3-2001

Special Research Report - The Real Story behind the Productivity "Miracle"

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The Jerome Levy Economics Institute of Bard College

THE LEVY INSTITUTE FORECASTING CENTER

Special Research Report

The Real Story Behind the Productivity "Miracle"

Srinivas Thiruvadanthai
Resident Scholar

January 2001

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The Real Story Behind the Productivity "Miracle"

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Preface

The Levy Institute Forecasting Center has addressed the issue of worker productivity growth and its impact on the economy several times during the past few years, pointing out popular misconceptions and misinterpretations. Public interest in the issue increased over the course of 2000, and so did the degree of exaggeration and distortion. We feel that it would be useful to provide a close look at productivity, productivity data, and their relation to economic performance.

Srinivas Thiruvadanthai examines the evidence behind the "productivity miracle" and reports that there is some good news but also little support for some of the more dramatic New Economy claims. We are optimistic about the potential for technology to boost productivity over the next generation, but the evidence does not support the popular contention that a broad-based productivity boom has arrived.

I call your attention in particular to one point that Srinivas brings out: The estimates of productivity growth in the manufacture of computers—which have enormous influence on the overall productivity figures—are based on an assumption that defies common sense. It is assumed that, in any given period, the large difference between the price of the current line of computers and the price of the previous generation can be attributed entirely to a rational, well-informed calculation of the increased usefulness of the newer machines. In fact, buyers face a great deal of uncertainty in the rapidly changing world of computers, and they are almost certainly paying premiums for having the latest machine in order to minimize the risk of incompatibility with future software or systems. Pricing that reflects buyers' fears of having obsolete machines is taken as an indication of the increased productivity of the computer industry and ends up boosting the country's reported productivity growth.

The alleged productivity miracle is widely portrayed as a cure-all for economic problems and a virtual guarantee of future prosperity. In fact, it has been an illusion that has encouraged the businesses and investors to ignore financial warning signs. Severe financial imbalances can lead to economic trauma even in periods of profound technological change. It is hard to think of a time when more exciting technological developments were sparking economic growth than in 1929: electricity and telephones were rapidly spreading, factories were automating, motor vehicles were shifting from luxury to mainstream transportation, broadcasting was in its infancy, and most major automatic home appliances were introduced. Although all the affected industries eventually grew remarkably and changed the way Americans lived and worked over the next few decades, financial instability delayed much of this progress and was the dominant influence on the economy in the 1930s.

We offer this report as an antidote to current illusions and as a guide to interpreting the productivity data in the future.

David A. Levy
Vice Chairman and Director of Forecasting
The Jerome Levy Economics Institute

The Real Story Behind the Productivity "Miracle"

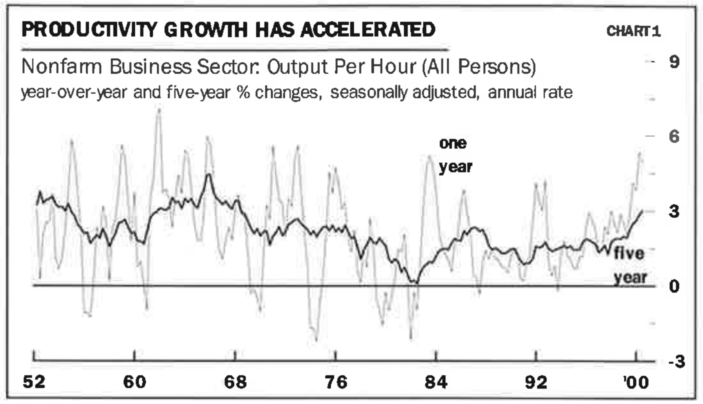
"New economy" analysts have been claiming that we have entered an era in which continuing worker productivity gains, driven by technological advances, will make it possible for the economy to sustain high levels of growth in profits and output without igniting inflation. It is true that productivity gains are at the core of economic progress, the source of increases in living standards. However, the optimistic claims about recent and future productivity trends rest on unreliable data and misconceptions regarding productivity figures and their implications for the economy and the markets.

The main findings of this report are:

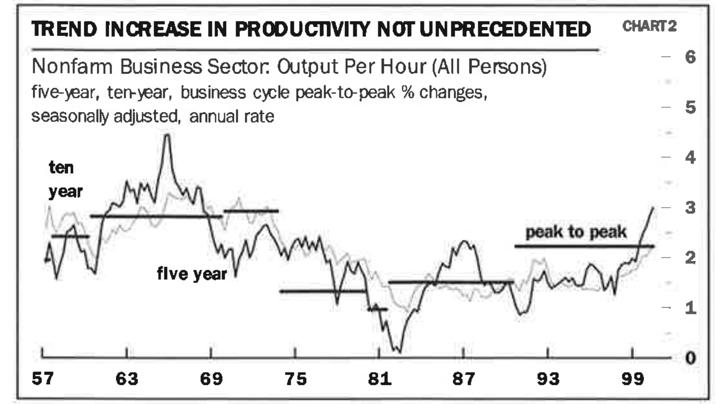
- Most measures indicate that there has indeed been some acceleration in trend productivity recently, but the rate of increase is not record-breaking. Moreover, improvements in productivity have been concentrated in one sector of the economy, namely computer manufacturing.
- The estimation of productivity is beset by conceptual and data-related issues that compromise the validity of reported productivity data and make quarterly changes unreliable.
- Productivity has limited ability to contain inflation when worker compensation rates are accelerating.
- Productivity has no *direct* effect on *aggregate* business profits in the economy.

Reading Too Much into Too Little Data

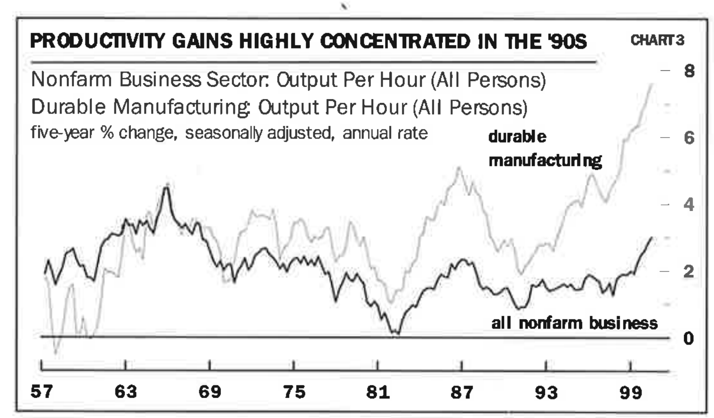
Most of the rosy projections of continuing rapid growth in productivity arise from the surge in reported U.S. productivity over the past two or three years. However, the recent acceleration is by no means unprecedented, and episodes of rapid productivity growth have not always signaled strong future performance (chart 1). Besides, it remains to be seen how much of the recent productivity gains are changes in the trend and not the result of cyclical influences.



It is hard to separate trend increases in productivity from cyclical increases. Cyclical aspects of the economy, such as changes in the tightness of labor markets, also distort the estimates of output and labor hours used in the calculation of productivity. For these reasons, a few alternative measures of long-term changes in productivity are shown in chart 2. All the measures indicate that there has been some acceleration in trend productivity recently, but the current increase is certainly not record-breaking. For much of the 1960s, all of the trend measures of productivity growth were well above the current levels.



Another factor to be considered in interpreting the recent improvement in productivity growth is that gains have been concentrated in the durable goods manufacturing sector, especially in one segment—computer hardware manufacturing, where rapid product evolution has caused problems in measuring output (discussed in the next section). Never before has the productivity growth in the durable goods manufacturing sector differed so much from that in the nonfarm business sector as a whole (chart 3). Productivity growth from the 1950s to the early 1970s was much more evenly based.



rything is Measurable

doubtedly, the recent gains in the computer industry tribute to future gains in productivity in other sectors. loes not seem likely that computers will lead to pro- nd widespread acceleration in productivity in the near For example, it is hard to envision sizable gains in the ivity of nursing home personnel anytime soon.

ere are several conceptual and data-related problems ed with the official measurement of productivity, and ons resulting from these have been especially acute in two years. To appreciate the problems, let us look at oductivity is defined and how the underlying data are d. For the nonfarm business sector[1], productivity is as output per labor hour (or widgets per labor hour),

$$\text{Productivity} = \frac{\text{Output (in real terms)}}{\text{Aggregate Labor Hours}}$$

arly, there are always two potential sources of error in ing productivity: measurement of output and measure- f labor hours. Potential distortions in both measure- aise questions regarding the reliability and implica- productivity data.

ns in measuring output:

nceptually, productivity is the number of "widgets" pro- per labor hour. Therefore, the first task is to measure nber of widgets produced in the economy. Several con- and data problems would vanish if there were just one type of widget that did not change through time. However, in the real world there are several different types of widgets (apples, oranges, autos, haircuts, etc.). The problem of adding different types of widgets (adding apples and oranges) is solved by using their dollar value instead of their number. However, using dollar value to measure output introduces the additional complication of adjusting for inflation. Estimating inflation would be a relatively simple matter if widgets were not being improved and new types were not being invented. But, as we will shortly see, adjusting estimates of inflation for quality changes is complex and poses conceptual problems.

Technological advances result in improved goods and services and in new ones, and neither the improved nor the new are strictly comparable to the goods and services that existed before. Imagine trying to compare a radio with a television set or a 1980 PC with a current-model PC! Rapid evolution of products in the information technology industry has rendered comparisons across periods problematic. This difficulty is especially serious because an overwhelming share of the productivity increase in recent times can be attributed to the acceleration in productivity growth in the sector that produces computers and other information technology equipment.

In order to compare output across time, especially for products such as computers, the Bureau of Labor Statistics (BLS) must take into account the two ways in which technology affects output–improvement in the quality of existing products and introduction of new products or new features.

The issue of new products and features is not tackled but circumvented. When a new product (or a product with new features) is first introduced, it is categorized and compared to

ivity is calculated only for the business sector. Most analysts and kers focus on the productivity of the nonfarm business sector.

est existing products. Thus, the product's newness is in the period in which it is first introduced. By the riod the product is no longer new and the first period's ts as a benchmark for comparison.

BLS attempts to account for quality changes in prod- *hedonic* estimation—a statistical method for estimating adjusted for changes in quality. A change in the price duct can be conceptually decomposed into two com- : (1) price change related to changes in quality and (2) ary or "pure" price change. The purpose of hedonic on is to separate the two components in order to com- price index that is a "pure" inflation indicator. This ue is especially important when technological change n vast improvements in products and many new fea- ch as in computer hardware in recent times.

mple example shows the reasoning behind the hedonic ology. Assume that the price of an apple is determined one factor—the characteristic of sweetness. Suppose average apple was priced at $1 last year and $2 this e conclusion might be that, since prices have doubled, is 100%. That reasoning would be simplistic, and the ion incorrect, because it does not take into account price-determining characteristic of the apple might anged from last year to this year. Suppose that the aver- le this year is three times sweeter than the average st year. This year's apple should be worth three times the consumer than last year's, but its price has only . If we adjust for this quality change, we find that the ce component of apples has actually declined over the other words, we have deflation and not inflation in ices.

Hedonic estimation attempts to apply this reasoning to complex real-world products, which have not one significant characteristic but many. For example, computers have CPU speed, RAM, storage, and so forth. In theory, a price is assigned to each of these characteristics and a change in each price can be decomposed into pure and quality-related price changes. In effect, each characteristic is a product. However, since buyers typically purchase a completely assembled computer, we have price data only for the computer as a whole, not for individual characteristics. Hedonic estimation makes the assumption that the price paid for a product is the sum of the buyers' implicit valuation of each characteristic. Based on this assumption, the BLS uses statistical methods to estimate the pure price inflation for each characteristic of a computer. The BEA then uses the pure inflation index to deflate the nominal dollar value of computers produced in the current period to arrive at a figure for "real" output of computers.

There is no doubt that computers have become cheaper and better. However, a substantial part of the massive and sustained deflation in computer prices in the 1990s is the result of the hedonic methodology, which is probably misleading. Hedonic estimation does not measure producer output; it measures user values. As we have seen, the assumption underlying the methodology is that users can and do value products for their characteristics. Furthermore, the methodology requires that buyers value the characteristics in a consistent and systematic way. When products evolve as rapidly as computers do, buyers making decisions in an environment of uncertainty may be willing to pay a substantial premium for a state-of-the-art product, especially if strategic considerations and compatibility issues enter into the picture. This would invalidate the hedonic analysis. Thus, in the computer industry, sharply lower

or models that are just a few months old may be more
ion of the elimination of the state-of-the-art premium
indication of reduced production costs, and, corre-
gly, the real value of computer production may not be
g as fast as the data indicate.

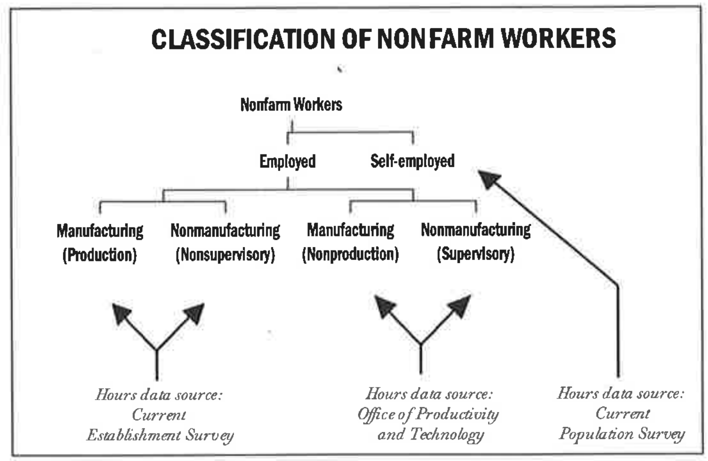
nceptual and data problems in measuring output have
ed complication in the service sector. In service indus-
roducts (that is, services) are generally not well de-
Moreover, customization and lack of standardization
comparisons virtually meaningless in many cases. Even
in which a service seems to be standardized, it may
Consider a haircut. In busy periods a barber may do a
. While the haircut may cost the same, its quality may
Even if the quality remains the same, the customer may
wait longer than usual. The barber's service defined
y as a "haircut" or even as a certain quality of haircut
the same, but most customers would experience a de-
the quality of service.

ally, we would like to be able to define and measure
of service. In practice, this is not feasible. Labor scar-
h as the country is experiencing now, affects the qual-
ervice and therefore the output of many service ven-
also affects the output of the goods industry since
anufacturers offer some warranty and after-sales cus-
upport service with the goods they sell. However, offi-
a on output will not record a drop in the level of ser-
perienced by customers. As a result, official data will
e increases in productivity (just as they would under-
oductivity in times of high unemployment).

ne analysts have remarked that in the "new economy" there have been many improvements in services (for example, 24-hour access to bank accounts through ATMs instead of limited-hours teller service) that are not being adequately reflected in the official data. To some extent, such problems resulting from service enhancements will arise continually since the economy is always changing. Although it is plausible that more enhancements are taking place today than, say, 15 years ago, there is little convincing evidence that a great deal more of these changes are being missed in the official data now than in earlier periods.

Problems in Measuring Labor Hours:

The measurement of aggregate labor hours in the economy is also beset with problems, some of which are similar to and overlap the problems in the measurement of output. Aggregate labor hours for the productivity data is the total number of labor hours used in the production of the aggregate output. It is derived from various sources, according to the following classification scheme (see diagram).



rkers in the nonfarm private sector are divided into ups: employed and self-employed. The employed work- then classified as: (1) production and nonsupervisory nonproduction and supervisory. Production and non- tion classifications apply to the manufacturing sector. A tion employee is one who is directly involved in pro- , for example, an assembly line worker in an auto plant. ountant working in the same plant would be classified nproduction worker. In the nonmanufacturing sector s are classified as nonsupervisory or supervisory.

ion and Nonsupervisory Workers

e total hours at work of production and nonsupervisory s in the nonfarm sector are not measured directly. They mated from data from the Current Establishment Sur- ES), a monthly survey of firms in the country. The CES the aggregate hours of these workers, but the hours it are "paid hours" (the hours for which the firms have nployees). This is not, as one might first suppose, the s hours at work. For example, paid hours may include n time, holidays, and all other time off. To estimate t work from data on paid hours, the BLS uses its an- rvey of hours at work. The BLS calculates the relation- tween paid hours and hours at work for the past year. It es this relationship to derive hours at work from data hours for all quarters of the current year.

veral potential distortions are associated with this l. First, the ratio of hours at work to paid hours may from year to year, distorting the current year's estimate s at work. Second, since the survey on hours at work is out annually, quarterly fluctuations in the ratio of hours to hours paid will not be reflected in productivity

data. Third, there are some questions regarding the accuracy and reliability of the annual survey of hours at work.

Nonproduction and Supervisory Workers

The source of the data on nonproduction and supervisory workers is the Office of Productivity and Technology. Here again, there is the problem of estimating quarterly figures based on an annual data. Moreover, the hours at work of nonproduction and supervisory workers do not always vary proportionately with output, since these workers are not involved directly in the production process. For instance, if the demand for autos increases in a given quarter, the aggregate hours of production workers at an auto plant will likely increase, but the hours at work of accountants, office receptionists, and other nonproduction workers will likely not. As a result, the overall productivity of the plant would seem to have increased in the reported productivity figures.

Self-employed Workers

The source of the data on self-employed workers is the Current Population Survey (CPS), a monthly survey of households. Since the CPS covers only a small sample of the entire population of households, its estimates are volatile and unreliable. Another problem is that some of the CPS benchmarks are based on data from the immediately preceding decennial census. Even though changes in demographic patterns occur only slowly, benchmarks based on a particular census can become more and more biased as time from that census increases[2].

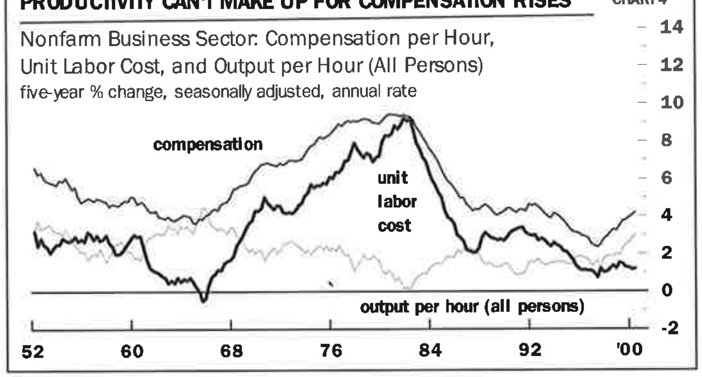
The extent to which data on hours of self-employed workers can distort reported productivity was demonstrated in the second quarter of this year. Hours of the self-employed reportedly fell at an incredible 7.6%, annual rate, during the most profitable quarter in the last seven years, and this decline ac-

[2] This problem with benchmarking is also the source of the widening discrepancy in recent times between the employment numbers from the CPS (household series) and from the CES (payroll series).

l for most of the slowdown in the growth of total labor n the quarter. Without this drop in total labor hours, ivity growth in the second quarter would have been .5%, substantially lower than the 6.1% reported in the data.

Productivity and Inflation

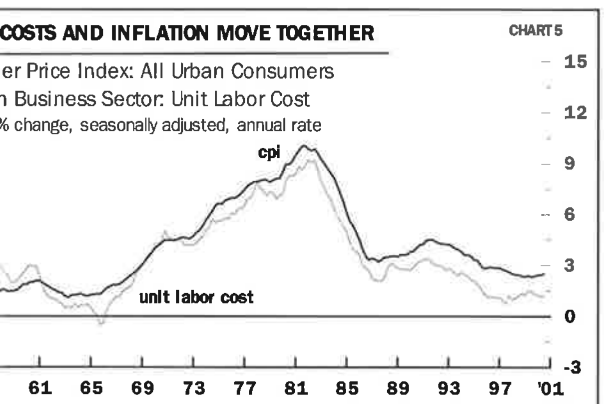
Many analysts are enthusiastic about high productivity growth because they believe it can keep inflation tame. It is true that higher productivity implies rising standards of living and increased satisfaction for consumers and thereby leads to less clamoring for pay raises. However, the claim that productivity gains prevent tight labor markets from causing inflation to accelerate is not well founded. Historically, swings in compensation inflation have accounted for more of the shifts in unit labor costs than have swings in productivity (chart 4), and unit labor costs are the key determinant of the inflation trend (chart 5, next page).



Compensation rates and prices are nominal concepts, whereas productivity is a real phenomenon bounded by physical and technological limitations. Thus, pay rates can potentially grow much faster than even fast-growing productivity and ultimately lead to accelerating inflation.

:ivity and Profits: Fallacy of Composition

other reason for much of the enthusiasm about produc- the misguided notion that higher productivity leads to profits and higher profit margins for the economy as a t is true that any firm that raises its workers' productiv- eases its profits, and therefore higher productivity is a al goal. However, productivity gains for aggregate busi- not directly raise aggregate profit[3]. Suppose every suddenly creates twice as much product per hour, and ers keep the same hours and pay (in dollars). Nominal l income does not change, and, assuming no change in onal saving rate, neither does nominal consumer spend- usiness cuts prices in half, it will sell twice as much at e cost while consumers buy twice as much for the same utlay. Although GDP (output) doubles, revenue, ex- and profits are unchanged, as deflation is 50%.



ductivity gains may be associated with strong invest- nd strong investment does raise profits. Productivity ct domestic firms' competitiveness against foreign firms, the trade balance and thereby affecting profits. Changes in relative costs and prices may lead to changes in personal saving, inventory building, or investment, all of which affect profits. However, productivity itself does not have a direct effect on profits.

Profits and productivity trends can be observed to move together not because productivity directly affects profits but because both are in large part a function of the business cycle. When profits weaken and output slows, diseconomies of scale and delays in adjusting employment reduce productivity. During recoveries, profits and output surge, making workers scramble before employment catches up.

vity does not appear in the aggregate profits equation (identity).

sion

e optimistic view that reported productivity growth is a
hat the economy will be able to sustain high growth
igniting inflation reflects exaggerated expectations for
productivity, unreliable estimates of productivity, and
n notions about the implications of productivity growth
nomic performance.

summarize,

Large short-term gains in productivity have little to do
e potential for continuing and long-term growth in pro-
y. Moreover, historically, the recent surge in productiv-
vth is not extraordinary.

Calculation of productivity has many conceptual and
ated problems that undermine the credibility of the
productivity boom, such as:

With rapid technological change come changes in prod-
w products, products with new features, improved prod-
at make comparison of output across time problematic.

Methods employed to separate quality-related price
s from inflationary price changes measure user value,
duction costs, and therefore distort output calculations.

The size of reported productivity increases for the
y in general is called into question by the concentra-
gains in the computer sector, and doubts about the
of the gains in the computer sector given that they are
n part, on the dubious assumption that buyers do not
remium for state-of-the-art equipment.

Inability to define and measure products directly in
industries means that official data often do not record
s in the level of service, thereby distorting output and
d productivity.

* Measurement of labor hours is affected by survey data that is not representative and benchmarks that are outdated.

* Cyclical fluctuations in demand affect the measurement of output (especially in service industries) and labor hours, thereby distorting reported productivity.

■ Productivity has limited ability to contain inflation. Employee compensation inflation is the dominant influence on inflation.

■ A change in productivity does not have a direct effect on profits. However, productivity may influence profits indirectly through its effect on investment, competitiveness in foreign trade, and personal saving. Productivity, like profits, is in large part a function of the business cycle.

About the Author

Srinivas Thiruvadanthai, Resident Scholar at the Levy Institute Forecasting Center, joined the organization in 1998, where he has done ground-breaking research into the stock market "wealth effect" on consumer behavior and its implications for total business profits. He has also been involved in every aspect of the research and forecasting operations.

Thiruvadanthai brings a broad and critical approach to economics because of his diverse background, which includes experience in banking, technology, and psychology as well as economics. He became the under-21 bridge champion of India while working toward his bachelor's degree in mechanical engineering from the Indian Institute of Technology in Madras. He received his postgraduate diploma in management (the equivalent of an American M.B.A. degree) from the Indian Institute of Management in Ahmedabad. He then spent three years as a lending officer at the Industrial Credit and Investment Corporation of India Limited in Bombay. Thiruvadanthai came to the United States to enter the graduate economics program at Washington University in St. Louis, where he collected both his M.A. and Ph.D. degrees in a mere four years. His doctoral dissertation was a highly unusual interdisciplinary analysis applying psychological models of human behavior to consumer credit problems.

In addition to the various topics that he is researching at the Forecasting Center, Thiruvadanthai is interested in research topics ranging from economic methodology to the psychology of saving behavior.