	8,647	1,508	6	1,366	136	7,139	2,133	2,598	2,408	414	62	385	-33	6,674	-8,028	-227	36,846
1958	22,845	4,854	8,535	1,397	2	1,258	137	7,138	2,089	2,808	2,241	-296	29	-238	-87	6,329	-7,321	-169	34,777
1957	21,492	4,573	8,689	1,327	2	1,209	116	7,362	1,669	3,099	2,594	170	-21	268	-77	6,379	-7,767	-23	33,513
1956	20,090	4,426	8,000	1,144	2	1,037	105	6,856	1,825	2,588	2,443	985	-6	750	241	6,350	-7,664	-129	32,058
1955	18,388	4,036	6,422	948	3	856	89	5,474	1,785	1,863	1,826	285	1	112	172	5,749	-6,390	38	28,528
1954	16,934	3,825	5,714	873	2	778	93	4,841	1,412	1,679	1,750	-202	-8	-113	-81	5,137	-5,543	53	25,918
1953	16,181	3,824	5,733	782	2	702	78	4,951	1,252	1,745	1,954	600	-27	416	211	5,380	5,806	-79	25,833
1952	15,162	3,620	5,096	779	2	705	72	4,317	946	1,574	1,797	499	68	64	367	5,568	-5,369	12	24,588
1951	13,857	2,811	4,424	640	2	572	66	3,784	834	1,303	1,647	871	-20	564	327	5,052	-5,580	205	21,640
1950	12,482	1,928	3,862	521	2	459	60	3,341	953	1,051	1,337	549	-24	399	174	4,158	-4,492	4	18,491
1949	11,365	1,722	3,439	456	3	398	55	2,983	795	933	1,255	78	27	150	-99	4,004	-3,853	45	16,800
1948	10,370	1,454	3,057	424	2	354	68	2,633	659	830	1,144	97	-32	85	44	4,055	-3,630	106	15,509
1947	9,362	1,343	2,350	304	2	253	49	2,046	455	610	981	343	-71	437	-23	3,661	-3,601	15	13,473
1946	8,012	1,655	1,682	237	2	191	44	1,445	416	451	578	195	-138	360	-27	3,281	-2,861	-79	11,885
1945	6,972	3,576	1,230	157	2	119	36	1,073	360	263	450	-340	-29	148	-459	3,561	-2,906	-230	11,863
1944	6,260	4,929	964	87	2	71	14	877	246	259	372	-134	11	-10	-135	3,541	-3,562	-150	11,848
1943	5,783	4,093	902	93	2	76	15	809	148	314	347	-142	38	28	-208	3,429	-2,906	-106	11,053
1942	5,466	3,622	1,055	86	2	70	14	969	128	333	508	145	10	-202	337	2,347	-2,306	-64	10,265
1941	5,089	1,576	1,096	101	2	84	15	995	155	290	550	85	-3	130	-42	2,456	-1,969	-51	8,282
1940	4,464	1,048	833	92	—	79	13	741	123	211	407	264	9	87	168	1,795	-1,609	-82	6,713
1939	3,972	566	687	148	—	124	24	539	121	165	253	282	—	101	181	1,437	-1,305	-18	5,621
1938	3,884	534	717	161	—	136	25	556	110	172	274	57	—	-21	78	1,343	-1,233	-30	5,272
1937	3,878	471	755	177	—	154	23	578	108	189	281	9	—	113	-104	1,575	-1,388	-59	5,241
1936	3,542	450	531	117	—	99	18	414	85	150	179	72	—	68	-140	1,413	-1,165	-65	4,634
1935	3,331	442	458	122	—	105	17	336	74	118	144	39	—	34	5	1,129	-1,000	—	—
1934	3,174	418	380	105	—	92	13	275	67	92	116								
1933	2,974	392	299	86															

Series F33-55. Gross national expenditure in constant (1971) dollars, by components, 1926 to 1976
(millions of dollars)

Year	Personal expenditure on consumer goods and services	Government current expenditure on goods and services	Gross fixed capital formation											Adjusting entry
			Total	Government					Business					
				Total	Residential construction	Non-residential construction	Machinery and equipment	Adjusting entry	Total	Residential construction	Non-residential construction	Machinery and equipment	Adjusting entry	
	33	34	35	36	37	38	39	40	41	42	43	44	45	46
1976	75,251	21,689	27,397	3,860	14	3,163	683	–	23,537	6,564	7,422	9,551	–	–
1975	70,645	21,399	26,661	4,127	15	3,421	691	–	22,534	5,503	7,822	9,209	–	–
1974	67,160	20,584	25,694	3,957	15	3,291	651	–	21,737	5,935	6,898	8,904	–	–
1973	63,879	19,795	24,384	3,751	20	3,194	537	–	20,633	5,966	6,411	8,256	–	–
1972	59,841	18,930	21,955	3,772	23	3,294	455	–	18,183	5,432	5,869	6,882	–	–
1971	55,616	18,368	20,800	3,754	18	3,310	426	–	17,046	4,816	5,952	6,278	–	–
1970	51,526	17,650	18,904	3,329	17	2,976	345	-9	15,581	3,718	5,715	6,118	30	-6
1969	50,353	15,993	18,850	3,350	14	2,982	359	-5	15,501	4,175	5,327	5,982	17	-1
1968	48,138	15,429	17,964	3,430	18	2,998	410	4	14,537	3,702	5,360	5,481	-6	-3
1967	45,863	14,343	17,942	3,403	14	2,994	391	4	14,543	3,229	5,405	5,865	44	-4
1966	43,778	13,388	18,015	3,307	16	2,895	391	5	14,716	3,168	5,774	5,755	19	-8
1965	41,606	12,253	16,259	3,003	11	2,686	314	-8	13,261	3,413	5,042	4,826	-20	-5
1964	39,218	11,637	14,549	2,652	11	2,370	277	-6	11,898	3,264	4,565	4,116	-47	-1
1963	36,992	11,070	12,841	2,682	11	2,436	249	-14	10,167	2,794	3,928	3,488	-43	-8
1962	35,272	10,911	12,278	2,664	14	2,419	245	-14	9,625	2,704	3,756	3,218	-53	-11
1961	33,761	10,494	11,748	2,378	13	2,161	216	-12	9,378	2,602	3,835	3,009	-68	-8
1960	33,392	9,218	11,790	2,142	8	1,984	165	-15	9,676	2,631	3,796	3,299	-50	-28
1959	32,264	8,999	12,191	2,090	9	1,934	163	-16	10,139	3,190	3,837	3,190	-78	-38
1958	30,562	9,074	12,126	1,942	3	1,785	165	-11	10,235	3,120	4,170	3,035	-90	-51
1957	29,504	8,807	12,262	1,751	3	1,618	143	-13	10,582	2,485	4,585	3,570	-58	-71
1956	28,440	8,956	11,446	1,425	3	1,296	133	-7	10,107	2,794	3,823	3,540	-50	-86
1955	26,456	8,736	9,678	1,308	3	1,190	121	-6	8,431	2,776	2,891	2,809	-45	-61
1954	24,375	8,549	8,858	1,296	3	1,170	128	-5	7,609	2,237	2,671	2,737	-36	-47
1953	23,512	8,890	8,861	1,162	3	1,055	110	-6	7,760	1,967	2,738	3,093	-38	-61
1952	21,984	8,624	7,892	1,090	3	989	102	-4	6,850	1,499	2,491	2,896	-36	-48
1951	20,546	7,000	7,068	915	3	821	96	-5	6,201	1,346	2,182	2,704	-31	-48
1950	20,394	5,367	7,042	884	3	787	99	-5	6,211	1,773	1,990	2,478	-30	-53
1949	19,138	4,982	6,553	806	4	710	95	-3	5,797	1,552	1,817	2,458	-30	-50
1948	18,099	4,504	6,103	779	3	655	125	-4	5,367	1,342	1,669	2,384	-28	-43
1947	18,546	4,747	5,316	627	3	526	100	-2	4,731	1,085	1,370	2,300	-24	-42
1946	17,324	6,302	4,207	537	3	435	100	-1	3,697	1,118	1,131	1,512	-64	-27
1945	15,592	13,326	3,182	368	3	285	83	-3	2,839	1,033	699	1,189	-82	-25
1944	14,160	19,379	2,486	200	3	168	30	-1	2,324	713	692	962	-43	-38
1943	13,210	16,878	2,371	219	3	183	34	-1	2,183	447	850	887	-1	-31
1942	12,831	15,421	2,923	214	6	177	34	-3	2,756	410	946	1,376	24	-47
1941	12,512	7,367	3,206	271	6	229	36	–	2,980	528	889	1,553	10	-45
1940	11,717	5,095	2,619	263	–	227	36	–	2,387	463	682	1,240	2	-31
1939	10,915	2,891	2,295	433	–	364	70	-1	1,850	483	551	836	-20	12
1938	10,613	2,720	2,371	460	–	387	73	–	1,896	442	567	897	-10	15
1937	10,766	2,423	2,483	504	–	438	68	-2	1,959	426	611	928	-6	20
1936	10,133	2,397	1,870	351	–	294	58	-1	1,509	361	523	635	-10	10
1935	9,693	2,382	1,645	378	–	323	55	–	1,247	320	422	517	-12	20
1934	9,284	2,282	1,379	327	–	285	43	-1	1,032	291	335	422	-16	20
1933	8,827	2,162	1,094	268	–	229	40	-1	807	237	286	296	-12	19
1932	9,054	2,568	1,532	378	–	323	55	–	1,131	324	442	380	-15	23
1931	9,822	2,647	2,762	530	–	459	73	-2	2,215	627	918	700	-30	17
1930	10,326	2,505	3,722	631	–	547	85	-1	3,085	681	1,216	1,200	-12	6
1929	10,778	2,287	4,254	494	–	430	68	-4	3,794	868	1,500	1,444	-18	-34
1928	10,148	2,034	3,845	436	–	373	64	-1	3,444	922	1,310	1,250	-38	-35
1927	9,265	2,012	3,235	378	–	326	51	1	2,885	873	975	1,088	-51	-28
1926	8,295	1,924	2,619	294	–	256	40	-2	2,348	783	780	840	-55	-23

The Growth Illusion: The P/E 'Cost' of Earnings Growth

Martin L. Leibowitz and Stanley Kogelman

It is intuitively tempting to view firms with high earnings growth as offering special value. Indeed, standard dividend discount models seem to equate price growth with earnings growth. But a firm can show substantial earnings growth—by increasing earnings retention, for example, or reinvesting at available market rates—without creating a single dollar of extra value for shareholders.

The significance of realized earnings growth becomes apparent only after one has determined the "baseline" level of P/E growth (or decline) consistent with the firm's initial prospects and valuation. One must then examine carefully the firm's franchise opportunities—its ability to invest in lines of business that offer more than the market rate of return. The firm's current earnings growth may be "excessive" in relation to the market average, yet not excessive at all given its expected franchise opportunities.

High earnings that derive from franchise opportunities already embedded in the firm's P/E reflect management's exploitation of preexisting opportunities. In effect, this exploitation represents a drawdown of the franchise value incorporated in P/E and suggests an inverse relation between realized earnings growth and realized P/E. Only if management has the skill or luck to extend the firm's franchise opportunities beyond those already embedded in the firm's valuation will excess earnings growth represent added value to shareholders.

We developed in a series of earlier papers a generalization of the standard dividend discount model that we term the franchise factor (FF) model.[1] In the FF model, as in all models based on present value, theoretical price (P) and price/earnings ratio (P/E) are determined by the projected earnings (and dividend) growth. All else remaining equal, higher projected earnings imply brighter future prospects and lead to higher prices and higher P/Es.

This article shifts the focus from the *prospective* earnings used to compute a theoretical P/E to the *realized* earnings that subsequently evolve. Realized earnings growth represents a depletion of the opportunities available at the time the P/E was set. This suggests there is an *inverse* relation between realized earnings growth and realized P/E over time, contrasting with the *positive* link between high prospective earnings growth and prospective P/E.

THE PROBLEM WITH A STABLE P/E

Historical earnings growth is commonly used as a baseline for estimating future earnings growth. Price appreciation is then presumed to follow projected earnings growth. By implicitly assuming that P/E will remain stable, investors make earnings growth the central determinant of investment value.

The problem with assuming a stable P/E can be simply illustrated. Consider a corn farmer who owns two plots, each comprising 100 acres of prime land. The first plot is producing corn at its highest possible efficiency. The second lies fallow while being developed to position it for maximum productivity next year. When the farmer (or his banker) places a value on the farm, he will surely take into account not only the current earnings from the productive plot, but also the future earnings from the currently fallow second plot. Thus the farm's price today is based on a projection of tomorrow's earnings. Current earnings, however, come only from the producing plot, so the P/E multiple based on current earnings will be high.

Now consider what happens by the end of the

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following year. The second plot has presumably reached its full potential, so total realized earnings show tremendous growth—essentially double the first year's visible earnings. This earnings growth provides no *new* information, however; it simply reflects the realization of previously known prospective earnings. The total value of the farm will have changed very little.

In contrast, the effect of these earnings on net P/E will be quite dramatic: P/E will drop by virtually half. Higher second-year earnings are thus accompanied by a large P/E decline. The lower P/E indicates that, even though putting the second plot into production may represent a significant achievement, the farmer's efforts were only value-*preserving*. They did not fundamentally *enhance* the farm's value.

This article shows that, rather than being a merely passive prop on a stage dominated by earnings growth, P/E plays a dynamic role in the evolution of firm value over time. This raises questions about the common practice of assessing value by discounting a growing stream of dividends and then applying a stable P/E to the terminal earnings rate achieved at the horizon.

Of course, the real world is more complicated than our closed theoretical system. As unforeseen (and unforeseeable) prospects ebb and flow and as uncertainty becomes reality, the earnings signal and the P/E ratio interact in a more intricate fashion than can be captured by any analytic model. Nevertheless, in terms of a fundamental baseline for analysis, our central message still holds: *Earnings growth alone cannot provide a valid gauge for assessing investment value.*

THE SUBSTITUTION EFFECT IN TANGIBLE-VALUE FIRMS

To understand how firms create value, first establish a benchmark against which incremental gains (and losses) can be measured. Consider the firm as a cash machine. At the end of each year, after paying all its bills, the firm will have some net amount of cash available for payment to investors or for reinvestment. If all such cash flows could be accurately predicted, the value (price) of the firm could be calculated by discounting the net cash flows at some "market rate."

For simplicity, consider an environment of no taxes and no debt. Assume the market rate, k, is a stable 12%, and is a fair compensation for the riskiness of equity. In addition, assume that investors have ample opportunities to invest in other firms that offer the same return and bear the same risk.

Given the value of cash flows from all current and future businesses and the corresponding price per share, we will show that there is a natural year-to-year evolution of (1) price, (2) earnings and (3) P/E. The projected path of these variables can be used as a baseline against which actual changes can be measured.

First consider a firm whose basic business produces earnings of $100 annually. The firm has no opportunity to expand by investing in new businesses that provide returns greater than 12%. This is a "tangible-value (TV) firm." While it may have an excellent business, it cannot create additional value for shareholders beyond that represented by its tangible earnings stream (assuming investors have the ability to achieve 12% returns on their own). Firms become value creators only when they can make new investments that achieve returns that exceed generally available levels.

Obtain the price of this TV firm by discounting the perpetual $100 earnings stream (E) at the 12% rate (k). This present value is simply $100 divided by 12%:[2]

Price = Tangible Value,

$$= \frac{E}{k}, \quad \leftrightarrow \quad P/E = \frac{1}{k},$$

$$= \frac{\$100}{0.12},$$

$$= \$833.$$

Although the TV firm does not have the potential to add incremental value, it may have an earnings retention policy that leads to earnings increasing. For example, suppose that of the $100 in first-year earnings, the firm pays out $35 in dividends at year-end and retains $65 to reinvest at the 12% market rate. In the second year, then, the firm will earn an additional $7.80 (12% of $65) beyond the initial $100 earnings. In exchange for giving up $65 in dividends in the first year, investors will see total earnings grow by 7.80% in the second. This realized growth in earnings (and associated price increase) is simply a "substitution"; it exactly compensates investors for the dividend payments they have forgone. If the investors had received the $65 at the end of the first year, they could have invested it at the 12% generally available rate and earned this same $7.80.

Figure A illustrates the direct relation between the TV firm's retention rate and its earnings growth rate. With 0% retention, all earnings are paid out as dividends; there is no money to invest, hence no earnings growth. With 100% retention, "growth" substitutes totally for dividends; $100 is invested at 12%, and earnings grow at this same 12% rate. For a TV firm, whatever the dividend policy, future price appreciation follows earnings retention, which in turn matches exactly the value of forgone dividends.

To compute initial P/E, simply divide the initial $833 price by the $100 earnings to obtain a ratio of 8.33 times earnings. Note that, in computing P/E, the $100 earnings "cancels out":

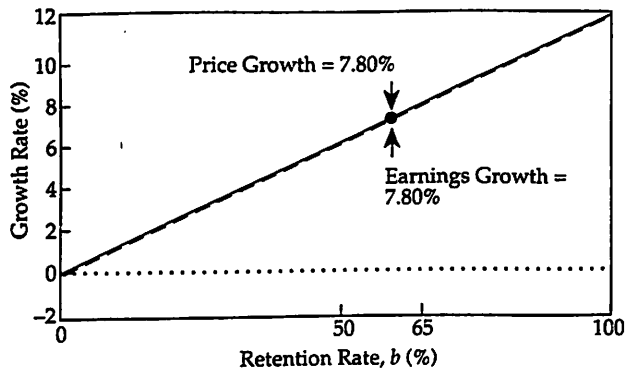
$$P/E = \frac{E/k}{E},$$

$$= \frac{1}{k},$$

$$= \frac{1}{0.12},$$

$$= 8.33.$$

Figure A. Earnings, Price and P/E Growth for a Tangible-Value Firm
(all new investments earn 12%)



This example illustrates a more general result: *For TV firms, P/E always equals the reciprocal of the market discount rate.* We call this value the firm's "base P/E."

Earnings Growth Based on Retained Earnings

The above example illustrates a well-known rule for calculating earnings growth:

$$g(E) = \text{Earnings Growth},$$

$$= \text{Retention Rate} \times \text{Return on Retained Earnings},$$

$$= b \times R.$$

In this example, with a 65% retention rate and a 12% return:

$$b = 65\%,$$

$$R = 12\%,$$

$$g(E) = 0.65 \times 12\% = 7.80\%.$$

Because price appreciation for a TV firm is due solely to earnings increases, the price growth rate must equal the 7.80% earnings growth rate. Because both price and earnings grow at the same rate, their ratio (P/E) does not change: It stays at 8.33. Figure A illustrates this.

In a stable 12% market, equity investors should earn 12% through a combination of price growth and dividend yield. In other words, price growth (i.e., capital appreciation) is determined by the market rate and the dividend yield. In our example, when $65 in earnings is retained and the remaining $35 is paid out as dividends, the result is a 4.20% dividend yield:

$$D/P = \frac{\text{Dividend}}{\text{Price}},$$

$$= \text{Dividend Yield},$$

$$= \frac{(1-b)E}{P},$$

$$= (1 - 0.65) \times \frac{\$100}{\$833},$$

$$= 0.35 \times \frac{\$100}{\$833},$$

$$= 4.20\%.$$

One can verify that the investor's total return is 12% by adding the dividend yield and the price growth:

$$\text{Total Return} = \text{Dividend Yield} + \text{Price Growth},$$

$$= D/P + g(P)$$

$$= 4.20\% + 7.80\%$$

$$= 12\%.$$

Because total return is k, the above relationship can be rearranged to yield a *general price growth formula*:

$$g(P) = k - D/P,$$

$$= k - \frac{(1-b)E}{P},$$

$$= k - \frac{1-b}{P/E}.$$

This formula shows that the *price growth rate is determined by the retention rate b and the initial P/E.* In the absence of surprises about the nature of a firm's business prospects, the price of any firm's stock should, theoretically, rise at the rate shown above.[3]

THE SUBSTITUTION EFFECT IN FRANCHISE-VALUE FIRMS

Firms with initial P/Es greater than the 8.33 base level have both tangible value and "franchise value" (FV). "Franchise value" refers to the part of a firm's current value that is attributable to the potential for value-generating investments. A positive FV implies that the firm will have the opportunity, at some point in the future, to make investments that provide returns in excess of 12%. In fact, FV is just the net present value (NPV) of all *future* investments. The total value of any firm can thus be expressed as:

$$\text{Total Value} = \text{Tangible Value} + \text{Franchise Value}.$$

Suppose that a firm with $100 in earnings from current businesses is trading at a P/E of 15. This means that its price is $1500 (15 × $100 in earnings). The TV of *any* firm with a perpetual $100 earnings stream is $833. The balance of the price is the firm's FV:

$$FV = P - TV,$$

$$= \$1500 - \$833,$$

$$= \$667.$$

The TV-firm example assumed that FV was zero and that all retained earnings were invested at 12%. Because any realized earnings growth is always capitalized into a higher tangible value, growth in E drives the same growth in TV. For the TV firm, this results in equality of price growth and earnings growth.

In contrast to the TV firm, a franchise firm (FV > 0) has an additional value term, whose growth pattern is likely to be quite different from g(E). Because its price growth results from a combination of TV growth and FV growth, price growth cannot be determined from g(E) alone.

For example, assume as before that 65% of earnings is retained at the end of the first year and reinvested at the 12% market rate. In other words, the FV firm is not prepared to take advantage of the higher-return "franchise investment" that will become available at some point in its future. In this case, the realized g(E) is 7.80% (0.65 × 12%), just as it was for the TV firm. For the FV firm, however, dividend yield and g(P) both will differ from the TV firm values. Price growth will be:

$$g(P) = k - \frac{1-b}{P/E},$$

$$= 0.12 - \frac{1 - 0.65}{15.00},$$

$$= 9.67\%.$$

The higher price growth compensates for the lower dividend yield of the FV firm. The lower dividend yield is in turn the result of the higher price (that is, the higher P/E):

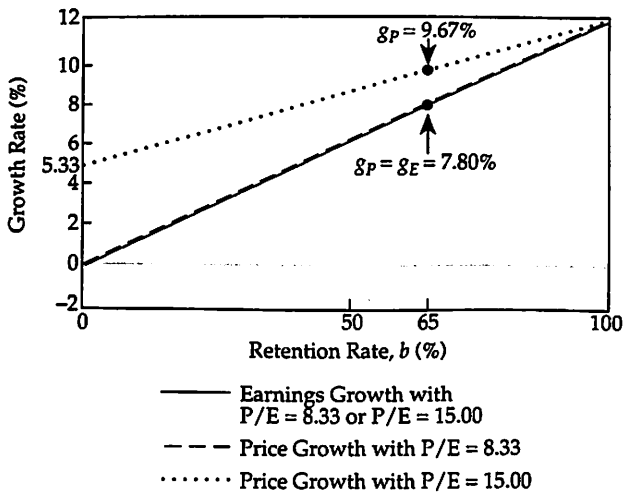
$$D/P = \frac{\$35}{\$1500},$$

$$= 2.33\%.$$

At higher retention rates, the amount available for dividends, hence the dividend yield, declines. In the limiting case of 100% retention, the dividend yield is zero, and as g(P) is the only source of return, its value must equal the required 12% return. At this 100% retention point, g(P) = g(E) = k, regardless of the P/E. Figure B illustrates this.

The firm starts out with a P/E of 15 but invests its retained earnings at only 12%, thereby failing to utilize any of its franchise potential. Assuming that the franchise is not perishable (that is, the opportunity to invest will continue to exist even if available franchise investments are not made immediately), FV will grow with time (at the 12% rate), and this growth will be reflected in price growth.[4]

Figure B. Price Growth for Franchise-Value and Tangible-Value Firms
(12% market-rate investment)



The 9.67% price growth in this example can be interpreted as the result of 12% "returns" on 100% of the FV and 12% returns on the 65% of earnings that are retained. Specifically, g(P) can be expressed as the weighted average of the TV growth rate—that is, g(E)—and the FV growth rate, where the weights are the proportions of TV and FV:[5]

$$g(P) = \left(\frac{TV}{P} \times g(TV)\right) + \left(\frac{FV}{P} \times g(FV)\right),$$

$$= \left(\frac{TV}{P} \times g(E)\right) + \left(\frac{FV}{P} \times g(FV)\right).$$

In the above example:

$$g(P) = \left(\frac{\$833}{\$1500} \times 7.8\%\right) + \left(\frac{\$667}{\$1500} \times 12\%\right),$$

$$= 4.33\% + 5.33\%,$$

$$= 9.67\%.$$

A General P/E Growth Formula

When price and earnings grow at different rates, the stability of P/E is lost. We can always find the new P/E by taking the ratio of the increased price to the increased earnings:

$$\text{New } P/E = \frac{P \times [1 + g(P)]}{E \times [1 + g(E)]},$$

$$= \text{Old } P/E \times \left[\frac{1 + g(P)}{1 + g(E)}\right].$$

We can use this general formula to find P/E growth:

$$g(P/E) = P/E \text{ Growth Rate},$$

$$= \frac{\text{New } P/E}{\text{Old } P/E} - 1,$$

$$= \frac{1 + g(P)}{1 + g(E)} - 1.$$

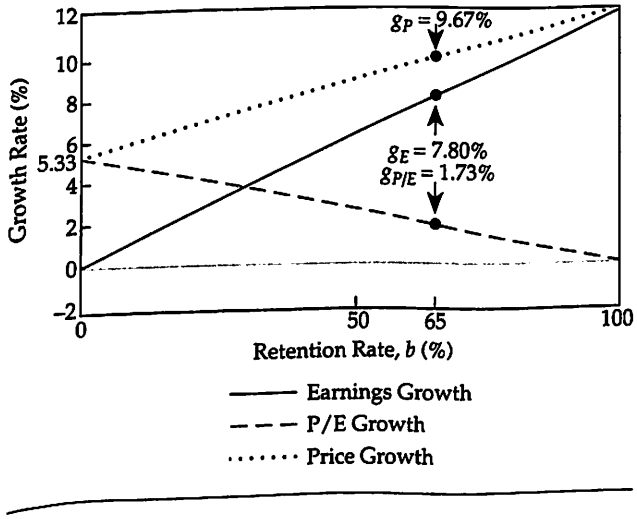
Substituting the example values of g(P) and g(E):

$$g(P/E) = \frac{1 + 0.0967}{1 + 0.0780} - 1,$$

$$= 1.73\%.$$

Figure C illustrates this. When all earnings are paid out as dividends and there is no franchise investment, g(E) = 0, and g(P) is entirely attributable to the growth of FV over time. In contrast, as the earnings retention rate increases, realized g(E) increases, the gap between price and earnings growth shrinks, and g(P/E) declines, finally reaching zero at 100% retention.

Figure C. Price, Earnings and P/E Growth versus Retention Rate
(P/E = 15; 12% market-rate investment)



This relationship between the three growth rates is quite general. It holds for any value of return on new investments.[6] We can approximate g(P/E) by taking the difference between g(P) and g(E):

$$g(P/E) \approx g(P) - g(E).$$

Applying this approximation to the preceding example:

$$g(P/E) \approx 9.67\% - 7.80\% = 1.87\%.$$

The difference between the approximate 1.87% and the precise 1.73% is shown in Figure C as a slight curve in the line representing g(P/E).

THE CONVERSION EFFECT

Additional insight into the nature of price growth is gained by rewriting the approximation formula given in the previous section as follows:

$$g(P) \approx g(E) + g(P/E).$$

Because g(P) is determined by the firm's P/E and the retention policy, the left side of the equation is fixed. There is thus always a direct tradeoff between realized g(P/E) and realized g(E).

But what happens when franchise investments realize returns in excess of 12%? Each such investment represents a conversion of a portion of the firm's franchise potential into incremental earnings, hence into a higher tangible value. When a firm makes franchise investments, earnings tend to grow rapidly. When g(E) > g(P), P/E declines.

The firm's price at the outset implicitly reflects a fixed level of future franchise investments. Unless new opportunities are discovered, all this franchise potential will ultimately be "used up," and the P/E will decline toward its base level.[7]

Franchise Firms Investing at 15%

Figure C illustrates price growth for the franchise firm with an initial P/E of 15. If the firm continues to retain 65% of earnings, g(P) will be 9.67%. But suppose the firm is able to utilize its franchise potential by investing retained earnings in projects that return 15%, rather than 12%. Because the franchise firm's prospective P/E reflects potential for above-market-rate investments, the availability of such 15% projects should not surprise us.

The value of g(P) is determined, again, by the market rate, the retention rate and P/E. Therefore, even with the higher 15% return, g(P) remains at 9.67%. In fact, the same g(P) line in Figure C applies, regardless of the rate the firm can obtain on new investments. The 15% return does, however, alter the line depicting realized earnings growth.

Figure D illustrates realized g(E) over the full range of retention rates. The higher 15% return results in a higher g(E) than in Figure C for all retention rates except 0%. The enhanced earnings come at the expense of FV growth, however. When investments are made at 12%, no FV is utilized, so FV simply grows at 12%. When franchise investments are made at 15%, franchise value declines correspondingly. At the same time, the "new business" adds to earnings and becomes part of the firm's tangible value. This is the essence of the franchise "conversion process."

With a 12% return, g(P) and g(E) are not equal unless there is 100% retention. With an approximate 15% return on new investment (more precisely, 14.87%), growth equality occurs at 65% retention:

$$g(E) = bR,$$

$$= 0.65 \times 14.87\%,$$

$$= 9.67\%.$$

Figure D. Earnings Growth with Retained Earnings Invested at 12% or 15% (P/E = 15)

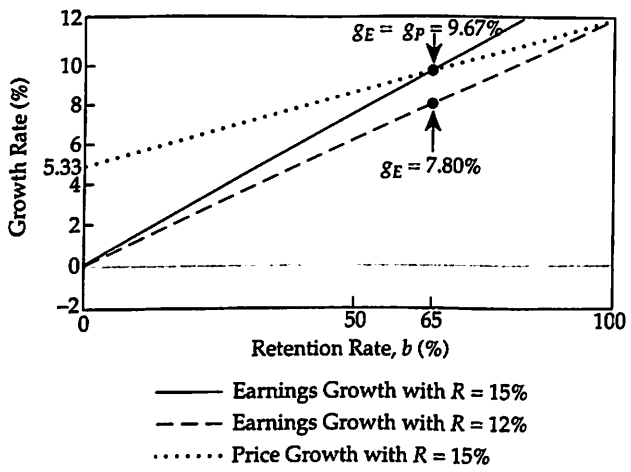
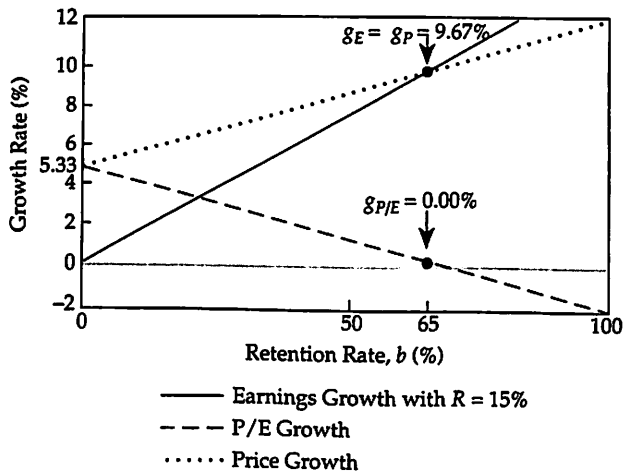


Figure E. P/E Growth when Retained Earnings Are Invested at 15% (P/E = 15)



Thus g(E) = g(P) at this particular point. Because P/E should be stable when g(E) = g(P), g(P/E) = 0. Figure E illustrates this P/E stability.

If we alter the balance between return and retention in virtually any way, the stability of P/E will be lost. At all other retention values, g(P/E) is either greater than or less than zero, and P/E will change from one period to the next. With retention rates in excess of 65%, g(E) > g(P), and g(P/E) becomes negative, so that P/E begins to decline. If this growth imbalance is sustained, P/E will continue to decline toward the base P/E of 8.33.

THE VALUE PRESERVATION LINE

We have now seen two different combinations of realized g(E) and g(P/E) that can lead to the same g(P). In Figure C, with 12% return on investment, g(P) of 9.67% is associated with g(E) of 7.80% and g(P/E) of 1.73%. In Figure E, with 15% return on investment, the same g(P) of 9.67% is obtained with g(E) of 9.67% and g(P/E) of 0.

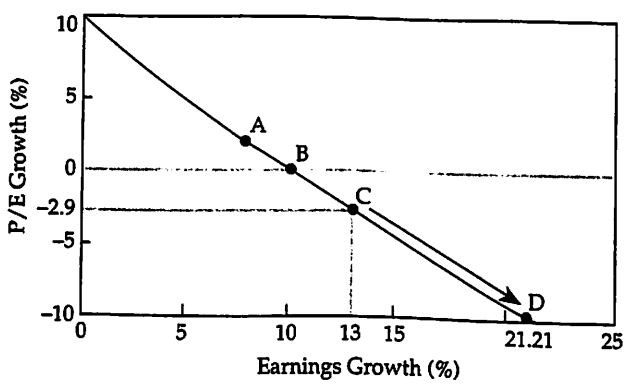
There is a continuum of combinations of P/E growth and earnings growth that lead to the same 9.67% price growth. This follows from the general P/E growth formula:

$$g(P/E) = \frac{1 + g(P)}{1 + g(E)} - 1,$$

$$= \frac{1.0967}{1 + g(E)} - 1.$$

Figure F presents the "value preservation line" (VPL), which illustrates that many combinations of g(E) and g(P/E) can theoretically provide a g(P) of 9.67%. In this figure, point A represents realized earnings growth with investment at 12% (corresponding to Figure C).[8] As the investment rate increases, so does the realized value of g(E). The "cost" of this growth is a reduction in g(P/E). Point B represents the 15% investment, where g(P/E) is zero, as in Figure E.

Figure F. The Value Preservation Line (P/E = 15, b = 65%)



A = 65% of Earnings Invested at 12%
B = 65% of Earnings Invested at 15%
C = 65% of Earnings Invested at 20%
D = 65% of Earnings plus Equal Amount from Financing Invested at 20%

Franchise Firms Investing at 20%

Suppose that, at year end, the $65 in retained earnings is invested in a franchise project returning 20% in subsequent years. This higher return brings more than $3 in additional earnings in years two and beyond, and realized g(E) increases from 9.67% to 13% (20% of $65). Point C in Figure F illustrates the additional move-

ment down the VPL that this enhanced growth represents. P/E declines because g(P/E) falls to −2.9%:

$$g(P/E) = \frac{1.0967}{1 + g(E)} - 1,$$

$$= \frac{1.0967}{1.13} - 1,$$

$$= -2.9\%.$$

At the end of one year, P/E will have declined from 15 to 14.6 [15 − (2.9% of 15)]. The decline in P/E with increasing franchise investment follows naturally from more FV being "used up" in higher-yielding projects.

The VPL is always determined by the forward P/E (the price at the beginning of the year divided by the year's anticipated earnings) and the retention rate (or dividend payout rate) that applies to these earnings. Investment (and financing) decisions taken at year end will determine the earnings for the subsequent year and will set the forward P/E that applies at the beginning of the following year. Thereafter, the next year's VPL will be determined by the new P/E ratio and the new retention rate.

ACCELERATED GROWTH THROUGH EXTERNAL FUNDING

The dividend discount model (DDM) assumes there is always an ample supply of franchise investment opportunities, but the firm can use only its retained earnings to seize them (see the appendix). In modern markets, the following conditions hold:

- There is a limited scope to most franchise opportunities.
- The capital available to a firm can easily exceed its retained earnings.

Generally, lenders will be willing to supply capital to pursue any demonstrably accessible franchise opportunity.

In contrast to the DDM, our franchise factor (FF) model recognizes that the franchise opportunities available to a given firm are likely to be intrinsically limited in time and scope. Moreover, the FF model assumes the firm can always access capital at the market price through equity (or debt) financing. In the context of this model, funding through new equity leads to a somewhat involved sequence of shifting claims on the part of the original and new shareholders.

When a firm issues new shares, it receives cash in return for a proportional claim on existing TV and FV. If the new cash is utilized in investments that return more than 12%, there will be some conversion of FV into earnings (i.e., into TV). This conversion alters the distribution of FV and TV, leading to a lower P/E. All these alterations, together with the "dilution" of original earnings, represent a rather complex transformation of the firm's ownership and value structure.

Trying to fix such external financing into the VPL framework can be puzzling. In what at first glance may be surprising, it turns out that the net effect of equity sales is simply to push accelerated earnings growth further down the same VPL.

Suppose, for example, that the firm can invest $130 (that is, a further $65 in addition to the $65 in retained earnings) at 20%. With only $65 in retained earnings, the firm must issue new shares to raise the additional $65. A straightforward computation shows that when the additional $65 is invested at 20%, earnings per share growth accelerates to 21.2%.[9] Point D in Figure F illustrates this new growth level. At this point, FV is being taken down more quickly than the natural 12% rate at which it grows. This leads to a 9.5% decline from the original P/E of 15 to a new P/E of 13.6.

GROWTH SIGNALS

We can use the value preservation line to distinguish value-generating growth from value-depleting growth. The line itself represents an expected level of price appreciation based on the following:

- an estimated market capitalization rate (12% in our example);
- an earnings retention rate (65%); and
- an initial theoretical P/E (15.0).

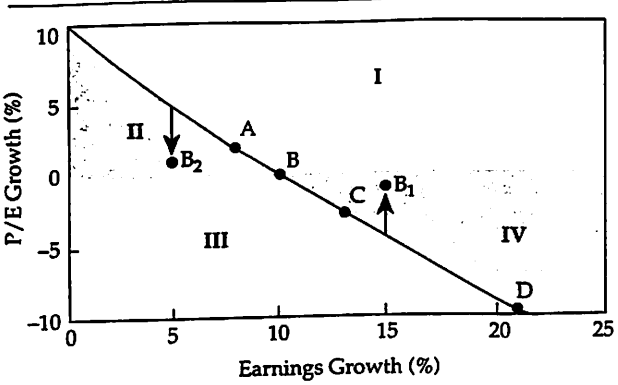
Each point on the VPL (such as A, B, C, and D in Figure F) represents a combination of realized earnings and P/E growth that is consistent with the required price growth (9.67% in our example).[10] No matter what the firm does—investing at 12%, 15% or 20%, selling shares or buying back shares—the realized g(E) and g(P/E) will counterbalance each other so that price grows at 9.67%.[11] In this sense, all actions that leave the firm on the VPL can be viewed as *value-preserving*.

Exploiting franchise opportunities, even those that represent a "legacy" anticipated by the marketplace, is no small feat. To bring about true *value enhancement*, however, management must improve the firm's prospects beyond embedded expectations.

We can view the VPL and the zero P/E growth line as separating all possible pairings of year-to-year earnings growth and P/E growth into the four regions illustrated in Figure G.

- Region I lies above the VPL and above the zero P/E growth line. The properties of this region are consistent with our intuition regarding the positive nature of growth. Each point represents both unexpected value-enhancing earnings growth and P/E growth.
- In Region II, positive earnings and positive P/E growth are insufficient to ensure that investors receive a market-level return. Consequently, there is unexpected value depletion.
- In Region III, P/E is declining, and there is not sufficient earnings growth to maintain value.

Figure G. The Value Preservation Line as a Baseline for Interpreting Growth Signals



I Value Enhancement and P/E Improvement
II Value Depletion and P/E Improvement
III Value Depletion and P/E Decline
IV Value Enhancement and P/E Decline

- In Region IV, it is possible to have value enhancement with a declining P/E. In this region, strong earnings growth places the firm above the VPL.

Consider two examples. First, at Point B_1 in Figure G, realized earnings growth is 15%, but g(P/E) is −1.0%. With realized g(E) of 15%, P/E should decline by about 5% to remain on the VPL. We interpret the more modest P/E decline as an indication that the firm has discovered unanticipated opportunities for future investment that will serve to replenish FV. New findings such as these will result in price growth in excess of 9.67%—that is, a windfall profit to current shareholders. (Once the stock price has adjusted to this new level of expectations, there will be a new P/E, hence a new VPL for the subsequent year.)

Second, at Point B_2 in the figure, realized g(E) is 5% and g(P/E) is 1%. For the firm to be on the VPL, the low 5% earnings growth should be coupled with P/E growth in excess of 4%. The observed P/E growth of only 1% may indicate an unexpected loss in FV. This could come about, for example, if the firm failed to take advantage of available, but perishable, opportunities. In that case, the firm might have lost these opportunities forever.

A second interpretation may be that the firm is using cash flows from "good businesses" to subsidize growth of marginal businesses. Such "covert reinvestment" may lead to earnings growth, but at an excess cost in terms of overall firm value. In either case, g(P) will fall below 9.67%. Consequently, investors will fail to achieve the full 12% market return, even when dividends are considered.

As the preceding examples demonstrate, it is difficult to interpret the significance of earnings growth without knowing the associated "baseline" level of P/E growth. Even positive levels of growth in both earnings and P/E do not always assure the price appreciation required for a fair return.

In practice, of course, the problem is considerably more complicated. Year-to-year earnings growth may be visible in an accounting sense, but it may be more difficult to discover true economic growth in earnings. In a market where interest rates and risk premiums are always changing, absolute and relative P/Es will also be on the move. It is no small challenge to determine how much of a realized P/E change is due to new market conditions, rather than to changes in the firm's underlying franchise value. Without an analytical framework for identifying the "baseline" correspondence between earnings growth and P/E changes, we cannot even begin to follow the path of a firm's P/E over time.

CONCLUSION

Equity analysts and investors must look to a variety of measures to gain insight into the prospects for current and future businesses. High earnings growth will prove a valuable indicator, however, only if one distinguishes between prospective growth and realized growth. High earnings derived from an embedded franchise may only indicate good performance in exploiting preexisting opportunities. Such growth is value *preserving* (and, accordingly, may represent a significant managerial achievement). Strictly speaking, however, it is not value *enhancing*. To add incremental value, management must have the vision (or the good fortune) to extend the corporate reach to include new opportunities beyond those already embedded in the firm's valuation.

APPENDIX

This appendix first reviews the standard dividend discount model (DDM) and shows how earnings growth derives from retained earnings. We then show how, in a general franchise factor (FF) model, external financing can lead to enhanced earnings growth. Finally, we show that external financing and premium investments lead to counterbalancing changes in a firm's tangible value and franchise value. In the absence of surprises, price growth is predetermined, earnings growth and P/E growth offset each other, and the firm remains on its value-preservation line.

Growth Assumptions in the DDM

The standard DDM assumes that a firm pays a dividend D_1 one year from today and that dividends in subsequent years grow at a constant rate g. If the

discount rate is k, we can discount the stream of future dividend payments to obtain the following price formula:

$$P_0 = \frac{D_1}{k-g}. \quad \text{(A1)}$$

In Equation A1, P_0 is the initial price based on annual dividend payments made at year end. We assume that the firm retains a fixed proportion b of earnings E and pays out the balance of earnings as dividends. In this case:

$$D_1 = (1-b)E_1,$$

$$P_0 = \frac{(1-b)E_1}{k-g}, \quad \text{(A2)}$$

$$P_0/E_1 = \frac{1-b}{k-g}. \quad \text{(A3)}$$

In the DDM, the basic assumption of a constant g and a constant retention b naturally leads to price and earnings growth at the same rate g. To see why this is true, we observe that the second-year dividend is:

$$D_2 = (1+g)D_1,$$
$$= (1+g) \times (1-b)E_1,$$
$$= (1-b) \times [(1+g)E_1].$$

Because dividends are always (1 − b) times earnings, it follows that:

$$E_2 = (1+g)E_1.$$

Dividends continue to grow at rate g, so the price at the beginning of the second year will be:

$$P_1 = \frac{D_2}{k-g},$$
$$= \frac{(1+g)(1-b)E_1}{k-g}.$$

On comparing the above equation with Equation A2, we can see that the price also grows at the rate g:

$$P_1 = (1+g)P_0.$$

With earnings and price growing at the same rate, P/E will have a constant value over time, namely (see Equation A3):

$$P/E = \frac{1-b}{k-g}. \quad \text{(A4)}$$

The DDM makes no provision for external financing. Instead, we obtain smooth growth g by making two heroic assumptions: (1) All investments are derived from retained earnings and (2) such investments provide the identical return r in each future period. If B_0 is the initial book value, then:

$$r = E_1/B_0$$

or

$$E_1 = rB_0.$$

At the end of the first year, we add retained earnings bE_1 to B_0, so that:

$$B_1 = B_0 + bE_1,$$
$$= B_0 + b \times rB_0,$$
$$= B_0(1+br).$$

The second-year earnings are:

$$E_2 = rB_1,$$
$$= r \times B_0(1+br),$$
$$= E_1(1+br).$$

Because $E_2 = (1+g)E_1$, it follows that:

$$g = br. \quad \text{(A5)}$$

In the standard DDM, then, book value, price and earnings all grow at the same rate as a result of continual new investments fueled by retained earnings. This smooth growth assumption creates a simple, easy-to-use model. However, in today's markets, investment opportunities—not capital—are the scarce resource. Consequently, more flexible models are required that allow for external funding and varying investment returns over time.

EPS Growth with External Financing

Below we develop a formula for the incremental growth in earnings per share that a firm achieves when it sells n new shares one year from today and invests the proceeds of the sale in high-return projects. We assume that the firm initially has N shares outstanding and earns E_1 dollars per share in the first year (see Table A1

Table A1. Symbols for a Firm that Issues n Shares After One Year

	Number of Shares	Retention Rate	Earnings Per Share	Price Per Share	P/E Ratio	Return on Retained Earnings	Return on Proceeds from Equity Sales
Initial	N	—	—	P_0	P_0/E_1	—	—
End of 1 Year	N	b	E_1	P_1	P_1/E_2	R	R*
End of 2 Years	N + n	b	E_2	—		R	R*

for a summary of symbols). At year end, the firm retains and invests b times the first year's earnings in projects that return R in all subsequent years.[12] This "core" investment leads to incremental earnings of $R \times b \times E_1$ in year two, in addition to the base earnings E_1. The corresponding core earnings growth (from year one to year two) is:

$$g_1(E) = \text{Core Earnings Growth},$$

$$= \frac{E_1 + (R \times b \times E_1)}{E_1} - 1,$$

$$g_1(E) = Rb. \tag{A6}$$

If the firm requires additional funds to take advantage of franchise investment opportunities that arise at year end, it can issue new shares priced at P_1. In a stable market, new-share issuance alone will not change the stock price.

If n shares are issued at the beginning of year two, the total external funding will be nP_1. On a per (initial) share basis, this funding can be expressed as follows:

$$\text{External Funds (per initial share)} = \frac{nP_1}{N}. \tag{A7}$$

We also can express the external funds as a proportion b^* of E_1:

$$\text{External Funds} = b^* \times E_1. \tag{A8}$$

By equating Equations A7 and A8 and solving for n, we find a formula for n that soon will become useful:

$$n = \frac{N \times b^* \times E_1}{P_1}. \tag{A9}$$

We assume that the proceeds of the equity sale are invested so as to return R^* annually. Because these proceeds are received and invested at the beginning of year two, there will be additional year-two earnings of $R^* \times b^* \times E_1$ per initial share.

We now compute total earnings per share growth, $g_{TOT}(E)$. As a first step, we convert earnings per share to total earnings:

$$\text{Year-One Total Earnings} = N \times E_1$$

$$\text{Year-Two Total Earnings} = (N + n) \times E_2.$$

There are three contributors to year-two earnings E_2:

$$\text{Year-Two Total Earnings} = \text{Base Earnings}$$

$$+ \text{ Income from Retained Earnings}$$

$$+ \text{ Income from Externally Funded Investments},$$

$$(N + n) \times E_2 = N \times E_1 + Rb(N \times E_1) + R^*b^*(N \times E_1). \tag{A10}$$

We now use Equation A10 to derive a formula for $g_{TOT}(E)$:

$$g_{TOT}(E) = \frac{E_2}{E_1} - 1,$$

$$g_{TOT}(E) = \frac{N}{N + n} \times (1 + Rb + R^*b^*) - 1. \tag{A11}$$

If no new shares are issued, total earnings growth will be the same as core earnings growth. That is, if:

$$b^* = n = 0,$$

then

$$g_{TOT}(E) = Rb = g_1(E).$$

When new shares are sold (that is, $b^* > 0$ and $n > 0$) and the proceeds are reinvested, $g_{TOT}(E)$ will increase if R^* is sufficiently large.

We now derive an incremental growth formula that eliminates the need to know the number of shares:

$$\text{Incremental Growth} = g_{TOT}(E) - g_1(E),$$

$$= g_{TOT}(E) - Rb.$$

We replace $g_{TOT}(E)$ by the expression given in Equation A11:

$$g_{TOT}(E) - Rb = \frac{N}{N + n} \times (1 + Rb + R^*b^*) - 1 - Rb. \tag{A12}$$

We utilize Equation A9 to eliminate the number of shares in the above expression:

$$\frac{N}{N + n} = \frac{N}{N + (N \times b^* \times E_1/P_1)},$$

$$= \frac{P_1}{P_1 + b^*E_1}. \tag{A13}$$

We can recast Equation A12 in a more revealing form by using Equation A13 and then performing a variety of algebraic simplifications. We arrive at the following formula:

$$g_{TOT}(E) - Rb = \left(\frac{P_1}{P_1 + b^*E_1}\right) \times b^* \times \left(R^* - \frac{(1 + Rb)E_1}{P_1}\right),$$

$$= \left(\frac{P_1}{P_1 + b^*E_1}\right) \times b^* \times \left(R^* - \frac{\hat{E}_2}{P_1}\right) \tag{A14}$$

where

$$\hat{E}_2 = \text{Year-Two Earnings Without Equity Sales},$$

$$= (1 + Rb)E_1.$$

We can view $\hat{E}_2/P_1$ as an "earnings yield threshold." Thus, for $g_{TOT}(E) > Rb$ (i.e., to have incremental earnings growth from the equity sale), we must be able to invest the equity sale proceeds at a rate $R^* > \hat{E}_2/P_1$. This threshold will be attained in general for franchise investments for which $R^* > k$, because the earnings yield $\hat{E}_2/P_1 \leq k$.

Table A2. An Example Calculation

E_1	$1 + Rb$	$\hat{E}_2 = (1 + Rb)E_1$	P_0	$1 + g(P)$	$P_1 = (1 + g(P))P_0$	$\hat{E}_2/P_1$
\$100	1.13	\$113	\$1500	1.0967	\$1645	6.87%

We now apply Equation (A14) to an example given in the body of the article:

$b = b^* = 65\%$,

$R = R^* = 20\%$,

$P_0 = \$1500$,

$E_1 = \$100$,

$g(P) = 9.67\%$.

Using the above values (see Table A2):

$\hat{E}_2/P_1 = 6.87\%$.

Because R* = 20% and b* = 65%:

$$\text{Earnings Growth Increment} = b^*[R^* - \hat{E}_2/P_1],$$
$$= 0.65 \times (20\% - 6.87\%),$$
$$= 8.53\%.$$

The contribution of the 8.53% growth increment to $g_{TOT}(E)$ is diluted by the increased share base. This increased base is reflected in the first factor in Equation A14. In our example, that first factor is:

$$\frac{P_1}{P_1 + b^*E_1} = \frac{\$1645}{\$1645 + (0.65 \times \$100)},$$
$$= 96.2\%.$$

Thus only 96.2% of the increment actually translates into increased total earnings growth. Combining the results for our example, we find that:

$$g_{TOT}(E) = Rb + (96.2\% \text{ of } 8.53\%),$$
$$= (0.20 \times 0.65) + (0.962 \times 0.0853),$$
$$= 0.13 + 0.082,$$
$$= 0.212,$$
$$= 21.2\%.$$

We can summarize as follows:

- When \$65 in retained earnings (65% of \$100) is invested at 20%, the earnings growth is 13%, adding \$13 (13% of \$100) to the year-two earnings per share.
- When another \$65 in investments is externally financed, the investment return is calculated as an incremental return over the earnings-yield threshold. Dilution reduces that increment, so that the additional earnings growth becomes 8.2%. This growth adds another \$8.20 to the year-two earnings per share.

Finally, we turn to the change in P/E that occurs from the beginning to the end of year one. We calculate P/E using the price per share at the beginning of the year and the earnings per share that accumulate over the course of the year. At the outset:

$$P_0/E_1 = \frac{\$1500}{\$100},$$
$$= 15.$$

At the beginning of year two:

$$P_1/E_2 = \frac{\$1645}{\$100 + \$13 + \$8.20},$$
$$= 13.57.$$

Thus:

$$g(P/E) = \frac{13.56}{15.00} - 1,$$
$$= -9.5\%.$$

This combination of 21.2% earnings growth and a 9.5% P/E decline is consistent with 9.7% price growth because:

$$g(P) = [1 + g(E)] \times [1 + g(P/E)] - 1,$$
$$= (1 + 0.212) \times (1 - 0.095) - 1,$$
$$= 9.7\%.$$

This 9.7% price growth characterizes all points on the value preservation line illustrated in Figure F. Thus external investment financing moves us along, but not off, the value preservation line.

Price Growth and the VPL

We used an external funding example above to illustrate a general principle: *In a stable market, earnings growth and P/E growth always offset each other in such a way that a firm's price growth is independent of investment returns and the funding mechanism.* In fact, year-to-year price growth is determined by the firm's initial P/E and its retention policy. Consequently, the balance between earnings growth and P/E growth can always be represented as a point on a fixed value preservation line.

We offer below a general proof of the above principle. To do so, we first show how investing in premium projects increases the firm's tangible value and decreases its franchise value. The balance between these two value changes (that is, the franchise conversion process) is such that both the return on investment and the extent of external financing "drop out" of the calculation of price per share growth. In contrast, both the investment returns and the extent of funding affect earnings per share growth. Because earnings increase while price growth does not change, there must be a counterbalancing decrease in P/E.

Recall that stock price (P) is the sum of the tangible value per share (TV) and the franchise value per share (FV). Initially, stock price is:

$$P_0 = TV_0 + FV_0. \tag{A15}$$

By the end of the first year, TV and FV will have changed in accordance with their growth rates g(TV) and g(FV). At the beginning of the second year:

$$P_1 = TV_1 + FV_1.$$

That is:

$$[1 + g(P)] \times P_0 = [1 + g(TV)] \times TV_0 + [1 + g(FV)] \times FV_0,$$

and

$$1 + g(P) = [1 + g(TV)] \times (TV_0/P_0) + [1 + g(FV)] \times (FV_0/P_0). \tag{A16}$$

To simplify Equation A16, we introduce another variable:

$$f = FV_0/TV_0. \tag{A17}$$

Combining Equations A15 and A17 yields the following formulas:

$$TV_0/P_0 = \frac{1}{1+f}, \tag{A18}$$

$$FV_0/P_0 = \frac{f}{1+f} \tag{A19}$$

Using Equations A18 and A19, we simplify A16:

$$1 + g(P) = \frac{1}{1+f} \times ([1 + g(TV)] + f \times [1 + g(FV)]). \tag{A20}$$

To find g(P), we must substitute appropriate expressions for g(TV) and g(FV). The formula for g(TV) was developed above for the general case in which investments are financed through a combination of retained earnings and new-share issuance. These investments were shown to increase earnings and TV. In contrast, the new investments deplete the FV. To derive a formula for g(FV), first compute the total franchise value after one year:

Total Franchise Value = Time Growth in Initial Franchise Value
(Start of Year Two)

—Franchise Value Depletion Due to Investing Retained Earnings

—Franchise Value Depletion Due to Externally Financed Investments.

The franchise value depletion from an investment is equal to the net present value of the cash flows produced by that investment. Utilizing this concept and the symbols used in Table A1 and Equation A8, we have the following relationships:

Total Franchise Value = $N \times FV_0$,
(Start of Year One)

Total Franchise Value = $(N + n) \times FV_1$,
(Start of Year Two)

$$(N + n)FV_1 = N \times \left((1 + k) \times FV_0 - \left(\frac{R - k}{k}\right) \times bE_1 - \left(\frac{R^* - k}{k}\right) \times b^*E_1\right).$$

Because $TV_0 = E_1/k$, the above relationship can be expressed as:

$$(N + n)FV_1 = N \times FV_0 \times \left((1 + k) - [(R - k)b + (R^* - k)b^*] \times \frac{TV_0}{FV_0}\right).$$

The above equation provides the basis for a formula for g(FV). Replacing TV_0/FV_0 by 1/f (see Equation A17), we have the following:

$$1 + g(FV) = FV_1/FV_0$$

$$= \left(\frac{N}{N+n}\right) \times \left((1 + k) - \frac{1}{f} \times [(R - k)b + (R^* - k)b^*]\right)$$

$$= \frac{1}{f} \times \left(\frac{N}{N+n}\right) \times [f + k(f + b + b^*) - Rb - R^*b^*]. \tag{A21}$$

We now substitute Equation A11 for g(TV)—that is, $g_{TOT}(E)$—and Equation A21 for g(FV) in the price growth Equation A20 and find that:

$$1 + g(P) = \frac{1}{1+f} \times \frac{N}{N+n} \times [1 + Rb + R^*b^* + f + k(f + b + b^*) - Rb - R^*b^*]$$

$$= \frac{N}{N+n} \times \left(1 + \frac{k(f + b + b^*)}{1+f}\right). \tag{A22}$$

At this point, we notice that both R and R* have "canceled out." This means that the price growth is independent of our return assumptions. Referring back to Equation A13 and Table A2, we see that N/(N + n) depends on P_1 and, in turn, g(P). We rewrite N/(N + n) as follows:

$$\frac{N}{N+n} = \frac{P_1}{P_1 + b^*E_1}$$

$$= \frac{[1 + g(P)]P_0}{[1 + g(P)]P_0 + b^*E_1}$$

$$= \frac{1 + g(P)}{1 + g(P) + b^*E_1/P_0}. \quad \text{(A23)}$$

We substitute Equation A23 in A22 and find that:

$$1 + g(P) = \left(\frac{1 + g(P)}{1 + g(P) + b^*E_1/P_0}\right) \times \left(1 + \frac{k(f + b + b^*)}{1 + f}\right).$$

Next we solve the above equation for g(P):

$$g(P) = \frac{k(f + b + b^*)}{1 + f} - \frac{b^*E_1}{P_0}$$

$$= k - \frac{(1 - b)k}{1 + f} + \frac{kb^*}{1 + f} - \frac{b^*E_1}{P_0}. \quad \text{(A24)}$$

The last term in the above expression involves the initial earnings/price ratio, which can also be written in terms of f:

$$\frac{E_1}{P_0} = \frac{k \times (E_1/k)}{P_0}$$

$$= \frac{k \times TV_0}{P_0}$$

$$= \frac{k}{1 + f} \quad \text{(A25)}$$

By using Equation A25 in A24, we see that the terms involving b* (that is, the extent of external funding) drop out. The result is a formula for g(P) that depends only on the retention rate b and the initial P/E:

$$g(P) = k - \frac{(1 - b)E_1}{P_0}$$

$$= k - \frac{1 - b}{P_0/E_1}. \quad \text{(A26)}$$

In arriving at Equation A26, we have shown that the franchise conversion process does not affect price growth. This verifies the fact that, even with external funding, price growth is simply the difference between the market rate and the dividend yield.

In the body of this article, we showed that:

$$g(P/E) = \frac{1 + g(P)}{1 + g(E)} - 1.$$

Because the franchise conversion process increases g(E) but does not change g(P), the above relationship shows that any increase in g(E) must be offset by a decrease in g(P/E). This is the basic tradeoff that defines the value preservation line for a given year.[13]

FOOTNOTES

1. See, for example, M. L. Leibowitz and S. Kogelman, "Inside the P/E Ratio (Part II): The Franchise Portfolio" (Salomon Brothers Inc, January 1991) and Leibowitz and Kogelman, "Inside the P/E Ratio: The Franchise Factor," *Financial Analysts Journal*, November/December 1990.
2. We assume that all earnings streams are in the form of "normalized" perpetuities. See "Inside the P/E Ratio: The Franchise Factor," *op. cit.*
3. In the special case of a TV firm with P/E = 1/k, the formula for g(P) reduces to b × k. This result confirms our earlier observation that, for TV firms, g(P) = g(E) = b × k. For a general discussion of the factors that influence share price, see S. M. Keane, "Can A Successful Company Expect to Increase Its Share Price?" *Journal of Applied Corporate Finance*, Fall 1990.
4. See M. L. Leibowitz and S. Kogelman, "Franchise Value and the Growth Process," *Financial Analysts Journal*, January/February 1992.
5. We could, of course, have obtained this same value from the expression g(P) = k − D/P = 12.00% − 2.33 = 9.67. However, the preceding analysis provides insight into the respective roles of the TV and the FV in the firm's overall price growth.
6. See "Franchise Value and the Growth Process," *op. cit.*
7. An exception to this P/E decline occurs when one has an FV structure in which all measures continue to grow at a given uniform rate. These are the special conditions that are implicit in the standard DDM. See the appendix.
8. At the end of the first year, the realized g(E) and g(P/E) at point A bring the firm to a new P/E multiple of 15.3 (1.0173 × 15). Consequently, with a different P/E at the start of year two, there also will be a new VPL for that year.
9. In issuing new shares, we dilute the growth in earnings per share relative to what it would have been if no new shares had been issued. If no external financing were needed, earnings would grow at 26% (0.20 × 130%). The 21.2% represents a 4.8% drop-off—compared with the hypothetical 26%—that is attributable to dilution in both earnings and franchise value. For more details, see the appendix.
10. In this article, we have focused on growth that takes place over one year. This single-period model can be extended dynamically by repeatedly applying the model to year-end values.
11. In these examples, we are only considering actions that retain the risk pattern of the firm. If the firm changes its risk class dramatically—for example, through disproportionate debt financing—the appropriate discount rate k will change and the firm will migrate to a new VPL. As long as all the firm's initiatives for the year—funding, acquisitions, distributions or investments—take place at the implicit 12% discount rate, the firm will remain on the same VPL over the one-year period.
12. When referring to the firm's earnings, we mean earnings per share.
13. We thank Lawrence Bader, Cal Johnson, Geoff Kieburtz, Eric Lindenberg, Robert Salomon, David Shulman and Eric Sorensen for their perceptive comments and suggestions.