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Hyman P. Minsky Ph.D.

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THE MODELING OF FINANCIAL INSTABILITY: AN INTRODUCTION

Hyman P. Minsky
Professor
Economics Department
Washington University
St. Louis, Missouri

Two steps have to be accomplished before we can empirically model financial instability. One is to develop a theory in which the properties that determine the relative stability of a financial system and of the economy are endogenous. The second is to define measures on the economy and financial system which can be used to estimate trends in the relative stability of the financial system and the economy.

The fundamental outline of a theory of financial instability can be derived from Keynes' General Theory.....[1] and Fisher's description of a debt deflation.[2] As is well known, much of Keynes' General Theory was lost in the development of today's standard Macroeconomics.[3] In some very important senses, what was lost is more significant than what has been retained, for Keynes in The General Theory advanced a "financial" theory of why the economy was so susceptible to fluctuations. In my interpretation, fluctuations are treated as a succession of system states and each system state "breeds" the seeds of its own destruction. Of particular importance in this scenario is the way in which a steady growth pattern evolves into a boom and how the boom leads to an unstable panic prone system. The fundamental instability is the way in which a period of steady growth evolves into a speculative boom. Central to this evolution is the endogenous determination of the accepted or desired liability structure of not only ordinary business firms (corporations) but also banks, generically defined to include the entire set of financial organizations. The spectacular panic and subsequent debt deflation is of secondary importance for our present concerns.

The best currently available data base for estimating trends in the financial system is to be found in the Flow of Funds accounts of the Federal Reserve System. These data as now constructed give us only hints as to the cash flows set up by financial instruments -- they do not give us the actual cash flows. Hopefully, as research proves the validity of the cash flow approach to modeling financial interrelations, the Flow of Funds accounts will be modified into sectoral cash flow accounts.

Inasmuch as this paper attempts to cover a wide territory it, of necessity, is a road map rather than the actual journey.

I. The Patinkin Resolution and Finance.

The fundamental proposition of the financial instability theory of a capitalist economy is that the capitalist market mechanism is flawed, in the sense that it does not lead to a stable price-full employment equilibrium, and that the basis of the flaw resides in the financial system. We immediately note that financial instability is rooted in actual existing institutions. This is not a theory for all economic system, rather it is a theory of how a particular economy works. It is fully consistent with the theory to have economic processes vary as institutions change.

The focus of the theory is the desired and actual liability structures of economic units -- in particular of ordinary business enterprises and financial institutions. A critical insight underlying the theory is that the desired liability structures for financing positions in real and financial assets by firms and financial institutions are due to endogenously determined expectations and preferences. Liability structures are not determined by technology, as are production techniques, or by exogenously given preference systems, as is assumed in demand theory. It is in the determination of desired liability structures associated with asset positions (and the reciprocal asset holdings associated with liability structures) that the dark and mysterious forces of uncertainty are really at home. Uncertainty is the fundamental analytical construct of this theory, and preferences with respect to uncertainty as well as units perception of uncertainty are taken to be endogenously determined by the past performance of the economy.

In a recent article, Professor Friedman[4] used the Patinkin resolution[5] to the standard or bastard Keynesian presentation of the possibility of an underemployment equilibrium in a capitalist economy as the key to the assertion that a capitalist market mechanism is not flawed. Prior to the acceptance of the Patinkin resolution, it was

argued that (1) product market equilibrium determines the aggregate demand for labor, (2) at a given money wage rate this demand can be less than the available supply, and (3) that the decline in money wages that follows upon the excess supply of labor might not be an efficient process for eliminating the excess supply.

Patinkin rescued the in principle validity of money wage declines as an effective device for eliminating aggregate unemployment by introducing money wages and prices as a determinant of consumption demand. The rationalization for this proposition is the real balance effect, which introduces the money balance divided by the price level into the consumption function. This feedback via money prices and consumption demand in the Patinkin resolution assures that the demand for labor as determined in the commodity market will be consistent with the productivity-preference determination of full employment equilibrium.

In a sense, the Patinkin resolution has an in principle validity because it would be operative even after a full-blown debt-deflation process triggered by the fall in money wages and prices has run its course. The Patinkin resolution, which is fundamental to modern neo-classical economics, implicitly accepts the view that the road to full employment might very well run through hell.

The Patinkin resolution is peculiar in that once it yields the so-called full employment equilibrium, no questions are asked as to whether the equilibrium sc defined contains ongoing processes which can rupture the equilibrium. If we look closely at what goes on when the system achieves such an equilibrium, we readily uncover ongoing processes that tend to destroy the equilibrium. These ongoing processes tend to rupture the equilibrium in an upward direction, i.e., from full employment, the system tends to generate a more than full employment speculative boom.

In a world where external finance exists, and where money broadly defined is an ever evolving concept whose supply is essentially endogenous, the change from less than full employment to sustained full employment leads to changes in the valuation of various capital assets and in the desired external internal financing ratio. Capital assets are desired only indirectly because of their productivity. The immediate determinant of the demand for capital assets is the cash flows or quasi-rents, that the capital assets are expected to yield in the ongoing functioning economy. Furthermore, the basic speculative element, in an economy in which external finance exists, is the extent to which "owners" of capital assets and their "bankers" externally finance positions.

Capital assets, both newly and previously acquired, as collected in firms, are expected to yield a series of quasi-rents, Q_i, and their current market valuation P_k, is a capitalized value of these flows. If these capital assets are being produced, their supply price P_I, will be "consistent" with P_k. If P_k varies, other things such as wages and financing conditions remaining the same, then the pace of production of these capital assets, investment, will vary.

Because of the way in which corporations report their performance and the way in which financial contracts are written, we can think of the Q's as discrete quarterly or annual results. Because of the memory of past downward deviations of income from full employment, during which realized cash flows were lower than full employment cash flows, at the time full employment is first achieved as a result of, say, a Patinkin process current expected cash flows have a mean value $\bar{Q}_i$ which is lower than the then current full employment cash flows Q_i^f. Furthermore, because the economy has in the past exhibited fluctuations, there is an expected variance $\sigma^2_{Q_i}$ to the currently expected cash flows.

As the Patinkin process sustains full employment, the realized quasi-rents are greater than expected and the variability of the quasi-rents is smaller than in the anticipated variability. Expectations are affected by realizations in a world with uncertainty, thus as full employment is achieved and sustained, $\bar{Q}_i$ increase and $\sigma^2_{Q_i}$ decreases.

If expectations become based upon full employment growth, then expectations become that $\bar{Q}_i = (1 + g)^i Q_{of}$ and the expected variance around this growth path approaches zero as time in full employment increases.

II. Hedge and Speculative Finance

Positions in the collection of capital assets owned by firms that yield Q_i are financed by some combination of equity shares and debts. Similarly, positions in collections of financial instruments owned by financial institutions are financed by some combinations of 'capital and surplus' and debts. Debts are best characterized by the cash payment commitment as stated in the contract. These cash payment commitments can be demand, dated, or contingent. For every demand or contingent cash payment commitment there is a frequency distribution of the expected cash payments. Thus with greater or smaller certainty, the liability structure of an economic unit can be translated into a time series of expected cash payments. These cash payments are on account of both "interest" and "principal." A given amount of debt in the form of a six month note requires a payment of the face amount and interest in six months, a fifty year bond requires only the payment of interest for fifty years. The principal is not due until the final date.

We will define two types of financing units: units which hedge and those that speculate. The hedge finance unit expects the cash flow from operating capital assets (or from owning financial contracts) to generate more than sufficient cash to meet contractual commitments. If "CC" are the contractual cash commitment on debts, $\bar{Q}_i$ are the expected quasi-rents, and $\sigma^2_{Q_i}$ is the variance of the expected cash flows, then for a hedge investor

we have that

1) $CC_i < \bar{Q}_i - \lambda \sigma^2_{\bar{Q}_i}$ where λ is sufficiently great so that the subjective probability of an actual $Q_{iR} < CC_i$ is acceptably small.

Equation 1 can be rewritten as

2) $CC_i = \tau(Q_i - \lambda \sigma^2_{\bar{Q}_i}), \tau < 1$

If we capitalize the cash flow commitments, written as K(CC), and the quasi-rents that capital assets are presumably "assured" of earning

$(\bar{Q}_i - \lambda\sigma^2_{\bar{Q}_i})$ at the same rate, so that

$P_{k,i} = K(\bar{Q}_i - \lambda \sigma^2_{\bar{Q}_i})$, we have that $K(CC_i) < P_{k,i}$

there is a margin of safety in the market value of assets, over the face value of the debts. ($P_k < K(CC)$ is the conditions for insolvency). We can write this as

3) $P_k = \mu K(CC); \mu > 1$

We can assume that the cash payment commitments on debts are taken to be more certain than the cash flows from the capital assets, and that the "owners" of the debts also assume greater variability in the Q_i than they are willing to tolerate in the cash they receive on the debts. As a result, the capitalization rate for the cash commitments by both the borrowers and the lenders will be greater than on the cash flows from capital assets, so that the need for a margin of safety on presumed market value of assets over liabilities implies that the $\bar{Q}_i > CC$ by some margin.

A hedge financing unit expects the cash flow from operations to generate sufficient cash to meet payment commitments on account of debts. However, further protection is possible by having a unit own excess money or marketable financial assets -- i.e., it is convenient (as an implicit insurance policy) to hold assets in the form in which debts are denominated. Thus a balance sheet of a hedge investor will include $\eta K(CC)$ of money or bonds in addition to the P_k of capital assets. Thus we have that

4) $P_k + \eta K(CC) = K(CC) + Eq, \eta < 1$

Thus for a hedge financing unit there are three parameters which determine desired portfolios: the margin of safety in asset values, M, the cash flow margin τ, and the liquid asset kicker η.

A unit speculates when CC for some periods is greater than expected $\bar{Q}_i$. In particular, a unit is speculating when CC exceeds the expected Q because the CC includes the repayment of principal. Thus a speculator can be defined as a unit in which for some near term i $CC_i > \bar{Q}_i$ and for which the capitalized value of the Q's exceed the capitalized value of the CC., i.e., $P_{k_i} > K_i(CC)$.

This is so because once the early or CC's are "paid" no further "CC's" enter into the capitalization formula. It is the earnings of the capital assets beyond the date of the speculative debts that yields the margin of safety which induces both the debt owner and the capital owner to engage in speculative finance.

Of course for a speculative finance unit, debt is repaid by the proceeds of new debt; thus, the conditions that $CC_i > Q_i$ and $P_k > K_i(CC)$ hold as a process in time.

For a unit engaged in speculative finance, the difference between CC_i and Q_i for these "early on periods" has to be met by refinancing. Thus a prerequisite for speculative finance is for a market to exist in which both borrower and lender believe that the firm can raise $CC_i - Q_i$ of cash without negotiations the sale of Q_i yielding assets.

Note that if $CC_i > Q_i$ for near term i's and nevertheless $P_k > K(CC)$ at some set of capitalization rates, then at another set of capitalization rates, associated with higher interest rates, $K(CC) > P_k$. Thus for a speculative finance organization solvency (the excess of P_k over K(CC)) depends upon the ruling interest rates. Inasmuch as the viability of speculative finance depends upon the existence of a margin of safety in the value of capital assets over the value of debts, rising interest rates will decrease the margin of safety of a speculative firm simply because the expect Q's are later dated than the contractual payments on debts.

The need for a speculator to regularly raise CC-Q of cash through some set of money markets implies that the operations of a speculator is dependent upon the normal functioning of these financial markets. Thus, whereas a hedging unit is dependent only upon the normal functioning of product oriented markets (or upon the fulfillment of contracts for a financial unit) a speculative unit is dependent upon the normal functioning of both product and money markets. A speculator has a dual dependency.

A speculative unit will also carry a liquid asset kicker η K(CC) in order to protect the unit against transitory quasi-rent or money market difficulties. We can expect η to be greater for a speculative unit than for a hedge unit.

Thus for a speculative unit we have

5) $P_k > K(CC); P_k = \mu K(CC), \mu > 1$

6) $CC > \bar{Q}_i + \lambda \sigma^2_{\bar{Q}_i}; CC = \tau(\bar{Q}_i + \lambda \sigma^2_{\bar{Q}_i}); \tau > 1$

and

7) $P_k + \eta K(CC) = K(CC) + Eq, \eta < 1.$

Once again we have parameters which measure the balance sheet, cash flow, and portfolio margins. The initial difference between hedge and speculative finance conditions is in the size of τ, a secondary

characteristic is in the size and composition of η K(CC). A third difference is that whereas for a hedge unit $P_k > K(CC)$ for all capitalization rates, for a speculative unit there exist some rates for which $K(CC) > P_k$.

III. External and Internal Financing of Investment and Positions in Capital Assets.

Let us redefine our cash flow commitment and quasi-rent relation to distinguish between the views of bankers and corporate managers on the maximum acceptable cash flows due to debts. We have that the maximum desired cash flow commitments by bankers $CC_b = \tau_b (\bar{Q}_i - \lambda \sigma^2_{Q_i})$ and by the corporate management is $CC_c = \tau_c (\bar{Q}_i - \lambda \sigma^2_{Q_i})$. Heroically, we assume that both the bankers and their customers agree on the expected cash flows $\bar{Q}_i$ and the variance $\sigma^2_{Q_i}$.

The actual cash flow commitment will be determined by the shortside of the acceptable ratios: CC_a is the minimum of CC_b and CC_c. Our normal expectation is that as a Patinkin process leads to a recovery, business will be more optimistic than bankers so that $CC_a = CC_b < CC_c$, because $\tau_b < \tau_c$.

As the Patinkin process sustains success, three things happen: results improve so that actual quasi-rents exceed expected quasi-rents, the observed variance of quasi-rents, especially on the downside, is less than the expected variance, and the willingness to commit quasi-rents to debt payment increases. (τ increases). The objective conditions as measured by realized Q's, and the subjective conditions by which the past affects the value of τ, both change in a direction that is conducive to increasing the cash payment commitments CC. Typically, businessmen will both perceive the increased profitability and will be willing to raise the ratio of CC to Q before the existing lot of bankers. As a result of this difference, some businessmen will seek alternative "banking" connections and will be willing to pay a premium for external finance. The profit situation is conducive to financial innovation(6) and a growth of "fringe" banking relations will take place.

As full employment is achieved and sustained, businessmen are willing to carry increased cash payment commitments with the inherited set of capital assets. In a world with innovative finance, this will be reflected in achieved financing relations. If ΔCC_i is this increment of cash payment commitments, then $K_\Delta(\Delta CC_i)$ is the increment of purchasing power available. In the world of corporations and corporate finance, this $K_\Delta (\Delta CC_i)$ is available for the purchase of capital assets. (A simple analogy is a margin stock market; a rise in stock prices increases the available funds in portfolios which can be used to purchase stock).

Continued success of the economy leads to the uncovering of "purchasing power" over capital assets in the portfolios of existing organizations, and this purchasing power leads to rising prices of capital assets and an increased pace of production of capital assets.

Thus we have that the rise in CC reflects the rise in the willingness of business to increase cash flow commitments and of the uncovering of bankers and banking organizations that will go along with the desires of business. On the other hand, the quasi-rents grow at the rate at which full employment income is growing. The rate of growth of cash flows due to financial commitments γ is greater than the rate of growth of quasi-rents g. The ratio of cash flow commitments to cash payment commitments increases.

In terms of the safety margin in the price of capital assets, we have that $P_k/K(CC)$ decreases, even allowing for the increase in P_k due to the acceptance of full employment quasi-rents as the normal.

It is important to note that the purchasing power uncovered in the liability structure can be applied to the purchase of items in the stock of capital assets as well as to the financing of investment. One aspect of a sustained full employment period that has not been emphasized sufficiently is that the liability structure associated with the stock of capital assets changes. Typically, these changes are the result of corporate maneuvers such as take overs.

IV. The Dual Dependency Relation for Speculative Organizations and the Pervasiveness of Speculative Finance.

The initial defining distinction between a speculative and a hedge financing unit is that for a speculative unit payments on debts (principal and interest) exceeds quasi-rents whereas for a hedge unit the quasi-rents exceed the cash commitments. Thus, a speculative unit is always refinancing its position by the issuance of debt.

A speculative unit requires that good markets exist for its debt; that these markets have a large number of participants and that the supply of financing available will be elastic with respect to small concessions in terms by the speculative firm. Basically, this comes down to the ability of a firm to sell liabilities in a number of different markets; it might have a variety of liabilities which it sells in a number of different markets and the amount it sells in each market depends upon conditions in the market.

The supply side of the "money markets" largely comes from the η K(CC), the liquidity kicker, kept by both hedge and speculative units so as to have assets which play the role of an insurance policy with respect to a short fall of either Q's or refinancing. The owners of the liquidity kickers are in a sense borrowing more than they really need so as to have this protection. Therefore, as liquidity kickers are necessary to dispel the fears and uncertainties of both lenders and borrowers, the units holding such kickers are predisposed to

use the funds rather than leave them idle -- if "safe enough" assets are available that fill the needs for standby reserves. Obviously, short term liabilities that are easily transferable into "cash money" are good substitutes for liquid assets.

Thus we have that a variety of assets make up the cash kicker, η K(CC). Some are debts of banks and other financial intermediaries, others are short term liabilities of government units, and still others are direct debts of private firms. There is a speculative element in the composition of the cash kickers. The speculative spectrum varies with the extent of the market for the assets and the degree of protection afforded for the assets by the actual or implicit central banks.

If we split the η K(CC) into its component parts, with η_m being money, η_g being government debt, and η_p being the debts of non bank private units, we have that

$$\eta \, K(CC) = \eta_m \, K(CC) + \eta_g \, K(CC) + \eta_p \, K(CC).$$

where

$$1 = \frac{\eta_m}{\eta} + \frac{\eta_g}{\eta} + \frac{\eta_p}{\eta}$$

The relative sizes of $\frac{\eta_m}{\eta}$, $\frac{\eta_g}{\eta}$ and $\frac{\eta_p}{\eta}$.

indicates the speculative aspects of asset structures.

An organization which speculates depends upon its ability to sell its private debts to organizations which keep what we have called cash kickers. One primary source of such financing is of course commercial banks, and the composition of commercial banks assets is a prime indicator of the aggregate speculative posture of an economy. However, as commercial bank ability to absorb private debt is limited not only by bank capital but also by reserves supplied by the Central Bank, the aggregate ability of banks to absorb private speculative debt is limited. Thus units willing to speculative finance will seek alternatives to bank financing -- and these alternatives will tend to increase η_p in the holdings of private units.

Once speculative finance exists for private units, the continued viability of these units depends upon the willingness of units to absorb their debts. For this to occur it is necessary for the $K(Q_i)$ to exceed the K(CC), i.e., the units must be solvent. From the above we see two persuasive influences of rising interest rates: one is that rising interest rates will tend to have a greater proportional effect upon $K(Q_i)$ than on K(CC) for speculating units because the Q_i are later than the CC, the second is that rising interest rates increase CC without any associated increase in Q_i.

V. The Limitations Upon a Boom.

During a period of sustained full employment, the parameters that affect the desired cash flow commitments and desired portfolio composition undergo systematic changes which increase the cash flow commitments relative to quasi-rents and increase the ratio of private as against monetary and government debts in the cash positions of units.

Demand for capital assets is financed by a combination of expected flows from income production, the portfolio changes resulting from the K(ΔCC) financing, and the shifts in protfolio preference of asset holders reflected in the rise in $\eta p/\eta$ for a broad set of asset holders. The increased effective demand for capital assets that results increases P_k and the production of investment goods. The increase in P_k becomes capital gains, and the capital gains in portfolios increases the margin of safety available for external finance. The increased production of investment goods leads to increased income above the Patinkin process full employment.

During a period in which P_k is rising, the greater the ratio of debt financing of positions in capital assets the greater the ratio of gain in the value of equity. Thus the initiators or leaders in debt financing do well as full employment is sustained. In particular, the heavier debt financing units among the business organizations will be those who engaged in speculative finance. Inasmuch as speculative finance is successful, and as units which speculatively finance their positions succeed in meeting their financial commitments, units which initially finance their operations in a hedge manner will tip over to a speculative financing technique, and units will increasingly hold their cash assets in the form of private debts.

Thus a period of sustained full employment spills over into a boom. The proportion of units which are speculating increases. An increasing proportion of total cash payment commitments on account of debts require refinancing through evermore sophisticated markets.

One result of the increase in speculative finance is that for a given K(CC) -- for a given nominal face value of debt -- the amount of payments required increases. In order to draw this increased short term finance out of the η K(CC) held by units, the interest rate on short term private debts to private portfolios rise, and along with this the longer term interest rates increase. By the very nature of interest rate payments, the rise in interest rates increases the cash payment commitments. The rise in the longer term interest rates decreases K (Q) relative to K (CC) for speculative units, thereby decreasing the margin of safety in portfolios.

The cumulative effect of a boom leads to ever greater dependence upon speculative finance and to a run up of CC. The basic source of capital values, and of the cash flows to meet payment commitments, the Q_i's are restricted to growing at the rate at which full employment income grows, g, unless the proportion of income that goes to capital increases or the Q's grow in nominal terms because of inflation. We can assume that there is a limit to the extent to which the Q's can grow as a proportion of income. Thus, to sustain a

boom process, inflationary growth in the Q's are required.

As we have generated a process by which the growth of CC depends upon past success, validating past CC commitments by inflation only leads to further growth in CC.

We do not at this stage need to break the inflationary boom. The break occurs when units revalue (1) the desired cash commitments relative to quasi-rents, (2) the extent to which they wish to engage in speculative finance, and (3) the ratio of private to monetary and government debt in their portfolios. This break can be set off by (1) a random bankruptcy, (2) a downturn in income and employment so that the quasi-rents decrease, or (3) the repercussions of a decline in the rate at which banks can add to their holdings of private debt. However, the break or crisis and the debt deflation process are of secondary importance -- the primary instability of capitalist finance in our theory is "upward."

VI. A final Note and a Comment on the Data.

We have set up a framework within which the development of a speculative boom out of sustained full employment can be analysed. The two results are that cash payment commitments will increase relative to the quasi-rents and that the financial assets of banks and the holders of liquidity kickers will show increasing ratios of private debt. Furthermore, the process by which this takes place -- the using of a portion of the initial margin of security and of initial holdings of money in the cash kicker will tend to raise the price of capital assets and the pace of investment. The resulting capital gains and increased income validates and reinforces the speculative thrust. The feedbacks to speculation, once full employment is achieved and sustained, reinforces speculation.

Even though the flow of funds accounts as they stand are quite poor from the perspective of our theory, the data indicate that the destabilizing process of the type we have described has been going on. The ratio of liabilities to corporate gross profits after taxes has increased over the postwar decades, and the "quality" of the assets which make up the cash kicker have decreased. It is clearly evident from the growth of markets such as the commercial paper market that a larger portion of units are engaged in speculative finance. In particular, the postwar period has seen a growth of fringe banks.

Any organized set of data, such as the flow of funds accounts, is a reflection of a theory which defines what is and what is not important. In the flow of funds accounts the emphasis is upon the financing of investment. The argument we have been advancing suggests that the emphasis should shift to the cash commitment constraints which the liability structure imposes. The term to maturity of various classes of debt is an indicator of the cash flows needed; perhaps as a first step, corporate and household debt should be divided by time to maturity in the sectoral balance sheets.

A concept of 'position making' might be introduced for each sector. The position making instrument is that instrument which will be sold (be it an asset or a liability) if the unit requires cash. Changes in the dependence of units or sectors upon financial market rather than quasi-rents for cash needs as stated by liabilities is an indication of trends in the relative stability of the financial system.

What we have done above is introduce a framework for the analysis of the stability of a financial system. Systematic empirical analysis lies in the future. Casual empiricism, based upon simple manipulations of the data in the flow of funds accounts, leads to measures which indicate that the American economy today is substantially more unstable than earlier in the postwar period.

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