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Debt and Macro Stability

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INTRODUCTION

There has been much recent interest in the problem of financial instability in the macro economy. Some researchers have looked for cyclical and secular co-movements between debt accumulation, financial crises, and problems in the real economy. Others have tried to rationalize, in formal models, the apparent connections between finance, changes in expectations, and macro instability. Two different points of view are embodied in this work. One, deriving from the work of Minsky, emphasizes the importance of ignorance and psychology. Firms are seen as financing accumulation on the basis of unverifiable expectations, accumulating debt burdens in the process. When the debt burdens are large enough, the economy becomes vulnerable to downward revisions of expectations. Such revisions reduce effective demand and stimulate financial crises. A second view emphasizes a structural determinant of instability—declining profitability. Problems with profits are viewed as a major cause of debt burdens, and the source of potential financial crisis.

What follows is an attempt to synthesize these two viewpoints into a manageable analytical framework. To set the stage, we begin with a brief review of Minsky's ideas, which have to this point received the greater attention. This is followed by a discussion of the structuralist view and some of the key supporting empirical evidence. Next a Keynes-Kalecki model of growth with debt is constructed. It suggests that in economies where debt finances accumulation, stable and unstable configurations of economic variables coexist simultaneously. The proximity of these regions is shown to depend on expectational and distributional factors. The model therefore introduces a way to characterize financial fragility in terms of stability theory, and shows how structuralist and Minskian ideas complement each other.

RECENT WORK ON FINANCE AND MACRO STABILITY

Minsky (1982) has long worked to develop a theoretical connection between debt and economic fluctuations which is basically Keynesian in spirit. He begins by looking at an economy at the end of a large scale depression. As a consequence of widely experienced economic disaster, existing firms will accept little debt, will prize liquidity, and will make cautious estimates of the potential profits from investment projects. Their rates of accumulation will therefore be low, they will easily meet their debt commitments, and gradually their confidence in the future will rise. Hence, they subsequently will raise estimates of future profitability, accept lower liquidity and higher debt burdens, and increase rates of accumulation. This becomes a self-reinforcing process which proceeds happily until some event disrupts the financial system. Minsky suggests that an increase in interest rates is the usual culprit. In an economy in which the demand for credit is interest inelastic, because of high debt burdens, and credit supply is also inelastic, because of policy or endogenous restrictions, increased interest rates spark a crisis. The difficulty firms have in making debt payments causes them the revalue the wisdom of investments. As investment demand declines, so do profits, which amplifies the problem. The depth of the decline will depend on how indebted

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firms are and how the goverment reacts. If the ultimate downturn is not too severe, it sets the stage for further expansion of debt and larger problems in the future.

Minsky's account is clearly driven by changes in expectations. Those expectations are presumed to be formed in a Keynesian world, in which the future is truly unknown; in which there are no contingent claim markets for all enumerable eventualities; and in which actors have enough experience to know that the future may generate events for which there is no current vocabulary. A neat, partial formulation of the Minsky view has been provided by Taylor and O'Connell (1985). Using a linear dynamic model, and making expected future profitability dependent on the deviation of interest rates from some normal value, they are able to show that changes household liquidity preference—a proxy for confidence in the economy—can switch the model from a stable to an unstable state.

In the Minsky-inspired strand of analysis, variability of income shares is not considered an important part of the story. Recent empirical work suggests this may be a significant omission. There is a long tradition of neo-Marxian research on the cyclical and trend profit squeeze in the U. S. economy (e.g. Boddy and Crotty, 1975; Weisskopf, 1979; Hahnel and Sherman, 1982; Gordon, Weisskopf and Bowles, 1983; Michl, 1987). Recently Wolfson (1986) made a very detailed study of financial crises in the post-war U. S. economy, using NBER business cycle dating techniques. He observed (Wolfson, 1986. pp. 145-6) a regular relationship between changes in the profit share and financial crisis:

> In every crisis period, a particular timing relationship has—with only one exception—occurred. Peaks have been reached in profit and investment variables for the nonfinancial corporate sector, in relation to the financial crisis, in the following order: (1) the profit [share], (2) new contracts and orders for plant and equipment (in constant dollars), (3) investment and plant and equipment (in constant dollars), (4) the financial crisis and (5) the financing gap [that is, the difference between capital expenditures and internal funds]. (materials in brackets added)

He concludes:

> . . . the financing gap increased in periods immediately preceding financial crises not only because investment spending increased, but also because internal funds declined. The failure of internal funds to maintain their rate of growth, in fact their tendency to decline, resulted in an increasing financing gap . . . a decline in profits occurring near the peak of the expansion generally has been responsible for this decrease in internal funds . . . it was the decline in profits that resulted in the corporations having difficulty in meeting their fixed payment committments—due to involuntary plant and equipment investment as well as debt.

Robert Pollin has looked at competing hypotheses which explain the rising corporate debt in the post-war period. He concludes (1986, p. 227) that the increase is a function of declining profitability and competitive pressure:

> The overall results of the econometric test and other statistical evidence point to one central conclusion: the trend decline in the corporate profit level and rate over phase two, 1967–80, provides the primary explanation for the rise of corporate debt dependency over that period. . . . With internal funds down, corporations were forced to borrow to an increasing extent in order to maintain a competitive level of spending and support their markets through trade credit extensions.

The model developed in the subsequent section incorporates ideas from Minsky and from those who emphasize profitability. It will be used to show why an economy with debt can have stable and unstable regions, and how changes in expectational and structural factors may affect the proximity of those regions.

A MODEL OF ACCUMULATION WITH DEBT

To keep life simple, we will begin with a closed economy in which aggregate demand, composed of investment and consumption, determines the rate of output. Goods markets will be assumed to clear immediately, and money prices will be assumed fixed. To determine flows of output we need an investment function. This is always a difficulty for anyone constructing a Keynesian-Kaleckian macro model. If the world is really characterized by ungrounded expectations, how does one represent accumulation as a function? Perhaps the best we can do is suggest that long term expectations are given, but within the constraint of those expectations, some functional relationships obtain. One common sense relationship might be that capacity utilization below a minimally acceptable level will exert downward pressure on accumulation. On the other hand, in a world of genuine uncertainty, it may make sense to grow with the market, even if capacity utilization is not total. Another sensible step is to carry over some of the insights of Kalecki, which have reappeared in the so-called "New Keynesian" literature on finance constraints and accumulation (e.g. Fazzari et al., 1988). One begins with the not too startling assumption that capital markets are not perfect. Lenders have difficulty evaluating investment projects, and have agent problems in monitoring and assessing outcomes. Hence firms may be forced to wait for self-finance to support viable projects, and lenders may use cash-flow or indebtedness measures to evaluate suitability of borrowers. Also, as Kalecki suggests, firms may have a definite aversion to bankruptcy risk, and thus restrict their use of finance as cash-flow declines or debt rises. Hence, even when the cheshire cat smile of capitalists' expectations is firmly in place, variations in debt or cash-flow will alter the rate of accumulation. This view will be represented by writing the desired rate of capital accumulation, g^d, as

$$g^d = \alpha(Y/K - \epsilon) + \beta\pi - \gamma rd \quad \alpha, \epsilon, \beta, \gamma > 0, \gamma > \beta \tag{1}$$

where Y is real output, K is real capital stock, π is the flow of profits divided by the capital stock, r is the rate of interest, and d is the ratio of firm debt to capital stock. This functional form is self-explanatory, with the exception of the differing parameters β and γ. This allows positive cash flows to have a negative effect on desired accumulation, which makes sense if dividends are to be paid to stockholders and principal is to be retired. A larger relative value of γ would indicate a more cautious mood on the part of capitalists.

Since there are acknowledged lags between order and construction in the capital goods sector, we will assume that the rate of accumulation, $g = \dot{K}/K$, moves according to

$$\dot{g} = \lambda(g^d - g - \eta g^2), \quad \lambda > 0, \eta > 0 \tag{2}$$

This is a standard partial adjustment model with one innovation.[1] The value of η reflects the capacity limits of the economy. If $g^d - g > 0$ and g is not so large that capacity is strained, then $\dot{g} > 0$. However, upward movements in g will be self-limiting, since large enough values of g will produce negative values for $\dot{g}$.[2] Given this relationship, we turn our attention next to the determination of the debt burden in this economy. It will be assumed that borrowing takes place only to finance capital accumulation or make interest payments which cannot be covered by retained earnings. Thus we have the relationship

$$\dot{D} = rD + I - \theta\Pi \tag{3}$$

where D is the real value of debt, I is investment, $1 \geq \theta \geq 0$ is the corporate retention ratio, and Π is the real value of profits. If corporate retained earnings always exceed investment expenditures, there will be no debt. Defining $d = D/K$, we have the identity

$$\dot{d} = \dot{D}/K - dg \tag{4}$$

and substitution of (3) into (4) gives

$$\dot{d} = rd - \theta\pi + g - dg \tag{5}$$

The dynamical system given by (2) and (5) is the one which will be used to analyze the ideas on finance and stability which were discussed in the previous section. This will be done in a series of cases, which make different assumptions about income distribution, aggregate demand, and the determination of the interest rate.

Case 1: Keynesian savings, interest rate and income shares fixed

As a first case consider an economy in which savings is proportional to income, and in which labor's share of income is taken to be determined exogenously by the relative power of workers and capitalists.

Then capacity utilization is given by

(6) $$Y/K = g/s, \quad 1 > s > 0$$

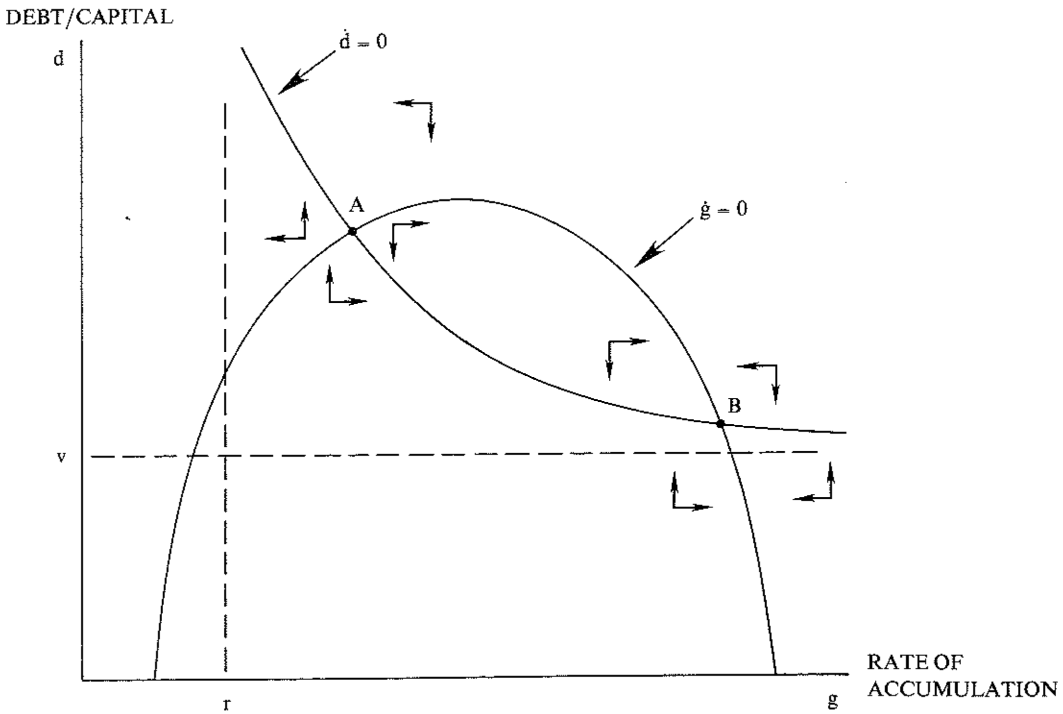
where s is the constant savings propensity. The rate of profit is

(7) $$\pi = (1 - \omega)g/s$$

where ω is labor's share. The rate of interest will be taken as fixed. Now this assumption may not be as strong as it seems. Unless one believes that the central bank can drive the long term rate of interest to zero, which would imply unlimited funds for every borrower and a very lenient capitalist system indeed, then it is likely that there is minimum rate of interest on debt used to finance accumulation. So long as there is, the following argument will go through. Expressions (6) and (7) can be substituted into (2) and (5) to obtain the corresponding dynamical system. Assuming $\phi = [(\alpha + \beta(1 - \omega))/s] - 1 > 0$, which is necessary for g ever to be positive, and $v = 1 - [\theta(1 - \omega)/s] > 0$, which is necessary to explain the existence of debt, we can write the dynamical system as

(8) $$\begin{aligned} \dot{g} &= \phi g - \gamma rd - \eta g^2 - \alpha\epsilon \\ \dot{d} &= rd + vg - dg \end{aligned}$$

where coefficients are implicitly redefined to account for the value of λ. The dynamics of (8) can be represented by the phase diagram given in Figure 1. Assuming that (8) has two solutions, they will correspond to critical points A and B in the diagram.



$\dot{d} = 0$ isocline: $d = \dfrac{vq}{g - r}$

$\dot{g} = 0$ isocline: $d = (\phi g - ng^2 - \alpha\epsilon)/\gamma r$

Figure 1.

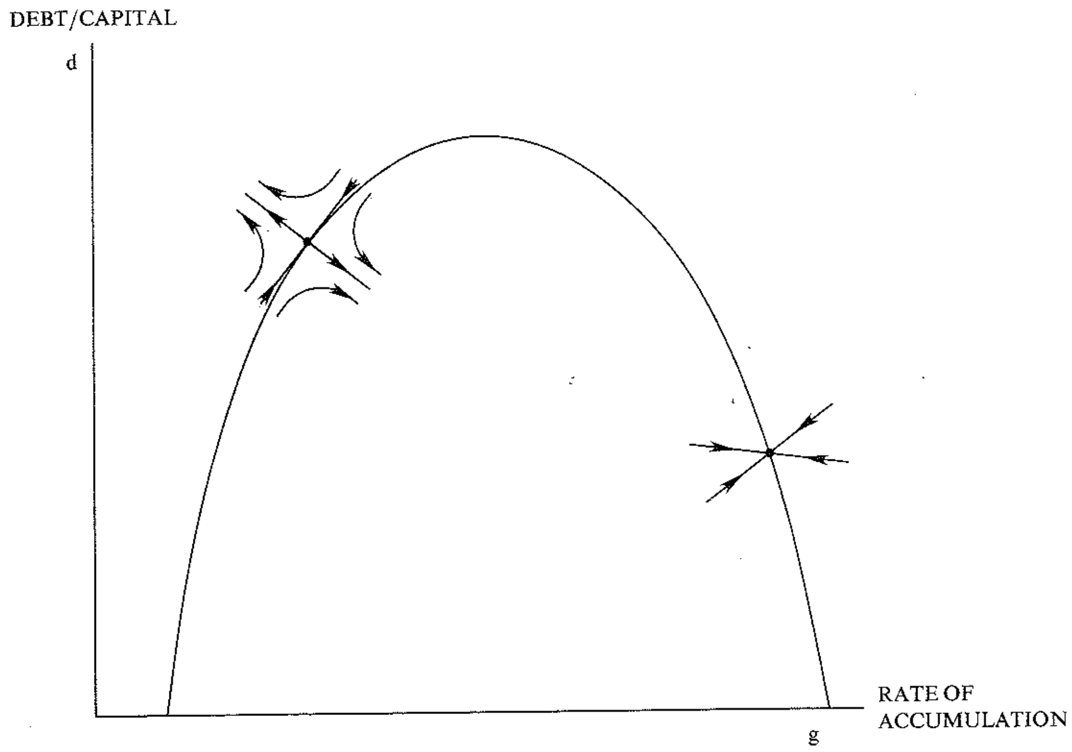


Figure 2.

The motion around these points is indicated in Figure 2, which can be derived from consideration of the vectors of motion given in Figure 1. Clearly point A, with a lower rate of growth and higher debt capital ratio, is locally a saddle point; while B is locally stable.[3] Their juxtaposition suggests the following intuitions about this model economy: Near point B, the economy will respond to small enough shocks by converging to point B. This might be taken to represent non-explosive business cycle behavior. Larger shocks, however, might move the economy so far to the northwest that it would begin to experience self-amplifying difficulties. Growth rates would decline and debt burdens would increase. That is, a financial crisis would develop.

Consider now the effects of a change in the distribution of income. An increase in labor's share would decrease profitability at every rate of accumulation, thus shifting the $\dot{g} = 0$ isocline downward. Similarly, the decline in profitability would shift the $\dot{d} = 0$ isocline upward, reflecting the fact that for any rate of accumulation, more external finance would be required. The net effect of these changes, illustrated in Figure 3, is to move the stable point and the equilibrium points closer together. A shock which previously generated local oscillations around the stable point is now capable of causing a financial crisis. Thus declining profitability makes the economy, in a measurable way, more fragile.[4]

It is also possible to examine how changes in the attitudes of capitalists and in financial market conditions affect the fragility of this economy. A deterioration in long range period expectations might be represented by an increase in the coefficient γ. This would shift the $\dot{g} = 0$ locus downward, moving the equilibria closer together and increasing fragility. An increase in the interest rate would shift the $\dot{g} = 0$ locus upward, while shifting the $\dot{d} = 0$ locus downward. This would also increase fragility. Shifts of these sorts would represent the kind of changes suggested by Minsky. However, the model indicates that fragility can exist without the shifts, and that changes in profitability can induce greater fragility without changes in expectations or changes in financial market conditions.

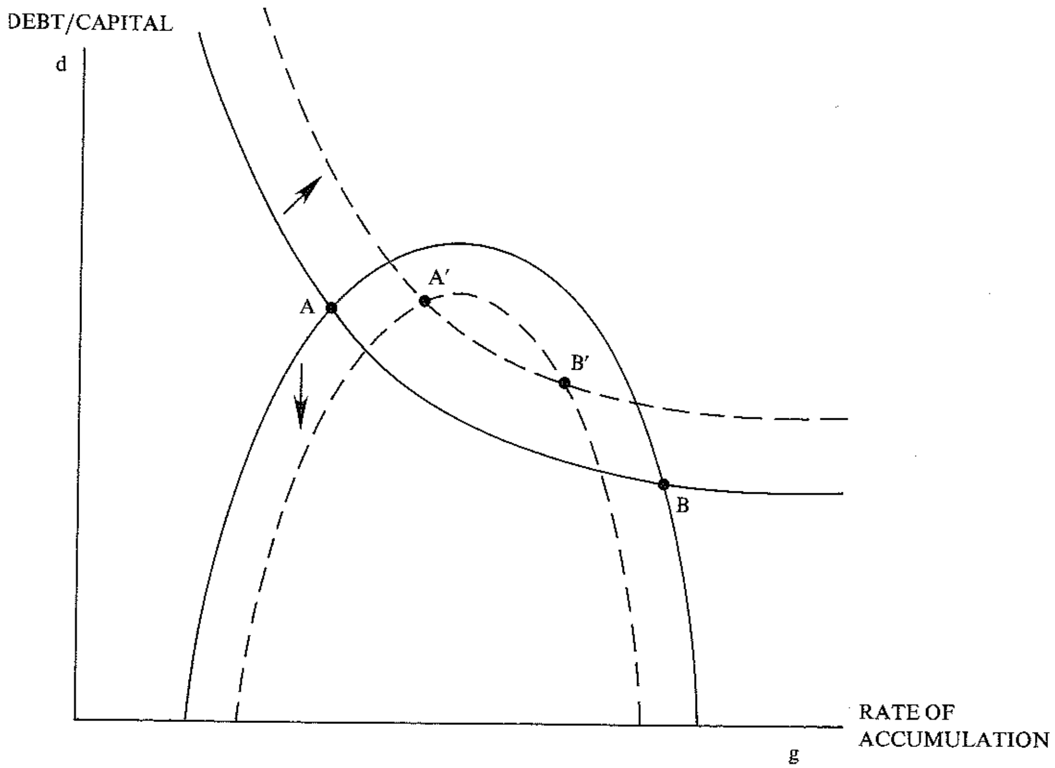


Figure 3.

Case 2: Keynesian savings, income shares fixed, interest rate variable

It is reasonable to consider in more detail whether the coexistence of stable and unstable regimes depends on the fixed interest rate assumption or on ignoring the ability of government expenditures to keep capacity utilization at some non-negative level. Clearly the ability of government to maintain aggregate demand is not, by itself, sufficient to eliminate instability. To see this, let us assume that the government tax-finances an expenditure proportional to the capital stock of t. Then $Y/K = t + g/s$ and the d intercept of $\dot{g} = 0$ isocline is a positive value. However, this does not change the qualitative dynamics of the economy. Then what about a variable interest rate, together with aggregate demand help from the government? To make the rate of interest responsive to levels of demand, write a Keynesian market clearing function for an exogenously given stock of money, M, as

(9) $$r = \zeta(Y/M), \quad \zeta > 0$$

This assumes an interest sensitive transactions demand for money only. If central bank policy is represented by $M = mK$, $m > 0$, the bank can drive the interest rate up or down depending on how m changes. Then (9) can be rewritten as

(10) $$r = \sigma(g/s + t), \quad \sigma = \zeta/m > 0$$

In this case, unless m is infinite, a somewhat unlikely bank policy, the rate of interest is not zero. Substitution of (10) into (8) will leave the dynamics unchanged.

Case 3: Kaldorian savings, income shares variable, interest rate fixed

As a final exercise, let us consider a case in which profitability is related to utilization in a more complex manner. The profit rate will be assumed to vary according to

(11) $$\pi = F(Y/K), \quad \begin{array}{l} F' > 0, (Y/K)^* > Y/K \\ F' = 0, (Y/K)^* = Y/K \\ F' < 0, (Y/K)^* < Y/K \end{array}$$

That is, profit rates are a one-humped function of capacity, with the slope changing from positive to negative at some value of the utilization rate $(Y/K)^*$. A relationship such as this is derived and investigated empirically in the work of Bowles et al. (1989), and is consistent with the empirical work on profitability over the business cycle. Assuming a Kaldorian consumption function, utilization will be given by

(12) $$Y/K = Cg - D\pi \quad C, D > 0$$

where c_ω is the fraction of wages consumed, c_π is the fraction of profits consumed, $1 > c_\omega > c_\pi \geq 0$, $C = 1/(1 - c_\omega)$, $D = (c_\omega - c_\pi)/(1 - c_\omega)$. These two relationships are represented in Figure 4.[5] It is clear from this figure that capacity utilization will increase with accumulation, but the profit rate will increase and then decrease. Hence the solution to (11) and (12) will be represented for expository purposes as

(13) $$\pi = \mu_1 g - \mu_2 g^2, \quad \mu_1, \mu_2 > 0$$

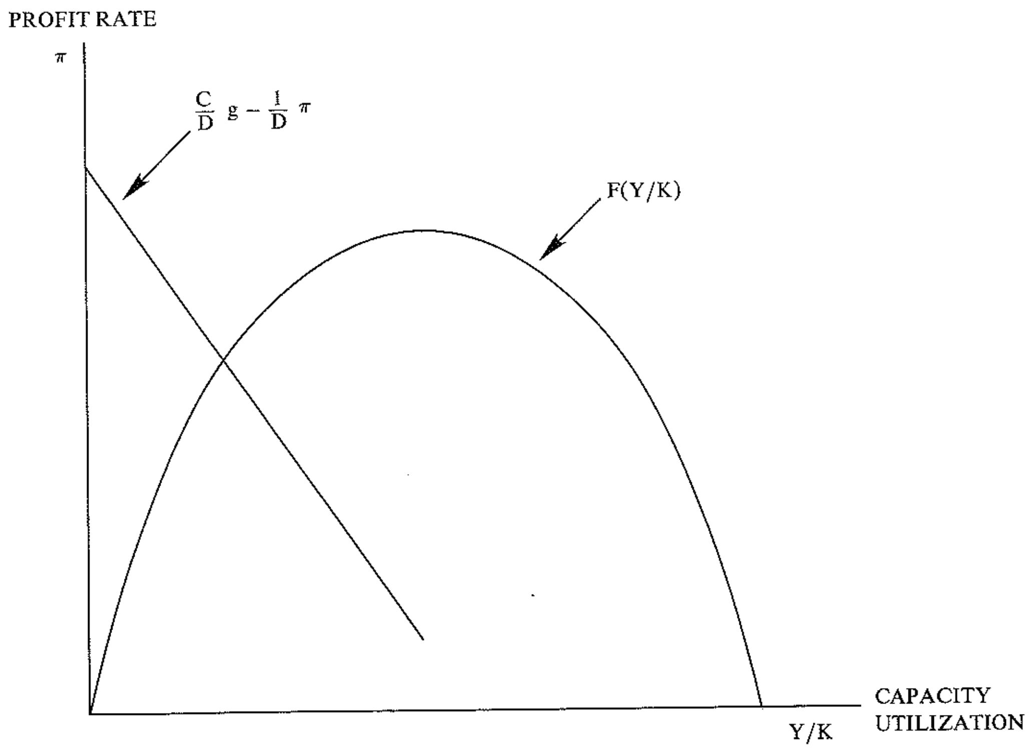


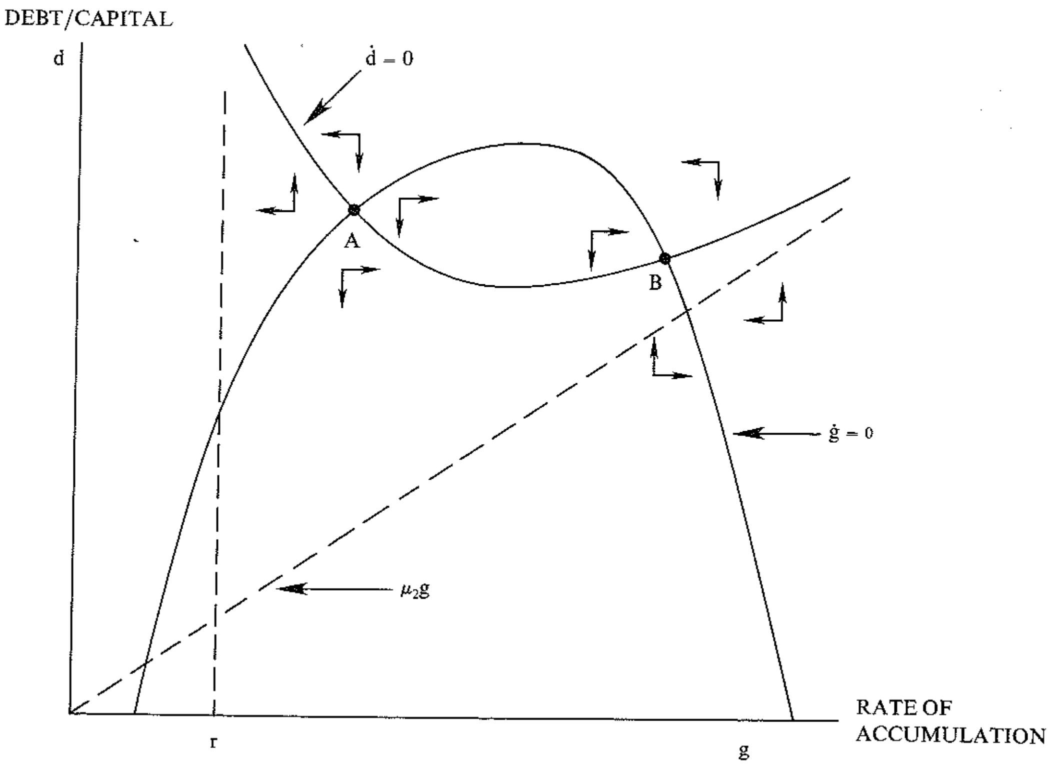
Figure 4.

where $(C - D\mu_1) > 0$. Substitution of (12) and (13) into (2) and (5) gives a dynamical system of the form

$$\text{(14)} \qquad \begin{aligned} \dot{g} &= -\alpha\epsilon + \psi g - \gamma r d - \tau g^2 \\ \dot{d} &= rd + (1 - \theta\mu_1) + \theta\mu_2 g^2 - dg \end{aligned}$$

where $\psi = \alpha C + (\beta - \alpha D)\mu_1$ and $\tau = (\beta - \alpha D)\mu_2$. The sign of τ will turn on the sign of $(\beta - \alpha D)$. A positive value for $(\beta - \alpha D)$ can be read to indicate that, in the determination of desired rates of captial accumulation, the negative effects of increased profitability on utilization are outweighed by the positive effects of increased cash flow. Since this fits the view of investment behind (1), it will be assumed that $(\beta - \alpha D)$ is positive in what follows. In (14) the capacity constraint is ignored and the coefficient η, from equation (5), has been set to zero. Thus the dynamics of (14), unlike those of (8) examined in the previous cases, do not depend on a capacity constraint.

System (14) is represented in the phase diagram of Figure 5 under the assumption that $(1 - \theta\mu_1) \geq 0$. In this case, there are now stable and unstable points. (If the term $(1 - \theta\mu_1)$ is less than zero there will be only an unstable point.) In this system, changes in expectational factors have the same effects on the proximity of the stable and unstable points as in (8). And a decrease in the potential profits at any rate of capacity utilization, which would be represented by a decrease in the parameter μ_1 or an increase in the parameter μ_2 will shift the $\dot{g} = 0$ locus down and the $\dot{d} = 0$ locus up, thereby making this system more fragile. Thus changes in potential profits can have, under certain conditions, the same effects in all three systems.



$\dot{d} = 0$ isocline: $d = ((1 - \phi\mu_1)g + \mu_2 g^2)/(g - r)$

$\dot{g} = 0$ isocline: $d = (\psi g - \tau g^2 - \alpha\epsilon)/\delta r$

Figure 5.

CONCLUSION

The model developed in the previous section provides a tractable framework for examining the connection of debt to macroeconomic stability. It shows that, under a variety of assumptions common to the Keynes-Kalecki tradition, an economy will have both stable and unstable regions. For some combinations of growth rate and debt burden, an economy will be stable. Shocks of a reasonable size may cause oscillations, but the economy will tend toward acceptable values. For other growth rate-debt burden combinations—generally for lower growth rates and higher debt burdens—the system will be unstable. The closer these regions, the more vulnerable is the system to shocks which move it away from the locally stable region.

The model therefore has the virture of providing a definition of financial fragility in terms of stability theory. The closer the stable and unstable basins, the more financially fragile is the system. Moreover, since proximity is determined by expectational, distributional, and interest rate factors, the model argues for a multivariate analysis of the causes of any financial crisis.

NOTES

1. Partial adjustment models are discussed in many places, e.g. Gandolfo (1980, pp. 235, 258)
2. In this case the maximum value for g is determined by setting $\dot{g} = r = 0$ and the rate of profit at its global maximum, and solving what will turn out to be—once functional values for Y/K and π are introduced—a quadratic in g. Note that while the upper limit to the growth rate is set here by capacity, accumulation may reach a limit before any capacity constraint is reached. An example is discussed below as case 3.
3. While the stability properties can be deducted from the phase diagram, they can be easily established algebraically in a particular case. Note that for the dynamical system (8), which has a $\dot{g} = 0$ isocline given by $d = (\phi - \eta g^2 - \epsilon)/\beta r$, the slope of the $\dot{g} = 0$ isocline is given by $\phi - 2\eta g$. To the left of $g = \phi/2\eta$ the slope is positive, and to the right it is negative. Note also that $d > v$ when $\dot{d} = 0$. Now the stability of a fixed point like A or B can be derived from the Jacobian matrix

$$J = \begin{bmatrix} \partial\dot{g}/\partial g & \partial\dot{g}/\partial d \\ \partial\dot{d}/\partial g & \partial\dot{d}/\partial d \end{bmatrix}$$

evaluated at the fixed point (Arrowsmith and Place, pp. 85–6). When $Det(J) > 0$ and $Tr(J) < 0$, the point is stable. When $Det(J) <$ it is a saddle. Taking the derivatives of (8) gives the Jacobian

$$J = \begin{bmatrix} \phi - 2\eta g^* & -\gamma r \\ v - d^* & r - g^* \end{bmatrix}$$

where d^* and g^* are the equilibrium values of d and g.

Now $Det(J) = (\phi - 2\eta g)(r - g) + \gamma r(v - d)$. Substituting and rearranging gives $Det(J) = g(2\eta g - \eta r - \phi) + r\epsilon$. Hence $Det(J) > 0$ if $g > ((\phi + \eta r)/2\eta)$. In the case where $\epsilon = 0$, (8) can be solved for g to give an equilibrium $g^* = \{-(\phi + \eta r) \pm [(\phi + \eta r)^2 - 4\eta r(\phi + v\gamma)]^{1/2}\}/(-2\eta)$. If g^* is to have two positive solutions, then it will be the case that the larger value of g^* will be greater than $(\phi + \eta r)/2\eta$. The smaller value of g^* will be less than this value. Hence A will be a saddle point, while B will be a stable point. For cases in which $\epsilon \neq 0$, direct solutions for g require solving a cubic equation. Hence we are content with the qualitative analysis of the phase diagrams. Note that in Figure 2 there are no oscillations in the convergence to B. However, for the isoclines of Figure 5, it may be possible that trajectories oscillate while converging.
4. Of course this is a *ceteris paribus* analysis, and decreasing profitability might, for example, cause firms to raise their retention rate, thereby generating offsetting tendencies. This may not always be possible, of course, if firm owners need to consume from profits. Moreover, the retention ratio cannot exceed 1, while if the wage share is large enough, borrowing will be necessary.
5. This graphical framework was suggested in an informal presentation by David Gordon of the theory underlying his recent econometric work. However, the inclusion of debt, the analysis of dynamics and the conclusions are things for which he cannot be implicated.

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