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DEVELOPING ECONOMY CYCLES
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Developing Economy Cycles

by Lance Taylor*

The topic of business cycles in economics is ancient, but rarely addressed in the context of developing or transition economies. To a degree, the absence of theory fits the reality. Although they are buffeted by frequent and at times substantial macroeconomic disturbances, non-industrialized economies often do not seem to generate their own endogenous fluctuations. But cyclical phenomena do still appear. For example, devaluation/appreciation cycles, oscillating capital inflows and outflows, and investment/excess capacity swings have occurred in many countries over the years. After a memory-refreshing glance at Richard Goodwin's (1967) predator-prey growth cycle, this paper sets out simple formal models of the three kinds of cycles just mentioned (the essentials have appeared previously in the literature) and points out policies that might be used to dampen the fluctuations, or even put them to better use.

1. Preliminaries

The formal specifications presented here all boil down to sets of two differential equations with a similar mathematical form. Consider the Jacobian J of the two equations evaluated at a stationary point:

$$J = \begin{bmatrix} j_{11} & j_{12} \\ j_{21} & j_{22} \end{bmatrix} \qquad , \tag{1}$$

with $TrJ = j_{11} + j_{22}$ and $DetJ = j_{11}j_{22} - j_{12}j_{21}$. We will be considering systems in which the first variable has stable own dynamics, $j_{11} < 0$, while the second feeds back positively into itself,

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$j_{22} > 0$, creating a potential instability. If the system is to avoid a saddlepoint with $DetJ < 0$ and instead generate cycles, it has to be damped by oppositely signed off-diagonal entries, i.e. $j_{12}j_{21} < 0$. That is, an increase in the second variable sets off a response in the first that drives the second back down.

If the damping is strong enough, the differential equations will generate a convergent spiral around the stationary point in a two-dimensional phase diagram. Continuing exogenous "shocks" would be required to keep the damped cycle going over time. The spiral may also tend toward a "limit cycle" approaching a "closed orbit," or else it may diverge. In the following discussion, we will not be greatly concerned with which of these possible outcomes happens. To find out, one has to resort to relatively sophisticated mathematics which would take too much time to develop here.[1] Rather, the emphasis will be on describing economic mechanisms that can make the potentially destabilizing positive value of j_{22} and damping through j_{21} and j_{12} show up in the first place.

The Goodwin model is a simplified version of this set-up, based on distributive conflict between capitalists and workers. The workers, as it turns out, are economic predators, with output and employment as their prey. The model assumes full utilization of capital and savings-determined investment (Taylor, forthcoming, shows how such un-Keynesian hypotheses can easily be relaxed). Let $K = \kappa X$, with κ as a "technologically determined" capital/output ratio. The employed labor force is $L = bX$. If N is the total population, then the employment ratio λ is given by $\lambda = L/N = b(K/\kappa)/N$. The growth rate of N is n. The wage share is ψ, and if all profits are saved and depreciation ignored, the growth rate g of the capital stock becomes $g = (1-\psi)X/K = (1-\psi)/\kappa$.

Over time, the evolution of the employment ratio is determined by growth in output and population,

$$\dot{\lambda} = \lambda(g-n) = \lambda\{[(1-\psi)/\kappa]-n\} \qquad , \tag{2}$$

with $\dot{\lambda} = d\lambda / dt$. Along Phillips curve lines, the wage share is assumed to rise in response to the employment ratio,

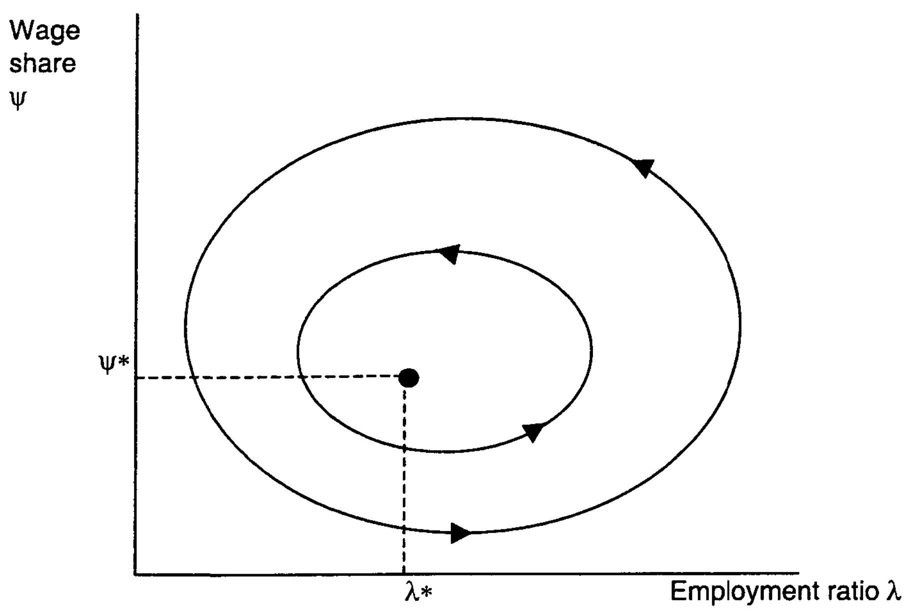
$$\dot{\psi} = \psi(-A + B\lambda) \qquad . \tag{3}$$

At a stationary point where $\dot{\lambda} = \dot{\psi} = 0$, the Jacobian of (2)-(3) takes the rather extreme form,

$$J = \begin{bmatrix} 0 & -\lambda / \kappa \\ B\psi & 0 \end{bmatrix} \qquad .$$

The two variables basically damp fluctuations in one another, with no dynamics of their own. Hirsch and Smale (1974, p.262) show that with zeros along the diagonal of the Jacobian, λ and ψ chase each other endlessly around a counter-clockwise closed orbit in the (λ, ψ) plane which encircles the stationary point (λ^*, ψ^*). See Figure 1, in which the particular orbit that the variables trace is set by initial conditions. The labor share is the predator since it rises with λ. The employment ratio, in turn, is the prey since a higher value of ψ squeezes profits and cuts back accumulation and growth.

Figure 1: Closed orbit in the Goodwin model



2. A Contractionary Devaluation Cycle

The real wage or wage share is by no means the only object of distributional conflict. In part because it affects the real wage, the real exchange rate $z = e / P$ often is a bone of contention (e stands for the nominal exchange rate and P the national price level). Its movements can set off cycles, especially when real devaluation has contractionary effects on output, apparently the case historically in many developing countries. With a lag, devaluation may lead to an export push, followed by wage increases that cut back on exports and ultimately demand and real wages themselves. Following Larrain and Sachs (1986) it is easy to model such interactions over time.

Let $\varepsilon = E / K$ be the export/capital ratio. A lagged response of ε to changes in z is a realistic assumption,

$$\dot{\varepsilon} = \alpha[\varepsilon^*(z) - \varepsilon] \tag{4}$$

in which $\varepsilon^*(z)$ is the "long run" export level corresponding to a given value of z. Because of pre-existing contracts, the need to search for new foreign outlets, and so on, exports do not immediately respond to price signals. Rather, their foreign currency value ε / e is likely to follow a "J-curve" as a function of time. After a nominal devaluation, ε / e first drops as e jumps up, and then gradually rises according to (4).

It is convenient to gauge economic activity by the output/capital ratio $u = X / K$. Suppose that the money wage rate w changes according to a simple Phillips curve,

$$\dot{w} = \beta b w(u - \bar{u})$$

in which β is a response coefficient, b the labor/output ratio and $\bar{u}$ a long-term level of the output/capital ratio.[2] From this equation, higher activity will make money wages begin to rise. Suppose that the price level is set as a mark-up over labor and import costs, $P = (1 + \tau)(wb + ea)$, in which a is the import/output ratio. Then $\dot{w} > 0$ means that the real exchange rate will start to appreciate (move downward), leading export expansion to slow.

One can show that real exchange rate dynamics are given by

$$\dot{z} = z(1 - \phi)[\hat{e} - \beta b(u - \bar{u})] \tag{5}$$

in which $\phi = ea/(ea+wb)$ is the share of imports in variable costs, and $\hat{e} = \dot{e}/e$ is an exogenous growth rate of the spot exchange rate. If devaluation is contractionary, an increase in z pushes u down, making $\partial \dot{z}/\partial z > 0$ and creating a potential instability.

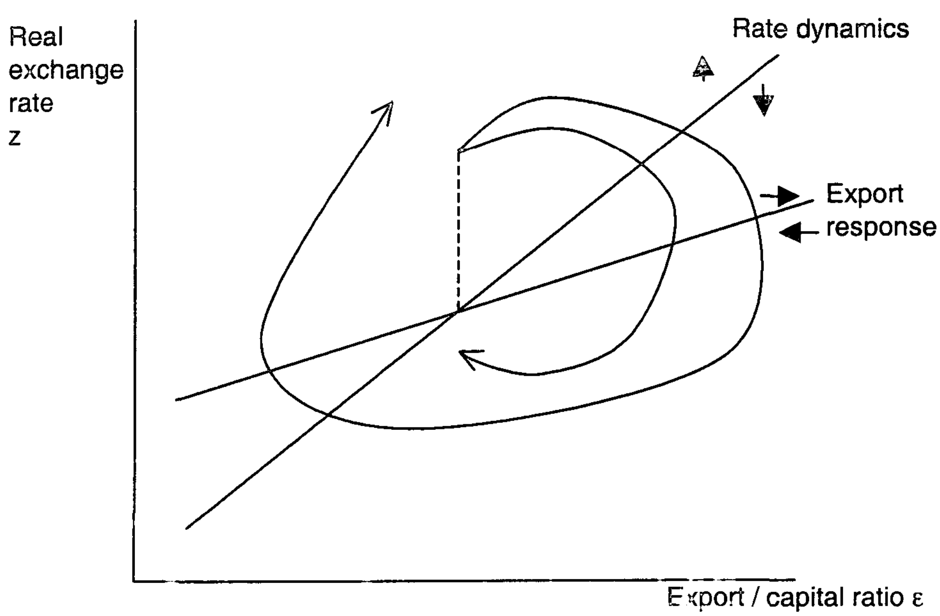
Around a steady state with $\dot{\varepsilon} = \dot{z} = 0$ with positive ε and z, the signs of the entries in the Jacobian of (4) and (5) are as follows:

	ε	z
$\dot{\varepsilon}$	-	+
$\dot{z}$	-	+

The off-diagonal terms have offsetting signs and can stabilize the system. In contrast to the Goodwin model, it is now the "prey" variable z with unstable own-dynamics - instead of rapidly reproducing wage-share foxes, think of real exchange rate rabbits.

Figure 2 illustrates the resulting cycles. The "Export response" curve corresponds to $\dot{\varepsilon} = 0$ and the "Rate dynamics" to $\dot{z} = 0$. Starting from an initial equilibrium, a maxi-devaluation followed by an exchange rate freeze displaces the real rate upwards. There is further depreciation until a trajectory crosses the Rate dynamics schedule. Due to the lag in the export

Figure 2: Contractionary devaluation cycles



response, ε keeps growing until the spiral crosses that curve. A downswing follows, setting off a clockwise spiral with oscillating exports and real exchange rate (not to mention output and inflation), or else cyclical divergence. A closed orbit would be an intermediate case.

An alternative policy could involve a steady depreciation at a rate $\hat{e}$. Via (5), this would shift the Rate dynamics schedule to the right, leading to a long-term export gain but a lower real wage. If higher profits and more exports stimulated technical advance, the economy could jump to a higher growth path. Amsden (1989) suggests that elements of such a strategy contributed to the South Korean export miracle around the three-quarter mark of the 20th century.

3. A Developing Country Debt Cycle

The instability in (5) is due to interactions between the real wage and effective demand. Another story can be built around capital movements and "confidence" in the home country's ability to manage its external debt. Such effects have been important in the debt cycles observed in many developing countries in the 1990s. A simple formal model emphasizing short- to medium-term dynamics follows, drawing heavily on ideas proposed by Frenkel (1983) and Neftci (2001).

We can begin by stating the familiar "uncovered interest rate parity" (or UIP) equation relating home and foreign interest rates and exchange rate expectations in the form

$$i = i^* + (\varepsilon / e) + \sigma \qquad . \tag{6}$$

The new symbols include i for the home interest rate and i^* for the foreign. It is assumed that there is a "credible" forecast ε (redefined from last section) of the expected instantaneous change in the nominal rate e, perhaps based on a crawling peg being pursued by the central bank. But even taking that into account, there is an observed "spread" between the home and foreign interest rates, with the former being substantially (as much as 1000 or 1500 basis points) higher. In effect, at least some market participants believe that there is a possibility of a large devaluation at some future time, and thereby insist on a return far exceeding $i^* + (\varepsilon / e)$ if they are to hold home's securities. The magnitude of the spread is measured by σ, and its dynamics have been crucial in observed crises. Falling well short of the drama of the real world, a simple example is presented below, based on the potentially unstable dynamics of foreign investor "confidence" in the home exchange rate.

A Post Keynesian wrinkle is that (6) can be interpreted as fixing (at least a floor under) the home interest rate on loans. That is, on the right-hand side of (6) the total cost of funds for a firm borrowing abroad to finance a project at home will be foreign rate + expected cost from depreciation + spread. Lending rates at home are unlikely to fall below this sum. But with (6) setting i, the home supplies of credit and money will have to be endogenous along Post Keynesian lines. We forego the analytical details here.

To set up equations for foreign borrowing, we can begin be letting Ω and Ω^* stand for home and foreign private sector wealth respectively. Let T and T^* be the stocks of bonds ("T-bills") issued by the two countries' governments, and qPK and $q^*P^*K^*$ be the asset values of their capital stocks (q and q^* are "valuation ratios" or levels of "Tobin's q"). Then total world wealth is $\Omega + e\Omega^* = (qPK + T) + e(q^*P^*K^* + T^*)$. Expressions for the two countries' individual levels of wealth will be presented momentarily.

With regard to foreign borrowing, assume that home private sector holds no foreign assets (we thus ignore interesting issues of "dollarization" and "capital flight") and that the foreign country does not bother to hold home's securities as reserves. Home's net foreign assets N then become

$$N = eR^* - T_f \quad ,$$

with eR^* as the domestic value of home's international reserves R^* and T_f as foreign private sector holdings of the home country's bonds. If bond markets clear and both countries satisfy their balance sheets, it is easy to show that $\Omega = qPK + T + N$ and $\Omega^* = q^*P^*K^* + T^* - N/e$. Let η^* be the share of the foreign private sector's portfolio assigned to home bonds, or

$$T_f = e\eta^*\Omega^* = e\eta^*(q^*P^*K^* + T^* - N/e) . \tag{7}$$

We concentrate on the dynamics of home's external debt T_f and reserves eR^*. The coefficient η^* in (7) will be determined in temporary equilibrium by the interest rates, expected rate of depreciation, and the spread, so to see what happens to T_f over time, we can just examine the behavior of the equation $\dot{T}_f = e\eta^* \dot{\Omega}^*$. Substituting through the relevant income/expenditure and flows of funds relationships gives

$$\dot{T}_f = \eta^*[eA^* + (eP^*auK - Pa^*u^*K^*) + iT_f] \tag{8}$$

with

$$A^* = (q^*g^* + \gamma^*)P^*K^*$$

and u and u^* as the output/capital ratios in the two countries.

The term eA^* represents the increase in demand for home's T-bills induced by growth in foreign wealth (with q^* as the foreign country's asset valuation ratio, g^* its capital stock growth rate, and γ^* its primary fiscal deficit as a share of the value of the capital stock P^*K^*). The term ($eP^*auK - Pa^*u^*K^*$) in (8) is the home trade deficit which must be financed by external borrowing and the last term iT_f shows that the home country is pursuing Ponzi finance in the sense that is running up more external debt to meet existing interest obligations.

The change in home's foreign reserves (ignoring its interest receipts ei^*R^* as being trivial) is

$$e\dot{R}^* = \dot{T}_f - (eP^*auK - Pa^*u^*K^*) - iT_f \quad ,$$

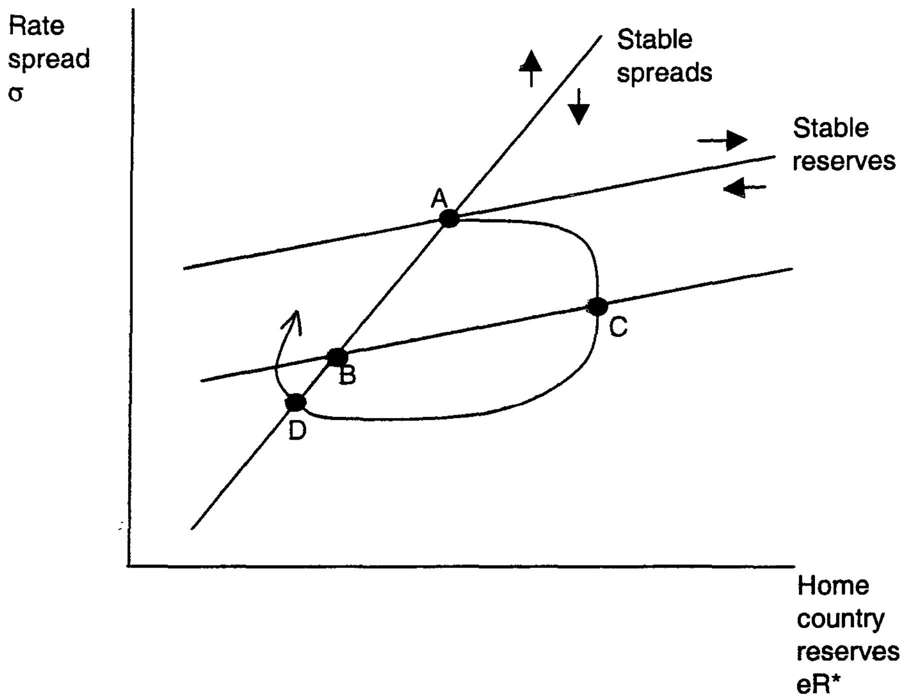
or flow capital inflows minus the trade deficit and interest payments abroad. Substituting (8) into this expression shows that

$$e\dot{R}^* = e\eta^*A^* - (1-\eta^*)[(eP^*auK - Pa^*u^*K^*) + iT_f] \quad . \tag{9}$$

So reserves grow faster with "autonomous" capital inflows $e\eta^*A^*$, and otherwise are eroded by the trade deficit and interest payments (with the term $1-\eta^*$ taking spill-overs into growth of foreign wealth into consideration).

Reserve increases are likely to lead to expansion of money and credit. Both economic activity u and the trade deficit ($eP^*auK - Pa^*u^*K^*$) should rise, reducing the growth of reserves: $\partial(e\dot{R}^*)/\partial(eR^*) < 0$ in (9). A higher rate spread σ will push up the interest rate i from (6). The cost of external debt service iT_f will increase but the trade deficit is likely to fall. We assume the latter effect dominates, so $\partial(e\dot{R}^*)/\partial\sigma > 0$. The "Stable reserves" schedule in Figure 3 corresponds to the condition $e\dot{R}^* = 0$. Suppose that η^* increases in a foreign portfolio shift toward home bonds. Since in (9) we have $\partial(e\dot{R}^*)/\partial(eR^*) < 0$, eR^* would have to rise to hold $e\dot{R}^* = 0$, i.e. the Stable reserves schedule shifts outward.

Figure 3: Cyclical adjustment of reserves and the rate spread to a shift in foreign portfolio preferences toward home bonds



Turning to the evolution of the spread over time, it is likely that higher reserves reduce anxiety in forward markets, so that $\partial\dot{\sigma}/\partial(eR^*) < 0$. On the other hand, there may be positive feedback of expectational changes into themselves, $\partial\dot{\sigma}/\partial\sigma > 0$, as a fall in the spread induces less perceived risk to holding home securities (and a rise creates greater preoccupations). We get the differential equation

$$\dot{\sigma} = f(eR^*, \sigma) \quad , \tag{10}$$

with the partial derivatives just indicated. The "Stable reserves" schedule in Figure 3 represents the condition $\dot{\sigma} = 0$.

Figure 3 shows local dynamics for the system (9)-(10). As in Figure 2, the dynamic system generates clockwise spirals. By shifting the Stable reserves schedule outward, an increase in η^* moves the steady state equilibrium from A to B. With the capital inflow, reserves start to increase, in turn making $\dot{\sigma} < 0$. These trends continue until the economy reaches point C, where an increasing trade deficit makes $e\dot{R}^* < 0$. At point D, reserve losses become severe enough to force the return spread to start to rise, pushing up the interest rate as well. In the diagram, a stable or unstable cycle may ensue. In practice in the 1990s, rising rates and currency imbalances in developing country balance sheets (with assets mostly denominated in local currencies and liabilities in foreign) forced σ to jump upward and crises followed. But the cyclical dynamic path that led into the collapses was exactly the one illustrated in the transition from points A through D in Figure 3.

4. Excess Capacity, Corporate Debt Burden, and a "Cold Douche"

Sticking to a stable interest rate in a generally Post Keynesian world, it is interesting to ask how animal spirits and corporate (as opposed to fiscal) debt interact over the cycle -some diagnoses of the East Asian financial crises come to mind. Cycles imposed on a growth model introduced by Lavoie and Godley (2000) help illustrate the dynamics. Several questions can be addressed:

Is there a tendency for industrialized economies (such as South Korea's) to generate excess capacity and/or a rising organic composition of capital, to prime the plumbing for a Schumpeterian "cold douche"?[3]

If investment continues to rise while capacity utilization is falling, how does the implied "realization crisis" work itself out?

In particular, how long can investors' optimism persist when over-capacity begins to raise its head?

Such questions were hotly debated in Left US policy circles around the latest turn of the century, e.g. Greider (1997) and many subsequent pieces. They obviously cannot be fully answered by contemplating a clockwise spiral in a two-dimensional phase plane, but perhaps the construct to follow can shed some light.

The key state variable for Lavoie and Godley is λ, redefined from section 1 as the ratio of corporate debt to the replacement value of the capital stock. That is, $\lambda = L/PK$, with L as business debt currently outstanding. For simplicity, we assume that business firms borrow only from banks, and that the banking system balance sheet takes the "Wicksellian" form $M = L$ with M as the money supply. Basically, "loans create money" in the story to follow. The firms also issue equity to the household sector. They practice mark-up pricing over wage costs at a constant rate, implicitly setting the profit rate r. Like r and λ, several other variables in the model are normalized by PK.

A key distinction centers on the effect of λ on the output/capital ratio u. Is effective demand "debt-burdened" ($\partial u/\partial\lambda < 0$) or "debt-led" ($\partial u/\partial\lambda > 0$)? Secondly, if the debt ratio behaves in self-stabilizing fashion ($d\dot{\lambda}/d\lambda < 0$ in a total derivative through the dynamic system), then what about the sign of $d\dot{\lambda}/du$? Lavoie and Godley call a negative value "normal." A positive "Minskyan" response of debt growth to economic activity is not a bad label.[4]

In a bit more detail, macro equilibrium can be described in terms of saving and investment functions. The growth rate of the capital stock permitted by available saving, g^s, follows from the flow of fund balances for firms and households. Firms save a proportion s_f of their income net of interest payments $r - j\lambda$ (with j as the pre-determined real rate of interest). Their other sources of funds are new borrowing $\lambda\hat{L}$ and issuance of equity. A working hypothesis is that they finance a share χ of their capital formation $g = I/K$ (I is gross investment and we ignore depreciation) with new shares. If V is the stock of equity outstanding and P_v its price, we get $P_v\dot{V}/PK = \chi g$.

Investment g equals the sum of business retained earnings $s_f(r - j\lambda)$ and new issues of securities. The overall flow of funds is

$$s_f(r - j\lambda) + \lambda\hat{L} + P_v\dot{V} - g = 0$$

which can be restated as

$$s_f(r - j\lambda) + \lambda\hat{L} - (1-\chi)g = 0 \qquad (11)$$

A Post-Keynesian or "endogenous money" twist in this equation is the term for the growth of bank credit, $\lambda\hat{L}$. The profit rate r and growth rate g are determined on the real side of the model, so the supply of bank loans has to be endogenous to allow firms to carry through their investment plans.

Total primary wealth in the economy is $\Omega = qPK$, all held by households. Their consumption $\gamma_h = PC/PK$ is assumed to depend on (normalized) income ξ_h and wealth,

$$\gamma_h = (1-s_h)\xi_h + \phi q \quad .$$

Household income comprises the wage bill per unit of capital stock $(u-r)$ and loan interest paid by firms which is assumed to be transferred to the household sector by banks ($j\lambda$). With $\xi_h = u - r + j\lambda$, the household flow of funds is

$$\{s_h[(u-r)+(1-s_f)r+s_f j\lambda]-\phi q\}-\chi g-\lambda\hat{M}=0 \quad . \tag{12}$$

Because $L = M$ and $\hat{L} = \hat{M}$ from the banking system's balance sheet, accounting consistency ensures that households obligingly pick up the new deposits $\lambda\hat{M}$ that bank lending creates.

The growth rate of the capital stock permitted by available saving, g^s, is the sum of (11) and (12),

$$g^s = [s_f(1-s_h)\pi + s_h]u - s_s(1-s_h)j\lambda - \phi q \quad . \tag{13}$$

Post-Keynesian investment functions emphasize cash-flow considerations. If the interest burden $j\lambda$ increases, firms are likely to cut back on capital formation g^i. For symmetry with the saving function (13) it is convenient to make g^i depend on q, and we also carry a term in capacity utilization:

$$g^i = g_0 + \beta u + \eta q - \psi j\lambda \quad . \tag{14}$$

The short-term macro equilibrium condition is $g^i - g^s = 0$, or

$$g_0 + (\eta+\phi)q + [s_f(1-s_h) - \psi\}j\lambda - [s_f(1-s_h)\pi + s_h - \beta]u = 0 \quad . \tag{15}$$

The usual stability condition is a positive value for the term in brackets multiplying u in (15), $s_f(1-s_h)\pi + s_h - \beta > 0$. Assuming that it is satisfied, note the ambiguous effect of $j\lambda$ on u. A bigger debt burden reduces investment demand through the coefficient $-\psi$ but also cuts into firms' saving. Filtered through profits distributed to households, lower retained earnings create a net leakage reduction of $s_f(1-s_h)j\lambda$. If this term exceeds ψ, effective demand is debt-led. When $\psi > s_f(1-s_h)j\lambda$, demand is debt-burdened. The remaining term in (15) involves q. Through both investment and saving effects, a higher q increases the level of economic activity.

To set up a cycle model around λ, we can bring in investment confidence. The straightforward approach is to make the intercept term g_0 in the investment function (14) a dynamic variable,

$$\dot{g}_0 = f_g(\lambda, g_0) \quad . \tag{16}$$

Positive feedback can be introduced by making the second partial derivative of the function f_g positive; a degree of caution on the part of investing firms (borrower's and lender's risks, etc.) suggests that the first partial should be negative.

From the business sector's flow of funds (11), a differential equation for λ can be written as

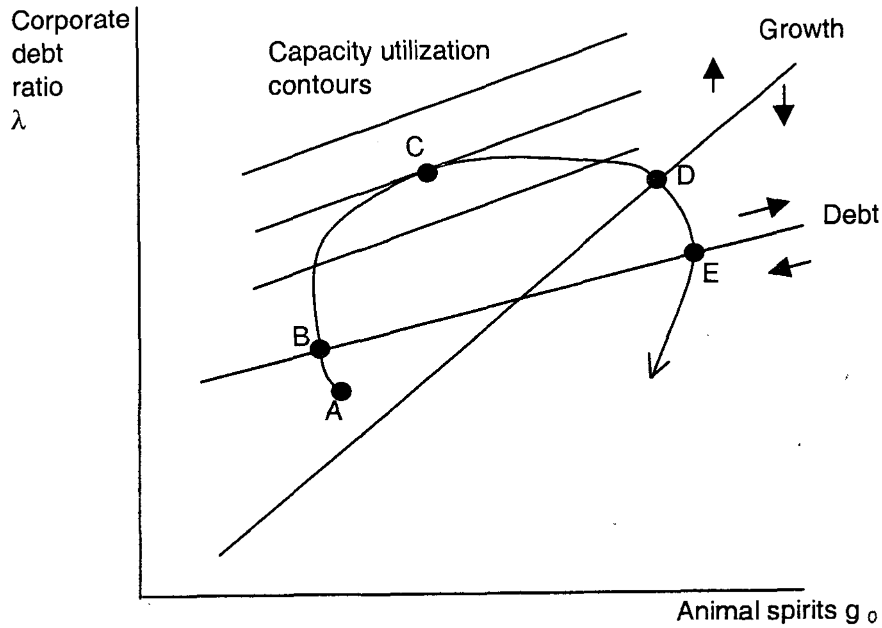
$$\dot{\lambda} = (s_f j - g)\lambda + (1-\psi)g - s_f \pi u \quad , \tag{17}$$

wherein the identity $r = \pi u$ with π as the profit share (implicitly set by the mark-up rate) is utilized. As noted above, $d\dot{\lambda}/du$ from this equation can take either sign while we assume that $d\dot{\lambda}/d\lambda < 0$. The short-term macro variables g and u will both respond positively to g_0 so (17) can be restated as

$$\dot{\lambda} = f_\lambda(\lambda, g_0) \quad . \tag{18}$$

Given the signs of the partial derivatives of f_g postulated in connection with (16), the existence of a cyclical solution to (16) and (18) requires that $d\dot{\lambda}/dg_0 > 0$, i.e. a Minskyan debt growth response to rising animal spirits. Figure 4 shows the dynamics, with the "Growth" schedule corresponding to $\dot{g}_0 = 0$ and the "Debt" curve to $\dot{\lambda} = 0$. The familiar clockwise spiral appears.

Figure 4: An animal spirits cycle in the Lavoie - Godley model



An initial low level temporary equilibrium at A will be associated with a falling debt burden and improving animal spirits until the (g_0, λ) trajectory crosses the Debt schedule at B. Then λ begins to rise while g_0 still increases until the Growth schedule is crossed (point D). Autonomous investment begins to fall, and the cycle bottoms out as the debt ratio declines after the trajectory crosses the corresponding schedule again at E. Around that point, presumably, the cold shower kicks in.

What happens to capacity utilization while this spiral uncoils? Almost certainly, u responds positively to g_0. It is also likely that effective demand is debt-burdened. On these assumptions ($\partial u / \partial g_0 > 0$ and $\partial u / \partial \lambda < 0$), we can sketch the positively sloped "Capacity utilization" contours in Figure 4. Each curve shows combinations of g_0 and λ that hold u constant, with its level increasing across contours toward the southeast. On this accounting, a realization crisis occurs at point C, where the trajectory is tangent to a contour line. Thereafter, u falls while animal spirits continue increasing until point D - growing over-capacity precedes a fall in optimism in this scenario. Together with a rising debt burden, a lower level of u slows investment demand; ultimately output $X = uK$ will begin to fall as well.

One argument in the late 1990s was that a cycle of the sort sketched in the diagram was especially threatening because industrial capacity had been growing worldwide since the mid-1980s under the stimulus of globalization. Instead of just one country's macro system, the whole world's was supposed to be going through a confidence squeeze. Apparent over-investment in capital goods supporting information technology (excess capacity for computer components) and infrastructure got the internet (thousands of miles of unused fiber optic cable) only made the situation worse.

Second, inflation had slowed almost everywhere, so that falling mark-up rates due to rising interest costs and decreasing capacity utilization were beginning to cause price levels to decline. Following Palley (1996), it would be straightforward to add a more complete treatment of the financial system to the present set-up to show how debt-deflation could further cut into economic activity.

Third, wage increases as advocated by people on the Left could restore aggregate demand - as may be the case in many developing countries - is wage-led.[5] It is also true that demand is not stimulated by higher interest rates. So attempts to push rates down make sense in terms of the present model. Whether such a move would forestall massive worldwide output contraction combined with severe price deflation may still be an open question.

.5. Final Thoughts

There are numerous oscillatory processes at work in the real economy, out there. Moreover, their import changes over time. Simple little two-dimensional models cannot begin to cope with all the *fluctuations* (and *fluctuations of fluctuations*) that exist.

Nevertheless, they can focus attention on key oscillations. Devaluation and external debt cycles in developing economies surely happen. In both rich and poor countries, distributive and some sort of Lavoie/Godley/Minsky financial oscillations are visibly present. Trying to put the whole set of motions into a plausible package is the challenge, which neither econometrics nor computer simulation is likely to meet fully. But at least the toy models and their fancier cousins give a modicum of insight into some of the mechanisms underlying the intrinsic fluctuations of capitalism. In the future, of course, new models will have to be developed to track novel forms of cycles when they inevitably begin to spiral.

Notes

1. In continuous time, oscillating variables appear in a two-dimensional system when its eigenvalues are conjugate complex (as opposed to real), i.e. they can be written in the form $\lambda = \alpha + \beta i$ and $\bar{\lambda} = \alpha - \beta i$ with $\alpha = TrJ/2$. For the oscillations to converge locally, the real part α of the eigenvalues has to be negative. Steady cycles show up when the real part equals zero, and there are divergent spirals when it is positive. The two standard methods to investigate the properties of such systems are Hopf bifurcations and the Poincaré-Bendixson theorem. The former analyzes the changing nature of cycles as the real part of the eigenvalues shifts through the value zero. The latter sets out global conditions for convergence to a closed orbit. Hirsch and Smale (1974) is a classic text on these matters, and Lorenz (1989) offers economic intuition.

2. As stated, the Phillips curve presupposes the existence of a "natural" level $\bar{u}$ of u at which there is zero wage inflation. This unpalatable assumption can be relaxed, but to set up a simple cycle model it is convenient to employ it here.

3. The reference is to Schumpeter's famous 1930s pronouncement to credulous Harvard undergraduates that the Great Depression was an unavoidable capitalist "cold douche" (Heilbroner, 1999).

4. There is an obvious parallel between using debt and a distributive variable such as the wage share or profit rate as a shift variable for effective demand. The literature on "wage-led" or "profit-led" demand shifts originated with Rowthorn (1982) and Dutt (1984) and is reviewed by Blecker (2001) and Taylor (forthcoming). Similarly, "normal" and "Minskyan" responses of debt growth to economic activity run parallel to "forced saving" and "profit squeeze" responses of the wage share. Minsky (1975) seems to point to the label adopted here.

5. One symptom of wage-led demand is contractionary devaluation. Analytical linkages between the cycles of sections 2 and 4 would be interesting to explore.

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