Finance and the Macroeconomic Process in a Classical Growth and Cycles Model

by

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Abstract

The aim of this paper is to derive an endogenous growth and cycles model which integrates the sectoral incomes, expenditures, and finance requirements into an *ex ante* social accounting matrix (SAM) in the spirit of the Cambridge Economic Policy Group. The SAM includes households, businesses, a banking sector with non-zero net worth, and the government. Investment in circulating capital, endogenous bank credit to finance accumulation and the negative feedback effect of debt on investment are at the core of the short-run cyclical dynamics. The business cycle dynamics are described by the *dual disequilibria* relationship which relates monetary and goods market disequilibria to each other. Market disequilibria result from the discrepancy between *ex ante* plans and expectations and *ex post* outcomes. The short-run cycle in the model is the 3-5 inventory cycle in which aggregate demand and supply chase each other ceaselessly in order to reach equilibrium. Firms respond to excess demand by lowering inventory stocks and increasing investment in circulating capital which expands output via the Léontief input-output relationship. Over the medium run, they respond to imbalances between actual and normal capacity by increasing fixed capital investment. Over the medium to long run, the path of accumulation is internally financed and regulated by the rate of profit. One can conclude that the macrodynamic model is a synthesis of the Physiocrats' "circular flow" approach to modeling the economy and the endogenous growth perpective of some classical economists, von Neumann, and Harrod. Finally, the endogenous cyclical dynamics are very much in the spirit of Kalecki and Minsky.

I. *Introduction*

This paper will serve as a prelude to the investigation of the impact of fiscal policy. Its aim is to integrate finance, government spending, and the banking sector into an alternative model of growth and cycles rooted in the classical tradition which is an extension of the social accounting matrix (SAM) framework pioneered by Godley (1996, 1998). The model is also an extension of the growth and cycles framework developed by Shaikh (1989) and, in addition, incorporates the flow-of-funds methodology of Earley, Parsons, and Thompson (1976). The classical growth and cycles (CGC) model developed here belongs to a general class of linear and nonlinear models that study real-financial interactions (Skott, 1989; Taylor and Connell, 1989; Woodford, 1989; Franke and Semmler, 1989; Shaikh, 1989; Duménil and Lévy, 1989). However, its dynamic disequilibrium properties, rooted in a stock-flow framework (Godley, 1996, 1998) with endogenous bank credit (Kaldor, 1982; Moore, 1988; Shaikh, 1989; Wray, 1990; Palley, 1996) distinguishes it from traditional macroeconomic models.

The CGC model has as its basis a modern formulation of the classical approach to growth and cycles developed by Shaikh (1989, 1991, 1992, 1996b, 1996c, 1996d, 1997a, 1997c). This framework begins with the central argument of classical political economy that both growth and cycles are endogenous and persistent features of capitalism. In the classical tradition it is the rate of profit which rules the roost, as it is the regulator of aggregate investment and therefore of aggregate effective demand and growth. Cycles, on the other hand, are inherent to the complex processes in which demand and supply chase one another endlessly as the market seeks to equilibrate itself. Such a dynamic and turbulent picture of the economy should be contrasted with the static general equilibrium approach of neoclassical economics.

In accordance with the classical tradition, growth in the CGC model is fundamentally driven by profit-motivated investment, as analyzed in the schemes of reproduction and the circuits of industrial capital. This approach to growth in classical political economy is very different from those in both the Keynes/Kalecki and the neoclassical traditions (Duménil and Lévy, 1993). Monopoly power or exogenous demand injections such as budget deficits in the

Keynes/Kalecki tradition and the intertemporal consumption decisions of households in the neoclassical one are respectively the drivers of the system.

A comparison of the CGC model with the state of the art of the heterodox macroeconomic literature (Tobin, 1980; Tobin and Buiter, 1980; Tobin, 1982; Taylor, 1985, 1991, 1997; Godley, 1996, 1998; Godley and Milberg, 1994) highlights the following features. As with this literature, the CGC model does not utilize standard neoclassical tools such as intertemporal optimizing behavior, production and utility functions, and the full employment assumption (McCafferty, 1990; Blanchard and Fischer, 1989). Moreover, it follows certain authors in this literature (Godley, 1996, 1998; Godley and Milberg, 1994; Tobin, 1980; Tobin and Buiter, 1982; Taylor, 1997) in relating sectoral expenditures to their respective finance requirements along with the corresponding changes in stocks and flows. Bank credit is a crucial type of the finance in the CGC model although unlike Godley (1998) and Taylor (1997) the banking sector is not incorporated into the SAM by assuming that bank net worth equals zero.

With regard to the short-run business cycle dynamics the CGC model follows other heterodox approaches in demonstrating the endogeneity of cyclical dynamics (Dore, 1993). This feature of these models distinguishes them from real business cycle (RBC) models in which cycles are caused by exogenous shocks alone. The short-run nonlinear business cycle debt dynamics in the CGC model is very much in the Minsky tradition and is therefore similar in spirit to the models of Franke and Semmler (1989), Flaschel, Franke, and Semmler (1997), and Duménil and Lévy (1989).

However as in Harrod, but in contrast to the above heterodox literature, growth in the CGC model is a continuous and persistent feature of the system at every point in time (Kregel, 1980). Thus its point of departure is not a given *level* of output but a continuous rate of growth. The implication is that, at the most fundamental level, the system operates in a growth environment and is driven by profitability. This quintessentially classical feature of the model (Eltis, 1993) distinguishes it from the Keynes/Kalecki tradition in which the short run is static and growth takes place only in the long run via exogenous demand-related factors. As discussed below, this dynamic feature of the CGC model is based on its distinction between fixed and circulating capital and the classical/Leontief input-output relationship. Moreover, the laws of motion of the CGC model also rest on its distinction between *ex ante* plans and expectations and *ex post* outcomes. In fact both market disequilibria and growth in the CGC model arise from these discrepancies and their feedback signals. These features are absent in the heterodox literature.

Finally, the CGC model follows the classical assumption that over the long run the system gravitates around normal capacity (Winston, 1974; Shaikh, 1992; Lavoie, 1995) which however is consistent with persistent employment as Goodwin (1967) demonstrated in his famous predator-prey model. Models in the Keynes/Kalecki tradition typically assume persistent excess capacity.

In short, the CGC model follows von Neumann and the line of classical thought which includes the Physiocrats and Marx (Chakravarty, 1989; Eltis, 1993) in demonstrating the dynamic, though turbulent, nature of market economies. In fact endogenous growth, the regulating role of the rate of profit, and the SAM methodology are consistent with the dynamic and "circular flow" view of the system that one finds in Quesnay's *Tableau Economique*. Moreover, the debt and cyclical dynamics are very much in the Minsky tradition. It is this synthesis that is derived in the next section and will serve as framework to investigate the impacts of fiscal policy.

II. *The Formal Model*

The following are the core features of the CGC model which is an extension of the classical growth cycles framework developed by Shaikh (1989, 1990, 1996a, 1996b, 1996d). First, as in Harrod, the model is a dynamic one in which growth takes place in both the short run and the long run (Kregel, 1980). However, unlike Harrod's model which is knife-edge unstable, the long-run warranted path is stable though turbulent with persistent endogenous cycles. The rate of profit regulates the warranted path.

Second, economic cycles are intrinsic to the model and are the consequences of disequilibrium adjustments. For example, the 3-5 year inventory cycle is the result of a process in which demand and supply fluctuate around each other whereas the 7-11 year fixed capital cycle arises from a similar cycling process between supply and normal capacity output (van Duijn, 1983; Shaikh, 1992). Each of these cycles corresponds to a particular equilibration mechanism.

Cycles have different lengths because disequilibria in the different markets do not adjust at the same speed. Thus adjustments in financial markets are the fastest processes because equity, bond, and loan supplies can be provided essentially on demand. Shaikh argues that the labor market also falls into this category since the hours of labor services supplied adjusts fairly rapidly to the demand for labor services.

With regard to the goods markets, however, adjustments to market disequilibria are slower because production involves a significant amount of time. Actual output at any point in time is based on sales expectations (and planned additions to inventories) of firms in the previous time period when the production process was initiated. The confrontation of actual output with the planned demand by customers generates an excess demand which brings about unplanned changes in the inventories of firms. But this discrepancy will also entail the revision of production plans (including the demand for inputs) and output in subsequent periods. It is this interplay between aggregate demand and supply which leads to the so-called 3-5 year inventory cycle[1] and describes the short run in the CGC model. Finally, fixed investment decisions require an even longer time horizon (depending on the type of industry, plant and equipment can last several decades) and involves an equilibration between actual and normal capacity utilization.

A reduction of inventories below their desired levels is an immediate response of firms in the face of a positive excess demand. If the latter persists, they will respond in the following period by increasing investments in raw materials and labor power so as to produce more output. This *fast dynamic* links investment in circulating capital to output à la Ricardo, Leontief and von Neumann. It is this classical input-output relationship which is at the core

[1] Note that implicitly the short run in the Keynes/Kalecki tradition is of a shorter time duration than it is in the classical tradition since it ignores disequilibrium adjustments. The point of departure of models in the Keynes/Kalecki tradition is the equality between aggregate demand and supply (Taylor, 1985, 1991; Lavoie, 1995; Palley, 1996). That is, all annual output is the *equilibrium level* of output in these models and no significance is attached to market disequilibria.

of the CGC model and distinguishes it from both orthodox and heterodox macro-models. It is an immediate response of firms and ensures that the system grows at *every point in time.* Thus the model is a synthesis of Harrod's warranted growth path and the classical input-output relationship.

Further, if the growth rate of output raises the utilization of capacity above normal, firms will eventually increase investment in fixed capital so as to raise capacity or potential output. This is a *slow dynamic* since it entails a more long run response of firms. As Shaikh (1989, 1991, 1992) demonstrates, it is this distinction between fixed and circulating capital that provides a solution to the famous knife-edge instability problem.

The dynamical properties of the model hinge on the interaction between these two adjustment processes. As with other theoretical traditions, it is assumed that aggregate demand and supply are roughly in balance over the course of the fast dynamic. However, this rough equality in the CGC model defines a *path* of output. This dynamic short-run path need not be an equilibrium one, since it can be the result of either stochastically generated cycles or deterministic limit cycles[2]. In the Keynes/Kalecki tradition, however, growth takes place only in the slow adjustment process or the long run. Thus Kalecki, for example, considers the short run as the period in which supply and demand are assumed to be in balance, the medium run in which he considers the movements of the business cycle around a given level of output, and the long run, in which he finally considers growth (Kalecki, 1959). Keynes also saw "growth [as] a long-period conception" (Kregel, 1980, p. 100). However, in his debate with Keynes (Kregel, 1980) Harrod was trying to show that his "new branch of economics" corresponded to steady growth or "steady advance" as he put it. For Harrod, the point of departure was not the stationary state, but a steady rate of advance in which *capital accumulation would be taking place continuously.* He disagreed with Keynes that steady growth is a long-period concept, arguing instead that his theory dealt with continuous changes in certain variables *at all points in time.*

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[2] Stochastically sustained cycles arise from generally nonlinear stable oscillatory systems that are randomly perturbed by a turbulent and uncertain economic environment. Deterministic limit cycles represent local instability that is contained by bounded forces.

Thus, in the dynamic classical approach, the average levels of aggregate demand and supply and capacity change over time so that supply and capacity define a path of capacity utilization (the ratio of actual output to capacity) over time. However, the classical tradition does not assume that the fast process will cause actual output to gravitate around capacity. If the fast process is measured in units of time less than the slow process (e.g. weeks rather than years) then the former will produce an annual level of capacity utilization u that will in general be different from the normal rate of capacity utilization u_n[3].

If the fast process roughly or *tendentially* equalizes aggregate supply and demand, then it needs to be asked what the effects are of deviations between actual and normal levels of capacity utilization. In the classical approach, this deviation between actual and normal levels of capacity utilization reacts back on the accumulation rate and alters thereby the paths of actual output and capacity, which in turn adjusts the initial deviation and feeds back on accumulation and so on.

Third, the dynamic characteristic of the model implies that all variables are written as shares of some variable such as output. Static model specifications tend to focus on the *level*, rather than the *path*, of a variable so that all adjustments occur in terms of changes in absolute levels rather than relative ones. It follows therefore that such specifications yield static results (Shaikh, 1992). Conventional formulations of effective demand theory as the Keynes/Kalecki short-run equilibrium models are specified precisely in these terms.

In contrast, a dynamic specification allows for the *continuous variations* of variables over time, so that all adjustments take place relative to any trends in these variables. This means that all variables are modeled in terms of growth rates or ratios, rather than levels. Following Goodwin, Shaikh argues that working with levels of variables rather than their ratios (to, say, output) excludes the possibility of endogenous growth.[4] The point is that the

[3] A distinction needs to be made between normal capacity and the engineering capacity. The normal capacity is the economically feasible capacity and is defined as that level which is determined by the normal intensity and length of the working day, the number of shifts, costs etc. It should be distinguished from the engineering capacity, which is the technical upper limit to normal capacity (Shaikh, 1991; Winston, 1974).

[4] For example, if $x = X/Y$ then the steady state value $dx/dt = 0$ of a differential equation in x implies that either X and Y are growing at the same rates or that they are at some levels. On the other hand, the solution $dX/dt = 0$ of a

form in which a model is written determines whether or not it includes the possibility of growth. Thus, within a growth context, it is convenient to write all variables as ratios since the rate of change of a ratio is itself a relative growth rate. Such relative adjustments are either in terms of changes in ratios of variables or in terms of changes in growth rates[5].

From a dynamical perspective, then, there is a difference between a rise in the level of government spending G and a rise in the share of government spending $g = G/P$ where P is output. A one-time increase in g is an acceleration of G relative to P whereas a one-time increase in G produces a pulse in g which eventually dies out: each of these fiscal policies has a different long-run effect on the system although the short-run stimulus is identical. Thus in a growth context, the nature of the fiscal policy needs to be specified. Models such as those of Blinder and Solow (1973), Taylor (1985, 1991), Godley (1995a), and Tobin (1980) which focus on levels and do not differentiate between the types of fiscal policy.

Fourth, following Earley, Thompson, and Parsons (1976), the CGC model incorporates the important relationship between the planned expenditures, expected revenues, and finance of each sector and integrates them into an aggregate social accounting matrix (Godley, 1996; Taylor, 1997). Morever, the CGC model's distinction between *ex ante* plans and expectations and *ex post* outcomes endows it with its disequilibrium properties. Thus the building block of the CGC model is an *ex ante* social accounting matrix (SAM). As in Godley, the CGC model is based on a watertight accounting system that is based on the principle "that every flow comes from somewhere and goes somewhere," (Godley, 1998, p. 5).

The formulation of the model in terms of the *ex ante* decision variables of different sectors implies the possibility of aggregate disequilibria since the plans and expectations of individual sectors may not necessarily match actual outcomes in an uncertain world in which rational expectations do not apply (Keynes, 1936; Davidson, 1991). In fact, as discussed

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differential equation in X implies that X is not growing and is at the same level.

[5] Note that Taylor (1985, 1991) also writes all variables as shares but does not discuss the implications of a static versus a dynamic specification.

below, it is precisely the disequilibria in the goods market that constitute the basis of economic cycles in the CGC model.

Market disequilibria in the CGC model are the results of representing each sector in *ex ante* space as a set of virtual sources and uses of funds. These *ex ante* sectoral budget restraints (Earley, Parsons and Thompson, 1976; Buiter, 1980; Tsiang, 1988) involve flows and changes in stocks. They are not accounting identities but are behavioral restrictions on each sector's planned expenditures and expected revenue streams; the excess of expenditures over revenues corresponds to the sector's finance requirements. Thus each sector's plans, expectations, and borrowings from other sectors have to be financially *consistent* (Clower, 1965). Sectoral budget restraints are aggregated into an economy-wide budget restraint which, when written in an appropriate form, shows the relationship between net *injections* of purchasing power in the form of additions to the money supply and *leakages* of money as desired reserves or buffer stocks (Goodhart, 1984; Laidler, 1990, 1993).

With respect to the money stock the central issue is that it is generated through private bank credit, the actions of the government (whose fiscal and monetary policies create high-powered money) and the trade balance in an open economy. None of these sources of money need correspond to the public's desire to hold money (currency and various types of deposits) as reserves or buffer stocks (Goodhart, 1984, 1989; Laidler, 1990, 1993). It is the discrepancy between the two which works its way through the different markets[6]. Thus, as with the commodity market to which it is linked by bank loans and government policy, the so-called "money market" will also be a relatively slowly adjusting one. One significance to this approach is that it enables an analysis of macropolicy from both sides of the exogenous money-endogenous money debate since the monetarist proponents of exogenous money emphasize the point that the money supply is determined by government (including central bank) policy whereas endogenous money theorists emphasize the private bank credit component.

The *ex ante* point of departure, which allows for the possibility of disequilibria, has

[6] In a neoclassical model, the interest rate would adjust rapidly to clear the money market.

important implications for model-building. The main significance is that the dynamics of the model are not *influenced* by assuming that the system is either in equilibrium or reaches it eventually. This issue of not assuming equilibrium distinguishes this framework from those in the Keynes/Kalecki tradition as well the new classical ones. In the former, equilibrium between aggregate demand and supply is assumed because the short-run is characterized by a given *level* of output so that growth takes place only in the long-run[7]. In the rational expectations models disequilibria are assumed away by using the so-called jump-variable technique (Flaschel, Franke and Semmler, 1997) to ensure that the system is always in equilibrium. The sole economic rationale for this technique is that the system is assumed to be in general equilibrium, with infinitely fast adjusting prices in all markets. On the other hand in the CGC model, while instabilities and disequilibria are intrinsic, endogenous mechanisms within it ensure that such instabilities are bounded. The model does not exhibit the problems of saddle-point or knife-edge instability.

Fifth, in the spirit of post-Keynesian models, bank credit in the CGC model is a crucial force in accumulation since it frees planned investment spending from available savings. Thus when I > S credit fills the gap. However this does not imply that bank credit is "freely-gotten finance" (Asimakopoulos, 1983, p. 222-227) since firms need to pay finance charges on this debt. Thus in contrast to models in the Keynes/Kalecki tradition (Taylor, 1985, 1991; Lavoie, 1995; Palley, 1996) both debt service payments as well as the disciplining effect of the stock of business debt are modeled explicitly. In fact the most fundamental short-run dynamic of the CGC model revolves around the interaction between demand, circulating investment, and debt.[8] It is with regard to the short-run debt dynamics

[7] This, of course, is contrary to Harrod's concept of a growing economy since he was interested in modeling the economy in terms of a continuous rate of change of output. This issue was the focus of his private correspondence with Keynes about the difference between a static versus a dynamic specification of the short-run (Kregel, 1980).

[8] The assumption of a fixed savings propensity is a standard one in macromodels. Of course, the fundamental role of bank credit in accumulation remains as long as the savings propensity *is* constant. Marx, however, was to demonstrate in the schemes of reproduction that accumulation can take place via *pure internal finance* without bank credit. In such a situation higher planned investment can take place when capitalists reduce their consumption spending, thereby releasing the additional savings needed to finance the investment (Bleaney, 1976; Shaikh, 1989).

that puts the CGC model in the same class of models such as those of Duménil and Lévy (1989) and Flaschel, Franke, and Semmler (1997).

While excess demand and debt describe the short-run dynamic, the medium-run warranted path along which excess demand and debt are roughly zero is financed via the aggregate or social savings rate s^* in the system. That is, the medium-run path of accumulation is determined by $s^* = s + (t - g)$ where s is the private savings rate and (t - g) is the government surplus. This reliance of the medium-run path of accumulation on savings is the quintessentially classical feature of the model and is reminiscent of the schemes of expanded reproduction, the von Neumann growth path, and Harrod's warranted path analysis.

The emphasis on bank credit places this model in a growing literature that stresses the importance of credit in economic activity (Radecki, 1990). This literature includes the work of authors such as Bernanke, Gertler, Stiglitz and Weiss (Bernanke and Gertler, 1986, 1987; Stiglitz and Weiss, 1981), as well as Minsky's famous financial fragility hypothesis (Minsky, 1982a) and Wojnilower's work on credit crunches (Wojnilower, 1980, 1985). The "creditist" view of accumulation, which also includes the models of Foley (1987), Wolfson (1994), Semmler and Sieveking (1993), and Flaschel, Franke, and Semmler (1997) has emphasized the role of credit supply in amplifying accumulation in upswings and choking it off in downswings, to the extent of transforming mild downturns into deep recessions. Business cycle asymmetries arise precisely because of the fluctuations in credit supply. The common thread uniting this vaste literature is its rejection of the Modigliani-Miller theorem. Unlike the New Keynesian literature, however, the CGC model does not rely on imperfect markets and information or on neoclassical tools such as optimizing behavior. Moreover, in contrast to models in the Keynes/Kalecki tradition (Taylor, 1985, 1991; Palley, 1996) business debt plays a vital negative feedback role in the determination of investment.

Sixth, banks are treated as profit-making entities and therefore the banking sector is incorporated into the *ex ante* SAM without assuming that bank net worth equals zero. It will be shown that banks have a dual role (Shaikh, 1997b). In their role of *banks-as-businesses* they are indistinguishable from other profit-seeking firms in that their planned uses of funds are based on their actual and expected sources of funds. However, in the endogenous money framework the supply of credit (and of deposits) is not subject to any reserve supply constraints. The supply of credit depends on the rate of cyclical growth and therefore on the banking sector's profit expectations and desired balance sheet liquidity ratio relative to the actual balance sheet ratio. Following the tradition of the Banking School, post-Keynesian authors (Moore, 1988; Rogers, 1989; Wray, 1990) reject the orthodox argument (Mishkin, 1995) that the supply of credit is restricted by available savings or reserves. In fact banks use asset and liability management and other reserve-economizing methods to make the link between reserves and loans a flexible one (Pollin, 1991; Palley, 1996).

Given this special status of banks we derive a relationship linking deposits, loans, reserves that constitutes the *differentia specifica* of banks and defines their role of *banks-as-banks* (Shaikh, 1997d). It is this relationship that allows the banking sector to be introduced into the SAM.

Since banks are treated as profit-making entities that seek to maximize profits and optimize balance sheet liquidity, the loan rate of interest is an endogenous variable. After all, its significance is that it is a determinant of the revenue streams of banks.
This approach to banking is consistent with what is called the structuralist tradition in the post-Keynesian literature (Palley, 1996). In contrast to the horizontalist view (Moore, 1988) this literature emphasizes the endogenous mechanisms that regulate the loan rate of interest.

Seventh, sectoral budget restraints from the *ex ante* SAM are aggregated to derive the so-called *dual disequilibria* relationship which links goods market disequilibria to the imbalance between the money supply and agents' desired money reserves or buffer stocks (Goodhart, 1984; Laidler, 1990, 1993). Economic disequilibria manifest themselves when the injection of the stock of money M_s does not equal agents' desired stock of money reserves M_d. That is, macroeconomic disequilibria are the result of imbalances between *actual* and *desired* stocks of money. It is precisely this discrepancy that fuels spending in the goods and asset markets and leads to persistent economic cycles.

The desired increase in money holdings (ΔM_d) refers to the holdings of money as a "buffer stock" (Rabin, 1979, 1993; Coghlan, 1981; Yeager, 1986; Goodhart, 1984, 1989; Dow and Dow, 1989; Laidler, 1990, 1993). The rationale for this notion is that in a complex market economy, supply and demand do not necessarily mesh instantaneously so that agents are likely to incur costs in finding a buyer for assets when money is required. Under these conditions of uncertainty each individual agent might be expected to hold some portion of his or her wealth in the form of money as a "temporary abode of purchasing power," to use Friedman's expression (cited in Laidler, 1990, p. 25). Given the degree of uncertainty and the opportunity costs of holding money reserves, agents are likely to have some desired or target money balances (buffer stocks) and let "news" or "shocks" impinge on those assets and liabilities which act as "shock absorbers" or as buffers (Goodhart, 1984).

Baumol (1952), Tobin (1956), Miller and Orr (1968), Orr (1970) and Akerlof (1979, 1980) were the ones who initially conceptualized reserve money holdings as flexible inventories. Drawing on this literature, Goodhart (1984) argues that in the face of uncertainty, both goods and financial assets are held as buffers to absorb unforeseen shocks. When these inventories rise or fall to some desired limit an adjustment process gets set in motion. For example, if at the end of a period a company accumulates undesired inventories, it will carry out certain readjustments in subsequent periods to either add to depleted stocks or run down unwanted ones. A similar argument can be made for desired money reserves. Goodhart concludes that for this reason shifts in desired money balances relative to desired levels should enter into expenditure functions. Note that the sources-and-uses of funds approach formulated by Earley, Parsons and Thompson (1976) and its extended version by Shaikh (1989) include such a variable, thereby ensuring that fluctuations in money reserves affect expenditures. Thus, fluctuations in money reserves act as an additional factor in the monetary transmission mechanism discussion. It should also be noted that the buffer stock demand for money is essentially a *stock* demand for money and is expected to rise with liquidity preference, a point which follows from Keynes and is discussed by some post-Keynesian authors such as Coghlan (1981), Goodhart (1984) and Dow and Dow (1989).

From this it follows that any deviation of the economy's stock of money from desired levels will lead to some dynamic adjustment processes that take a while to work themselves out in the system. Hence the notion of disequilibrium money (Goodhart, 1984).

.....the windfall gains and losses which the agent experiences from time to time might well manifest themselves in unexpected variations in cash holdings. A discrepancy between actual and long-run target money holdings can just as well arise from this source as from changes in the arguments of the agent's long-run demand-for-money function, and there is no reason to believe that the response to such a discrepancy depends in any way upon what it generates. *Given that a discrepancy exists, the agent will attempt to move towards a long-run target demand for money by altering the current rate of flow of expenditures on goods, services, and asset accumulation.* That is to say, for the individual agent, a discrepancy between actual and desired cash balances will set in motion a real balance effect (Laidler, 1990, p. 27, emphasis added).

During the time that there is monetary disequilibrium, aggregate demand will be different from aggregate supply. However, in both the 'Keynesian' neoclassical synthesis and new classical economics such disequilibria are annulled instantaneously. Interest rate flexibility in the neoclassical synthesis case and wage and price flexibility in the new classical case ensure continuous market-clearing. Laidler argues that in these two theoretical approaches market disequilibria are corrected in *meta* time whereas for the buffer-stock theorist disequilibrium adjustments work themselves out in *real* time. As Goodhart argues

...an initial shock to the supply of money is likely to be buffered, in the short run, both by a larger proportion of agents moving towards the top end of their acceptable inventory of holdings and by the delays between holdings going beyond such notional limits and decisions being taken and made effective to return money holdings to their preferred starting-point, e.g. by expenditures on other assets, or by changing work/leisure programmes. Even when the tolerance, the range between the limits, is quite small and the speed of individual agents' reactions to shocks is fast, the overall lag in adjustment for the system *as a whole* in response to a supply shock, particularly if that shock is concentrated narrowly in the system rather than widespread, can be lengthy, because of the resulting long-lasting interaction between the atomistic agents within the system (Goodhart, 1984, p. 257).

As Laidler states with regard to these adjustment lags,"Money is very easy for the individual agent to get rid of, but very difficult for the economy as a whole to get rid of, if it is being pumped through credit creation" (cited in Goodhart, 1984, p. 257). Hester and Pierce (1975) have studied such lags in the adjustment process.

To summarize, the foundation of the CGC model is a warranted path of output in which capacity utilization fluctuates around the normal (potential) level, the actual rate of profit fluctuates around the normal (potential) profit rate and growth is internally generated from the reinvestment of profits even when there is no technological change.

However, if normal capacity growth is not attainable because of the knife-edge problem the central role of profitability would have to be replaced by other regulating factors such as population growth, waves of exogenously-given technological change, government spending, expectations etc. The bulk of the growth theory literature uses some combination of these factors to explain growth because of the apparent inability of the system to sustain balanced growth.

One common solution to the knife-edge problem has been to assume that the actual growth path of the economy *is* the warranted path. The analysis then shifts to the properties of this path or the relationship between it and the labor utilization rate, i.e. to the relationship between the warranted path and the natural growth rate which is determined by population growth and technological change. The Swan-Solow models (Sen, 1970), the ceiling-floor growth-cycle model of Hicks (1950) and Goodwin's (1967) non-linear growth-cycle model all fall in this broad approach.

Another common response to the knife-edge problem is to take growth as given, so that the focus of this line of research is on the cyclical fluctuations around this exogenous trend. The Lucas Rational Expectations models and the Nordhaus Political Business Cycles models all fall into this category (Mullineaux, 1984), as do the non-linear cyclical models of Kaldor (1940), Hicks (1950), and Goodwin (1951). The various cyclical models of Kalecki also fall in this category (Kalecki, 1971; Steindl, 1981).

Finally, multiplier-accelerator models comprise the third response to this problem (Shaikh, 1992). In these models, certain parameter ranges yield damped oscillations around a stationary path while other parameter ranges yield growth that is asymptotic to a non-warranted path. However these models do not yield warranted growth (Shaikh, 1992).

To conclude, the growth literature can be subdivided into the following three categories. The first group consists of short-run models. Of these, the *static* models assume short-run equality between aggregate demand and supply so that I = S is the point of departure (Kalecki, 1971; Steindl, 1979; Kregel, 1980; Taylor, 1985, 1991; Lavoie, 1995). In these models growth of output takes place via exogenous factors. On the other hand, the series of models developed by Shaikh (1989, 1991, 1992) are *dynamic* and in the short run do not assume that I and S are equal. The possibility of short-run aggregate excess demand is a crucial aspect of Shaikh's approach since this is precisely the feature that makes growth a persistent feature of the system, as conceptualized by Harrod (Kregel, 1980).

The second group assumes that over the medium-run capacity utilization u is approximately at the normal level u_n and that the economy's actual growth equals the warranted growth growth. Harrod's famous warranted path model (Sen, 1970; Hacche, 1979) and the various models by Shaikh (1989; 1991; 1992) fall in this category. Other authors such as Robinson (1956, 1962) and Solow (1956) discuss the warranted growth path, but their concern was also with the convergence between it and the natural growth rate (Sen, 1970).

This is the research agenda of the third group of models. Their goal is to identify the particular long-run conditions that make the warranted growth rate g_w converge to the natural growth rate g_n (Sen, 1970). This equilibrium growth rate is what Hacche (1979) calls the *steady-state growth rate*. If s is the savings propensity, κ the capital/output ratio, n the rate of population growth and m the rate of technological change then this convergence implies that $s/\kappa = g_w = n + m = g_n$. The goal of this literature is to identify the particular circumstances that make the savings propensity, the capital/output ratio or the rate of technological change adapt to ensure the above equality. Non-neoclassical models in this category are those by Kaldor (1955-56, 1957), Kaldor and Mirrlees (1961-62), Kalecki (1954), Pasinetti (1962, 1965) and Robinson (1956, 1962). The basic neoclassical models are those by Solow (1956) and Swan (1956) and the literature that follows (see Sen, 1970 and Hacche, 1979). The CGC model investigates the interaction between the short run and the medium run as well as the convergence to the warranted path. The question of the convergence between g_w and g_n is beyond the scope of the present work.

The growth and cycles model of the pure private sector economy in Shaikh (1989) can be extended into an *ex ante* SAM as demonstrated in Moudud (1998a). While bank credit is fundamental to Shaikh's growth cycles model, the banking sector is not explicitly represented in it. Moreover, the interest rate on loans is exogenously controlled through some appropriate policies which are not the central concerns of his model. The extended *ex ante* SAM shown in Table 1 is a further extension of Shaikh (1989) with four sectors: household, firms, commercial banks, and the government. The superscripts "p" and "e" stand for plans and expectations respectively. All variables are defined in Appendix 1.

Table 1. *Ex Ante* Social Accounting Matrix with the Government Sector

	Households	Firms	Banks	Gov't.	**Ex Ante Gaps**
Consumption of domestic goods	$- C_d^p$	$+ C^e$			$+ C^e - C_d^p$
Investment of domestic goods		$- (I_d^p)_f + I^e$	$- (I_d^p)_{bk}$		$+ I^e - I_d^p$
Government expenditures on domestic goods		$+ G^e$		$- G_d^p$	$+ G^e - G_d^p$
Subtotal					$\mathbf{(C^e + I^e + G^e) - (C_d^p + I_d^p + G_d^p)}$
Taxes	$- T^p_h$	$- T^p_f$	$- T^p_{bk}$	$+ T^e$	$T^e - T^p$
Wages	$+ w.(N^e)$	$- w.(N_d^p)_f$	$- w.(N_d^p)_{bk}$		$+ w.(N^e - N_d^p)$
Dividends (δ = dividend yield)	$+ \delta.(EQ_{t-1})^e$	$- \delta.(EQ_{t-1})_f^p$	$- \delta.(EQ_{t-1})_{bk}^p$		$+ \delta.(EQ_{t-1})^e - \delta.(EQ_{t-1})^p$
Subtotal					$\mathbf{- [(Y_d^p - Y_s^e) + (T^e - T^p)}$ $\mathbf{+ w.(N^e - N_d^p)}$ $\mathbf{+ [\delta.(EQ_{t-1})^e}$ $\mathbf{- \delta.(EQ_{t-1})_f^p] = -[(I_d - S^p) + (G_d^p - T^e)]}$
Interest flows on deposits, bonds and loans	$+ i_d.(D_{t-1}^e)_h$ $+ i_b.(BG_{t-1}^e)_h$ $- i_L.(L_{t-1}^p)_h$ $+ i_b.(BP_{t-1}^e)_h$	$+ i_d.(D_{t-1}^e)_f$ $+ i_b.(BG_{t-1}^e)_f$ $- i_L.(L_{t-1}^p)_f$ $- i_b.(BP_{t-1}^p)_f$	$- i_d.(D_{t-1}^p)$ $+ i_b.(BG_{t-1}^e)_{bk}$ $+ i_L.(L_{t-1}^e)$ $+ i_b.(BP_{t-1}^e)_{bk}$ $- i_{dw}(BR_{t-1}^p)$	$- i_b.(BG_{t-1}^p)$ $+ i_{dw}(BR_{t-1}^e)$	$+ i_d.(D_{t-1}^e) - i_d.(D_{t-1}^p)$ $+ i_b.(BG_{t-1}^e) - i_b.(BG_{t-1}^p)$ $+ i_L.(L_{t-1}^e) - i_L.(L_{t-1}^p)$ $+ i_b.(BP_{t-1}^e) - i_b.(BP_{t-1}^p)$ $+ i_{dw}(BR_{t-1}^e) - i_{dw}(BR_{t-1}^p)$
Change in high powered money (net of fiscal and monetary policies)	$- (\Delta Cu_d^p)_h$	$- (\Delta Cu_d^p)_f$	$- \Delta R_d$	$+ \Delta H^p$	$+ \Delta H^p$ $- (\Delta Cu_d^p + \Delta R_d)$

	Households	Firms	Banks	Gov't.	**Ex Ante Gaps**
Change in borrowed reserves (discount window loans)			$+ \Delta BR^e$	$- \Delta BR_d$	$+ \Delta BR^e - \Delta BR_d$
Subtotal for sources and uses of high powered money					$(\Delta H^p - \Delta BR^p)$ $- \Delta Cu_d^p - (\Delta R_d - \Delta BR_d)$ $= \Delta H^p - (\Delta Cs_d^p + \Delta R_d)$ $+ (\Delta BR^e - \Delta BR_d)$
Change in deposits	$- (\Delta D_d^p)_h$	$- (\Delta D_d^p)_f$	$+ (\Delta D^e)_{bk}$		$+ \Delta D^e - \Delta D_d^p$
Change in equities	$- (\Delta EQ_d^p)_h$	$+ (\Delta EQ^e)_f$	$+ (\Delta EQ^e)_{bk}$		$+ \Delta EQ^e - \Delta EQ_d^p$
Change in private bonds	$- (\Delta BP_d^p)_h$	$+ (\Delta BP_d^p)_f$	$- (\Delta BP_d^p)_{bk}$		$+ \Delta BP_d^p - \Delta BP_d^p$
Net change in gov. bonds (net of fiscal and monetary policies)	$- (\Delta BG_d^p)_h$	$- (\Delta BG_d^p)_f$	$- (\Delta BG_d^p)_{bk}$	$+ \Delta BG^e$	$+ \Delta BG^e - \Delta BG_d^p$
Change in bank loans	$+ (\Delta L_d^p)_h$	$+ (\Delta L_d^p)_f$	$- \Delta L^e$		$+ \Delta L_d^p - \Delta L^e$
Column Sums	0	0	0	0	0

The government sector includes both the Treasury and the monetary authority.

Godley (1996) uses a similar kind of matrix in which all variables are *ex post* ones. In an *ex post* mode, the funds received by one sector in a transaction exactly equal the funds paid out by another. For example, *ex post* wages paid out by firms ($-W_f$) are identical to those received by households ($+W$) or *ex post* consumption expenditures by households ($-C$) exactly equal the sale of consumption goods by firms ($+C$). Thus *ex post* row sums are always zero. However, in an *ex ante* mode such exact equalities need not hold since the wages *planned* by firms ($-W_f^p$) need not match the wages *expected* by households ($+W_h^e$). This difference between *ex ante* and *ex post* was explicitly recognized by Buiter (1980) who, however, restricted it to planned and expected dividends. The implication is that in the aggregate discrepancies are likely to arise between planned, expected, and variables. This, in fact constitutes the basis of disequilibria in Shaikh's framework.

The assumption that *ex ante* sources and uses of funds of each sector are internally consistent can be imposed by the requirement that columns sum to zero. However rows add to to zero when all cross-sectoral expectations are exactly correct. This is the situation when the wages planned by firms ($-W_f^p$) exactly equal the wages expected by households ($+W_h^e$) or the consumption planned by households ($-C_h^p$) exactly equals the consumption demand expected by firms ($+C_f^e$) (Shaikh, 1997d).

For households, firms, and government columns sum to zero since total uses - total income = total external funds for each of these sectors. These external funds are bank loans for households and firms and bonds plus high powered money for government. But for banks, caution needs to be exercised in writing an *ex ante* budget restraint since from the endogenous money perspective the supply of credit is not determined by such a restraint. That is, this particular source of funds is not restrained in any direct technological sense by the other inputs into the banking firm. Godley (1996) and Taylor (1997) introduce the banking sector into the SAM by assuming that bank net worth equals zero. One advantage of this is that it converts the balance sheet *identity* assets = liabilities + net worth into a *constraint*. The problem with this assumption is that at best it is a special case but is not consistent with the banking models of a number of post-Keynesian authors who treat the banking firm as a profit-making entity (Rousseas, 1985; Moore, 1988; Wray, 1990; Palley, 1996). Moreover the zero net worth assumption reduces banks to mere passive entities, a view that is inconsistent with the literature that has discussed the aggressive nature of bank lending (Minsky, 1982a; Darity and Horn, 1988; Wray, 1990).

To deal with the problem of the banking sector it is proposed for analytical purposes that it has a dual identity: *banks-as-businesses* and *banks-as-banks*. The former role describes the normal activities of the banking firm which implies that the sum total of its sources and uses of funds has to equal zero, as with non-banking firms. Thus in this role the bank can be represented by a budget restraint:

Sources = Uses

1. $[i_L(L_{t-1}) + i_b(BG_{t-1}^{e})_{bk} + i_b(BP_{t-1})_{bk} - \delta(EQ_{t-1}^{p})_{bk} - i_d(D_{t-1}) - i_{dw}(BR_{t-1}^{e})] + (EQ^{e})_{bk}$
$= T^{p}_{bk} + (I_d)_{bk} + w.(N_d)_{bk}$

The term in brackets groups together the income earned by banks net of all interest and dividends paid.

The role of banks-as-banks has to do with those kinds of activities that specifically distinguish banks from other sectors. These activities pertain to the supply of deposits and loans, borrowing from the discount window and maintaining an adequate level of reserves. From the endogenous money framework, the provision of loans is not related in some mechanical fashion to reserves (as in the exogenous money approach) but is determined by banks' desired balance sheet liquidity (Wray, 1990; Pollin, 1991; Palley, 1996). One would therefore not expect the variables corresponding to banks-as-banks to be part of a budget restraint since they are in the final instance determined by other factors such as the desired balance sheet liquidity, the pace of accumulation etc. Our next step is to show that these variables are related to one another via a particular relationship which is derived by taking into account not only the *forms* in which money is kept (currency plus a broad range of deposits) but also the *sources* of money.

The change in money supply

2. $\Delta M_s = \Delta L^{//} + \Delta H^{//}$

where $\Delta H^{//} = \Delta H - \Delta BR$ = exogenous component of the money supply, BR = borrowed reserves (discount window loans), $\Delta H = \Delta C + \Delta R$, and $\Delta L^{//}$ = aggregate bank credit to public and private sectors. In other words, the exogenous increase in the money supply equals the aggregate injection of base *net* of discount window loans. This exogenous component is the net resultant of fiscal and monetary policies and corresponds to the net purchase or sale of government bonds by state institutions (comprising the Treasury and the central bank). It turns out that the expression for the aggregate money stock $M_s = L^{//} + H^{//}$ allows us to introduce a relationship which constitutes the *differentia specifica* of the banking sector.

The change in aggregate loans extended by banks is

3. $\Delta L^{//} = \Delta L + (\Delta BG_{bk} + \Delta BP_{bk})$

in which the first term on the right is new bank credit to the private sector and the second term in parentheses is the purchase of government and corporate bonds out of commercial bank excess reserves. Let the form in which money exists be $M_s \equiv C + D$ = currency + non-interest and interest bearing deposits Then in a closed economy, the aggregate change in money supply is given by

4. $\Delta M_s \equiv \Delta C + \Delta D = \Delta L + (\Delta H - \Delta BR) + \Delta BG_{bk} + \Delta BP_{bk} = \Delta L + \Delta H^{//} + \Delta BG_{bk} + \Delta BP_{bk}$

This equation identifies the sources of money supply in a closed economy. The two bond purchases out of commercial bank excess reserves essentially involve the monetization of those reserves since these purchases increase the money stock. However, this monetization does not entail any increase in aggregate base. For simplicity, it will be assumed that *all* bonds purchased by banks are done so through excess reserves. Therefore,

5. $\Delta M_s \equiv \Delta C + \Delta D = (\Delta H - \Delta BR) + \Delta L + \Delta BG_{bk} + \Delta BP_{bk} = \Delta H^{//} + \Delta L^{//}$

Writing the money supply in terms of its sources enables us to derive an expression that captures a particular relationship between loans, deposits and reserves.
Since $\Delta M_s = \Delta L^{//} + \Delta H^{//}$ it follows that:

6. $\Delta C + \Delta D = \Delta L + \Delta BG_{bk} + \Delta BP_{bk} + \Delta H - \Delta BR$

$= (\Delta L + \Delta BG_{bk} + \Delta BP_{bk}) + \Delta C + (\Delta R - \Delta BR)$

7. $\therefore\ \Delta D = (\Delta L + \Delta BG_{bk} + \Delta BP_{bk}) + (\Delta R - \Delta BR) = \Delta L^{//} + (\Delta R - \Delta BR)$

In other words, in terms of plans and expectations,

8. $\Delta D^{e} = [\Delta L^{e} + (\Delta BG_{d})_{bk} + (\Delta BP_{d})_{bk}] + (\Delta R_{d} - \Delta BR^{e})$

This is a crucial result that relates the key operational variables of banks-as-banks to each other. The term ΔBR^{e} is the expected increase in bank reserves through discount window borrowing from the central bank, i.e. it is the expected sale of this particular asset by banks to the central bank. *No assumptions about bank net worth were made in deriving this result.* As shown in Appendix A, Brunner and Meltzer (1990) derive a similar result but by assuming that bank net worth equals zero.

Eliminating the relationship represented by equation 8 from the banking column would leave the budget restraint of banks-as-businesses which was derived above. The combination of this budget restraint (equation 1) and equation 8 ensures that the column sum of the banking sector equals zero.

We next turn to fiscal and monetary policies. The Treasury has basically three sources which it can use to finance its deficit (Ritter and Silber, 1991). The impact on high-powered money and the money supply depends on who buys the government bonds: (a) if either the non-bank public or banks with zero excess reserves buy the bonds then both the money supply and the high-powered money remain unchanged; (b) if banks with excess reserves buy the bonds, the money supply expands though there is no change in high-powered money and (c) if the central bank buys the bonds[9], there is an expansion of both the money supply and high-powered money. Note that the purchase of bonds by the central bank is "the modern-day equivalent of printing money to finance a deficit,"(Ritter and Silber, 1991, p. 262)[10].

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[9] In the U.S. the Fed does not *directly* buy securities from the Treasury. Instead, the Federal Reserve banks act as the Treasury's fiscal agent and hold auctions at which they bring newly issued bonds to the market. Securities dealers buy the newly issued Treasury bonds. In pursuit of its monetary policies the Fed could decide to buy back some of these securities from the dealers by issuing money (Ritter and Silber, 1991).

[10] However, under existing institutions in the U.S., it is the prerogative of the Fed in deciding how much of the Treasury debt it should monetize. This relative independence of the Fed in pursuing monetary policy was

For the sake of completion we should also mention what the effects on the money supply and high powered money would be because of the monetary policies of the central bank. The latter alters the quantity of high powered money through its open market operations and discount window loans. Some of these actions also affect the aggregate money supply. Thus the purchase of bonds from the nonbank public injects high powered money and expands the money supply. The purchase of bonds from commercial banks increases high powered money (by expanding bank reserves) and not necessarily the money supply. Finally, bank reserves can expand from discount window loans though again this may have no effect on the money supply. Note that from a neoclassical perspective, any expansion of bank reserves automatically leads to an expansion of money via the money multiplier (Mishkin, 1995).

The government budget restraint is given by:

9. $$(G - T) = \Delta M_G + \Delta BN_G$$

where $\Delta M_G = \beta(G - T)$ is the monetized portion of the budget deficit and consists of the money "printed" to finance the budget deficit $H^{//}$ and that which originates from banks' purchase of government bonds out of excess reserves. The portion of ΔM_G which originates from central bank borrowing directly injects new high powered money and expands the money supply. This is called "government money creation" (Burdekin and Langdana, 1992, p. 3). Note that β is a variable that is inclusive of the fiscal and monetary policies of the Treasury and the central bank respectively. Thus the above equation is the net injection of money and bonds from the joint interaction of fiscal and monetary policies. It is assumed that β is a policy variable and is positively related to the interest rate on bonds which is approximately the same as the interest rate on bank loans:

10. $$\frac{d\beta}{dt} = \beta' = \beta(i) \qquad \text{where } \frac{\partial\beta}{\partial i} > 0$$

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established after the Treasury-Federal Accord of 1951.

In other words, the higher is the interest rate on the government's loans from the private sector, the more it will monetize the deficit.

$H^{//}$ = part of the deficit that is financed through central bank borrowing ("printed" money) and $L^{//}$ = aggregate bank credit = $L + (BP_d)_{bk} + (BG_d)_{bk}$ where $L + (BP_d)_{bk} = D_B$ is bank credit to the private sector and $(BG_d)_{bk} = D_G$ is bank credit to the government (purchased out of bank excess reserves). Since $M_G = H^{//} + D_G$ = money created to finance the budget deficit, $L^{//} = L_h + L_f + (BP_d)_{bk} + (BG_d)_{bk}$ = aggregate bank credit, and $L_f + (BP_d)_{bk} = D_B$ = aggregate bank credit to businesses it follows that the aggregate stock of money M_s can equivalently be written as

11. $$M_s = H^{//} + L^{//} = [H^{//} + (BG_d)_{bk}] + [L_f + (BP_d)_{bk}] + L_h = M_G + D_B + L_h$$

From Appendix A, the expression for aggregate excess demand E is derived:

12. $$E = (I^p - S^p) + (G^p - T^e)$$

Appendix A also shows how the *ex ante* SAM can be used to derive an aggregate budget restraint for the economy and thereby relate excess demand to its sources of finance. We repeat here just the principal results. Assuming zero expectational errors (at least in the short run)

13. $$E = [\Delta H^p - (\Delta C_d + \Delta R_d)] + (\Delta BR^e - \Delta BR_d) + (\Delta D^e - \Delta D_d) + (\Delta L_d - \Delta L^e) = \Delta H^p + \Delta L_d - (\Delta C_d + \Delta D_d) - \Delta R_d + (\Delta D^e - \Delta L^e) + (\Delta BR^e - \Delta BR_d)$$

But since $\Delta D^e - \Delta L^e - \Delta R_d + \Delta BR^e = (\Delta BG_d)_{bk} + (\Delta BP_d)_{bk}$

14. $$E = (\Delta H^p - \Delta BR_d) + \Delta L_d + (\Delta BG_d)_{bk} + (\Delta BP_d)_{bk} - (\Delta C_d + \Delta D_d)$$

Thus,

15. $E = (I_d - S^p) + (G_d - T^e) = (\Delta H^p - \Delta BR_d) + [\Delta L_d + (\Delta BG_d)_{bk} + (\Delta BP_d)_{bk}] - (\Delta C_d + \Delta D_d) = \Delta M_s - \Delta M_d$

This equation shows that the private sector and the government budget deficits are financed by the injection of bank credit, the injection of bank excess reserves, through the "printing" of money (i.e. the sale of bonds to the Fed) and via the running down of the money reserves of the non-bank private sector. This last source of finance was discussed by Earley, Parsons and Thompson (1976) and is also a line of argument that can also be found in the classical and post-Keynesian (Sawyer, 1985) traditions.

If ΔM_d is the private sector's desired change in money reserves relative to whatever the initial stock of money was then $\Delta M_d = M_d - M_{s0}$ and if ΔM_s = change in money stock relative to its initial level $= M_s - M_{s0}$ then $\Delta M_s - \Delta M_d = M_s - M_d$. Then the *fundamental equation of finance* (Shaikh, 1989, 1996d) in this extended model becomes

16. $E = M_s - M_d$

We will now turn to a formalization of the CGC model. Given the complexity of the system of nonlinear differential equations, we will make the simplifying assumption that firms are the only private sector entities that borrow from banks. This is not to imply that household debt is unimportant. However, following the classical tradition, this assumption makes firms the driving force of accumulation and therefore places them at the core of the CGC model.[11]

The government budget restraint from Table 1 is given by:

9 $(G - T) = \Delta M_G + \Delta BN_G$

We next turn to the financing needs of businesses. From the aggregate budget restraint $E = M_s - M_d$, so that

[11] Neoclassical economists would disagree with this since households constitute the point of departure of neoclassical macromodels (McCafferty, 1990).

15. $E = \Delta M_s - \Delta M_d$

From equations 9 and 12,

16. $(I - S) + (G - T) = \Delta D_B + \Delta M_G - \Delta M_d$

Therefore

17. $\Delta D_B = (I - S) + (G - T) - (\Delta M_G - \Delta M_d)$

But given equation 9

18. $\Delta D_B = (I - S) + (\Delta BN_G + \Delta M_d) = I - [S - (\Delta BN_G + \Delta M_d)]$

Therefore,

19. $\Delta D_B = I - [S - (\Delta M_d + \Delta BN_G)]$

The economic meaning of this equation is as follows. Aggregate total savings S is the sum of business retained earnings and household savings. A portion of aggregate savings is set aside to add to money reserves (ΔM_d) and another portion (ΔBN_G) to purchase government bonds. It is the remaining part of S which is available to finance investment. The excess of planned investment over the actually available savings determines the gap that must be filled by businesses through net new borrowing ΔD_B[12].

Abstracting from household credit the aggregate stock of money M_s as discussed

[12] Note that negative borrowing is essentially the reduction of existing bank debt.

above is

20. $$M_s = H'' + L'' = M_G + D_B$$

In terms of ratios to output

21. $$m_s = m_G + d_B$$

As discussed earlier, the demand for money is a demand for buffer stocks (Coghlan, 1981; Laidler, 1991). This stock of money reserves is stored in the form of cash and non-interesting bearing deposits, i.e., as narrow money.

22. $$m_d = m_d(i) \qquad \frac{\partial m_d}{\partial i} < 0$$

Internal finance available to the firm at time t is X_t and is given by

23. $$X_t = \text{(realized profit at time t)} - \text{(debt service at time t+1)} = (P+E)_t - F_{t+1}$$
$$= (P+E)_t - (1+i)D_{B(t+1)}$$

Accumulation of circulating capital investment is assumed to be proportional to the excess of firms' internally available finance at time t over potential profits at the beginning of time period t (Shaikh, 1990)[13] :

24. $$\left(\frac{I_c}{P}\right)_{t+1} - \left(\frac{I_c}{P}\right)_t = h\frac{[(P+E)_t - (1+i)D_{B(t+1)} - P_t]}{P_t} = h\frac{[E_t - (1+i)D_{B(t+1)}]}{P_t}$$

where h > 0. Therefore, in continuous terms[14]

[13] Note that $(1+i)D_{B(t+1)} = (1+i)\Delta D_{B(t+1)} + (1+i)D_{Bt}$ where the first term on the right-hand side represents the interest payments on net new debt incurred in the time period between t and t+1 and the second term is the interest payment on the stock of debt incurred at time t.

[14] The prime represents the time derivative.

25. $a_c^{/} = h[e - (1+i)d_B - (1+i)\frac{D_B^{/}}{P}]$

This equation shows that the rate of change of a_c is positively related to e and negatively related to d_B and the interest rate i. Models in the Keynes/Kalecki tradition do not have a growth function such as equation 25. As in the CGC model, firms in the Keynes/Kalecki tradition respond to the stimulus generated by the budget deficit by increasing investment and bank credit liberates new investment plans from available savings. This is implicit to the post-Keynesian models that investigate the impact of fiscal policy (Pasinetti, 1995; Palley, 1997). However, what this literature omits to account for is the disciplining effect of debt and the subsequent negative feedback effects on investment.

The significance of this accumulation reaction function is that it roots the "animal spirits" of firms to their net cash flow and balance sheet liquidity. Thus if any given rate of accumulation produces a level of internal finance above potential output, firms will increase their accumulation rate for the next period. Conversely, if internal finance falls below potential profits the accumulation rate will fall. In other words, the "animal spirits" of firms are related to their financial strength.

This mechanism linking business investment to expectations and financial liquidity is similar to the model of Flaschel, Franke, and Semmler (1997) as well as the business cycle model of Wolfson (1994) who draws on Minsky, Wojnilower, and others. Wolfson refers to a number of business variables such as the interest coverage ratio, the debt/asset ratio, and the liquidity ratio all of which can be used to gauge the financial strength of firms.

Equation 25 has one reaction coefficient and therefore puts the stimulus to accumulate (excess demand) on the same footing, so to speak, as the factor which slows it down (debt). It would also be instructive to separate out these two opposing components of the accumulation function and assess the impacts of each of them separately:

26. $a_c^{/} = h_1 e - h_2[(1+i)d_B + (1+i)\frac{D_B^{/}}{P}]$

This more general form of the accumulation reaction function will enable us to investigate the post-Keynesian relationship which relates exogenous demand injections to short-run increases in output and employment. Relationships such as equations 25 and 26 are absent in the Keynes/Kalecki tradition (Taylor, 1985, 1991; Palley, 1996).

The expansion in output is related to investment in circulating capital via the input-output coefficient μ. Thus the growth rate of output is related to the share of circulating capital a_c by

27. $$\frac{P'}{P} = \mu a_c$$

The equation system 25 or 26 and 27 are the key ones desribing the short-run dynamics of the model and constitute the *classical* features of the model since they relate the expansion of output to investment in circulating capital. The feedback links between excess demand, debt, and investment in circulating capital which they describe are absent in the fiscal policy literature (Blinder and Solow, 1973; Tobin and Buiter, 1976; Nguyen and Turnovsky, 1983;Tobin, 1980; Tobin and Buiter, 1980; Godley and Milberg, 1994; Godley and McCarthy, 1996; Taylor, 1985, 1991, 1997).

Drawing on the endogenous money tradition following Minsky (Dow and Dow, 1989; Wray, 1990, 1995; Shaikh and Moudud, 1996), the CGC model has an endogenous interest rate that is a function of the pace of accumulation and banks' desired and actual liquidity ratios[15]:

27. $$i' = -je$$

We now turn to a discussion of the economic meaning of the reaction coefficient j.

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[15] Following the terminology of Eckstein and Sinai (1986) with regard to the different phases of the cycle, in the *accumulation* phase (early-mid expansion) growth is robust and banks eagerly supply credit. The *pre-crunch* period (mid-late expansion) is characterized by a progressive squeeze of liquidity of all sectors. Moreover, this is the phase in which unit labor costs tend to rise faster than prices so that profit margins of businesses get squeezed (Klein and Moore, 1982; Shaikh, 1992). The *crunch* phase is the crisis period and the *reliquefication* phase is the recovery stage.

Over the course of the business cycle, the interest rate varies with the demand for and supply of credit. The demand for credit is determined by the pace of accumulation (Moore, 1988; Wray, 1990) whereas the supply of credit is determined by how illiquid banks want their balance sheets to become (Dow and Dow, 1989; Wray, 1990). As discussed below, one measure of balance sheet liquidity is the reserves/loan ratio, which is a function of banks' profit expectations.

Higher levels of credit demand put an upward pressure on the interest rate. However, the extent of this pressure depends on banks' *desired liquidity ratio* $\lambda_{des} = (R/L)_{des}$ where R = bank reserves and L = bank loans[16]. If λ_{des} is high relative to the *actual liqudity ratio* $\lambda_{act} = (R/L)_{act}$ banks will be reluctant to extend credit. In other words, if compared to their actual liquidity ratio, banks desire to hold a greater stock of liquid reserves relative to the stock of loans (one of their more illiquid income-earning assets), their restrictiveness in extending credit will be high and consequently the interest rate charged on loans will also be high. Conversely, a low λ_{des} relative to λ_{act} indicates that bank balance sheet liquidity is high compared to the level of liquidity that they desire. Thus banks will be willing to extend the stock of loans relative to their liquid reserves so that the interest rate will be low. From this discussion the reaction coefficient j is a function of the difference between these two liquidity ratios:

28. $$j = j_0(\lambda_{act} - \lambda_{des}) \qquad j_0 > 0$$

In this equation λ_{des} is determined by bank profit expectations and therefore ultimately by loan defaults, given all other running costs of the banking firm. Thus $\lambda_{des} = \lambda_{des}(\delta^e)$ where $\frac{\partial \lambda_{des}}{\partial \delta^e} > 0$. A higher degree of the expected rate of default δ^e will raise λ_{des} relative to λ_{act}. This will lower j and exercise a greater upward pressure on the interest rate for a given value of e. As $(\lambda_{act} - \lambda_{des})$ decreases, banks will be willing to extend credit at progressively higher interest rates. That is, the higher interest rates compensate banks for the opportunity

[16] A number of authors have written about the significance of bank balance sheet liquidity in the determination of the supply of credit (Minsky, 1982; Dow and Dow, 1989; Wray, 1990; Shaikh and Moudud, 1996). Balance sheet liquidity can be gauged from the ratio of some of the most liquid assets to the most illiquid earning assets.

cost of holding the high desired liquid reserves relative to loans. In the limit, if $\lambda_{act} < \lambda_{des}$ then $j < 0$ and $i' > 0$ when $e > 0$.

This linkage between default risk, profit expectations, balance sheet liquidity and interest rate changes has been discussed by a number of authors in the literature (Dow and Dow, 1989; Wray, 1990; Wolfson, 1994). Darity and Horn (1988) discuss the positive impact of the growing default risk of Third World countries on the interest rates charged by international banks.

The actual liquidity ratio $\lambda_{act} = (R/L)_{act}$ will be partially determined by the actual pace of accumulation and partially by monetary policy. The former will determine the stock of loans and the latter the stock of bank reserves. Therefore, in terms of the cyclical variation of the interest rate discussed above, the extent of interest rate fluctuation will be a function of the default risk on loans, monetary policy and the pace of accumulation since all three variables determine the function $j_0(\lambda_{act} - \lambda_{des})$ and thus the magnitude and sign of the coefficient j. For example, *ceteris paribus,* a higher expected default risk and/or more restrictive monetary policy with a given value of e will generate more sharp increases in the interest rate.

The above model has some interesting implications for fiscal and monetary policies and, as discussed in Moudud (1998b), for foreign flows. A rise in (g - t) has two effects. On the one hand, it raises excess demand and therefore the demand for credit. We will call this the *credit demand pull effect.* On the other hand, to the extent that the budget deficit is partially monetized and partially bond financed, the rise in (g - t) injects some additional high-powered money into the system and expands the reserves of the banking system. This is the *liquidity effect.* Given the default risk, and therefore λ_{des}, should the demand pull effect dominate the actual liquidity ratio λ_{act} will fall, and make j more negative: the deficit will put greater upward pressure on i. On the other hand, if the liquidity effect dominates λ_{act} will rise and attenuate the increase in the interest rate from the deficit. But as long as $\lambda_{des} > \lambda_{act}$ the reaction coefficient j will be negative so that the budget deficit rise will raise the interest rate.

But suppose the rise in the budget deficit is accompanied by expansionary monetary policies. If the liquidity effect dominates to the extent that the actual liquidity ratio exceeds the desired liquidity ratio so that $j > 0$, the interest rate after the rise in the deficit will fall relative to its earlier level.

Finally, to the extent that the central bank pursues accommodationary monetary policies (Moore, 1988) the difference $j = 0$ will be constant and the rise in the deficit will have no impact on the equilibrium interest rate. This is a horizontalist result (Moore, 1988) and is implicit to the constant interest rate assumption in Shaikh (1989).

This discussion leads to two conclusions. First, the kind of monetary policy matters in determining what the impact of a rise in (g - t) on the equilibrium interest rate will be. This conclusion is consistent with Buiter (1977) and Nguyen and Turnovsky (1983) although their discussion is within the context of the ISLM framework and exogenous money. Second, the above discussion confirms that the impact of the budget deficit on the interest rate is an ambiguous one, a conclusion that is confirmed by the empirical literature (see Arora and Dua, 1993, for a review of the literature). Using a different mechanism, Taylor (1985) also demonstrates the ambiguous link between the budget deficit and the interest rate.

Given the government budget restraint, equation 11, and the business budget restraint, equation 19, we get

29. $$\Delta D_B = E - (\Delta M_G - \Delta M_d) = E - (\Delta M_\sigma - \Delta M_d)$$

where $M_\sigma = M_G$ = money creation from budget deficit[17]. But $\Delta D_{Bt} = D_{Bt} - (1+i)D_{B(t-1)}$ so that

30. $$D_{Bt} = (1 + i)D_{B(t-1)} + E - (\Delta M_\sigma - \Delta M_d)$$

In continuous terms

[17] The new variable M_σ has been defined as a general variable that includes all injections of money that are not due to bank credit. In the open economy model M_σ also includes the additions to the domestic money supply from the balance of payments.

31. $D_B^{/} + D_B = (1+i)D_B + E^{/} + E - (M_\sigma^{/} - M_d)$

Dividing through by P

32. $\frac{D_B^{/}}{P} + d_B = (1+i)d_B + \frac{E^{/}}{P} + e - (\frac{M_\sigma^{/}}{P} - m_d)$

Making substitutions of the form $e^{/} = \frac{E^{/}}{P} - E.\frac{P^{/}}{P^2}$ and simplifying we get

33. $d_B^{/} = (e^{/} - m_\sigma^{/} + m_d^{/}) + id_B + e + (e - d_B - m_\sigma + m_d)\frac{P^{/}}{P}$

Written as shares of output equation 12 becomes

34. $e = (a_c + a_f - s) + (g - t)$

Therefore

35. $\frac{P^{/}}{P} = \mu a_c = \mu[e - a_f + s - (g - t)] = \mu(e + d)$

where $d = s - a_f - (g - t)$ and $s - (g - t) = s^*$ is the *social savings rate* (Shaikh, 1992). If in the short run d is a parameter then $e^{/} = a_c^{/}$ and using equation 23 we obtain the following two nonlinear differential equations that characterize the fast adjustment process:

36. $e^{/} = h[e - (1+i)d_B - (1+i)\frac{D_B^{/}}{P}]$

37. $d_B^{/} = (e^{/} - m_\sigma^{/} + m_d^{/}) + (1+i)e + (\mu d - i)(e - d_B - m_\sigma + m_d)$
$+ \mu e(e - d_B - m_\sigma + m_d) + i(m_d - m_\sigma)$

The slow dynamic of the system is based on the degree of capacity utilization and investment in fixed capital a_f:

$$38. \quad \frac{a_f^{/}}{a_f} = k(u-1) \qquad k>0$$

In other words, investment in fixed capital increases when the capacity utilization rate is above the normal rate. Equations 36, 37, and 38 capture the interaction process between the short-run business cycle and the medium-run warranted growth path.We finally turn to some key simulations that highlight the role of the excess demand variable as well as some of the classical features of the model. Figure 1 shows that a rise in the budget deficit raises excess demand and business debt.

Note that the cyclical comovements of excess demand and debt are persistent macroeconomic features (Shaikh, 1989) since they reflect the investment decisions of firms operating in an uncertain environment. The above figure shows the additional stimulus that is given to the system when the budget deficit rises.

Figure 2 shows the warranted path of growth with fluctuation of capacity utilization around the normal level. Note that this growth path corresponds to a given level of the budget deficit. In other words, growth of output is not predicated on the growth of exogenous demand g = G/P but is rather internally generated by profitability.

Finally, Figure 2 underscores the crucial role of the rate of profit. Curve A corresponds to a higher rate of profit than Curve B. Since the rate of profit is ultimately determined by income distribution and technology in the classical tradition, any factor which influences these will also alter the growth rate of output and employment.

Following the classical tradition the rate of profit in the CGC model is a key variable that *drives* investment spending. Thus, in contrast to the Keynes/Kalecki tradition, the path of accumulation of the system is fundamentally regulated by the rate of profit. From a policy standpoint, increases in productivity growth relative to wage growth, a rise in the turnover time of capital, and other measures to increase long run profitability will have the effect of

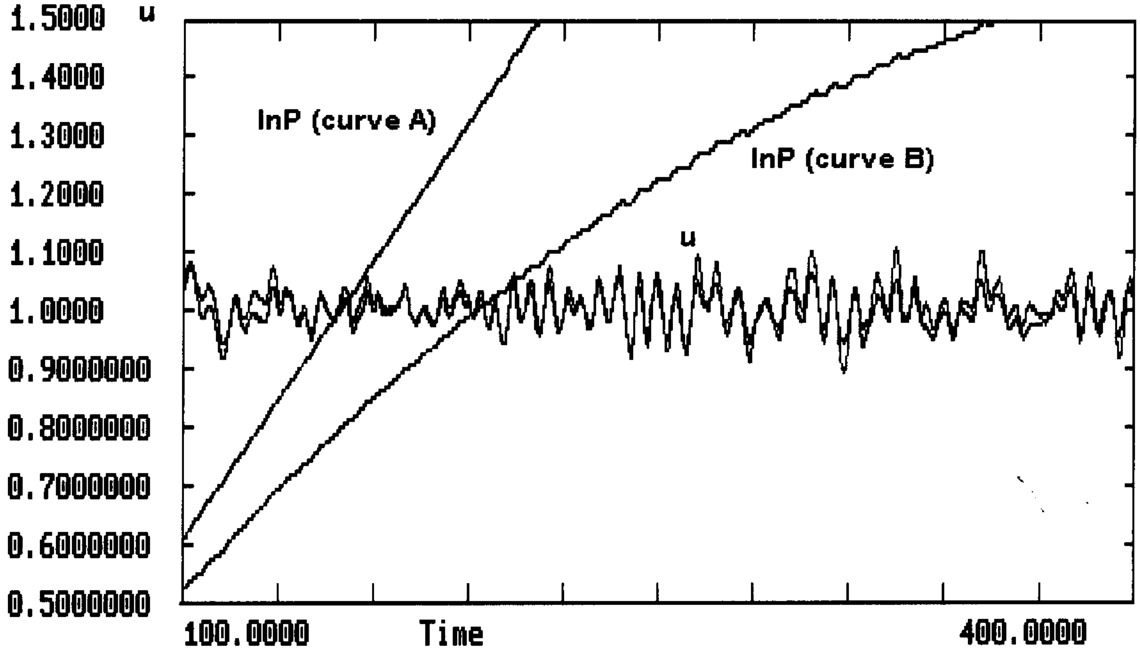

Figure 2. Normal Capacity Utilization and the Warranted Growth Paths at Different Rates of Profit

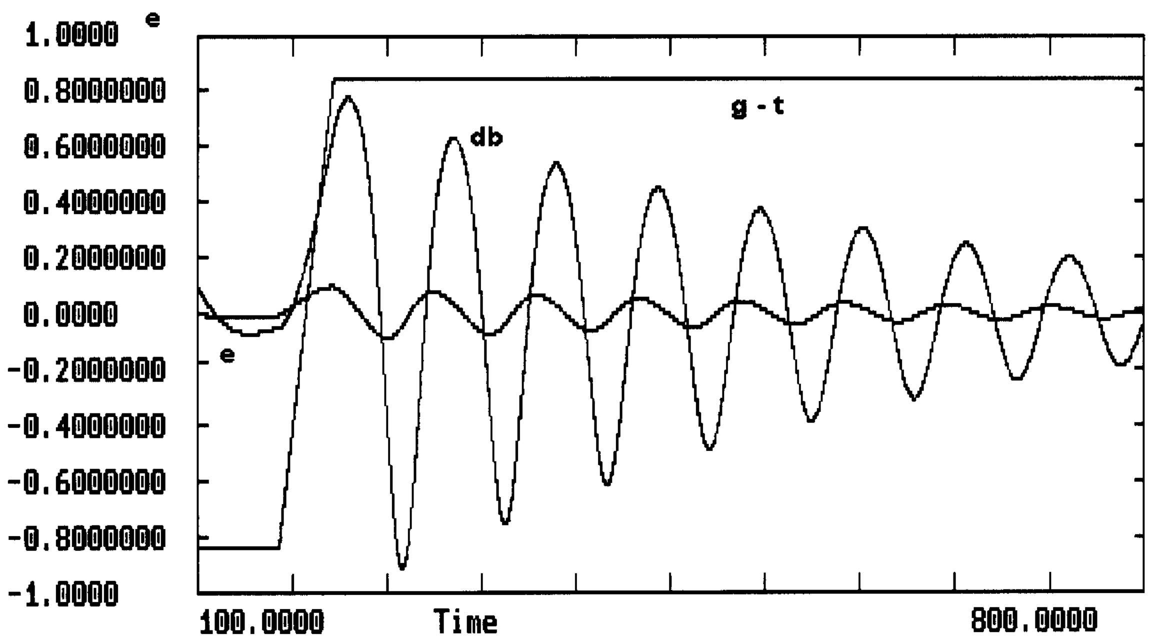

Figure 1. The Effect of an Increase in the Budget Deficit on Excess Demand and Business Debt

raising the warranted growth rate.

The importance of the rate of profit is formally shown as follows. Let I = S + (T - G) = sP + (T - G) where actual profits $P = uP_n$ and P_n = normal profits. Assuming a balanced budget[18],

40. $I = suP_n$

Dividing through by the aggregate capital stock K

41. $g = \frac{I}{K} = su\frac{P_n}{K} = sur_n$

where g = growth rate, and r_n = normal rate of profit. If following the classical tradition $u_n = 1$ over the long run then the warranted rate of growth g_w becomes

42. $g_w = sr_n$

Thus the warranted rate of growth is regulated by the normal rate of profit which in the classical and Sraffian tradition is determined by technology and income distribution (Kurz and Salvadori, 1995). It therefore follows that at the most fundamental level the CGC model does not depend on exogenous demand-related factors such as government spending to bring about growth (see Shaikh, 1989).

III. *Conclusion*

The classical theory of effective demand that underpins the CGC model is the framework developed by Shaikh (1989). Shaikh's classical model is distinct from the two major traditions in economics, which assume either that aggregate supply generates its own demand (Say's Law and neoclassical models) or that the system is demand-constrained

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[18] The balanced budget assumption is made to underscore the fundamental role of the rate of profit in the determination of the warranted path.

(models in the Keynes/Kalecki and stagnationist traditions). In fact this model follows the classical tradition in which both aggregate demand and supply are regulated by more fundamental factors, notably the rate of profit (Kenway, 1980; Foley, 1983). The turbulent and dynamical system ensures that aggregate demand and supply fluctuate around an endogenously generated growth path (Bleaney, 1976; Shaikh, 1978; Garegnani, 1979).

Models in the stagnationist and post-Keynesian traditions (Taylor, 1985, 1991; Lavoie, 1995; Palley, 1996) are essentially static in the classical and Harrodian sense (Kregel, 1980) since they begin with a given short-run level of output which is established from the savings-investment balance, I + G = S + T. Thus, implicitly in these models investment in circulating capital is zero and growth becomes a long-period phenomenon caused by exogenous factors. These factors include the degree of monopoly and technological change (Kalecki, 1965; Taylor, 1985, 1991), the structure of labor markets, demand-determining policies or expectations (Palley, 1996) . Authors in other theoretical traditions also rely on exogenous factors to explain growth. For example the model of Foley (1985) depends on the exogenous growth of money while Goodwin (1986) bases his growth and cycles model on population growth and technical change.

The fundamental equation of finance $e = (a_c + a_f - s) + (g - t) = m_s - m_d$ is the key dynamical relationship that describes the CGC model. It links the two sources of demand in a closed economy to their finance requirements. Excess demand is fueled by the excess of monetary injection m_s over monetary leakage m_d and is responsible for both the cyclical dynamics and the growth path of the system. In other words, the condition $e \approx 0$ does not correspond to a level of but rather to a path of output. The path of output is itself regulated by the rate of profit.

The key distinction between the CGC model and the heterodox literature lies with the role of circulating capital investment in the former. This is the feature that makes it a dynamic model. Aggregate excess demand leads to an expansion of output which takes place via the accumulation reaction function 25 (or 26) and the classical input-output relation 27. This is a process that is fueled by bank credit which attenuates the expansion as business debt rises.

Thus in this model the proportion of profit that is devoted to the expansion of output responds positively to excess demand and negatively to debt. This dynamic produces short-run cycles around a growth path. In the medium run, the proportion of output that is used to increase capacity (via fixed capital investment) rises if capacity utilization is above normal and falls if capacity utilization is below normal capacity. In other words, the model generates two cycles, one of which represents imbalances between aggregate demand and supply and the other represents discrepancies between actual and normal capacity utilization.

The model's consistent stock-flow accounting with "no black holes" (Godley, 1998) along with its internally-generated growth process locates it in the broad tradition of Quesnay's *Tableau Economique*, Marx's reproduction schema, the von Neumann growth model, and Harrod's warranted growth path analysis. The endogenous business cycles and debt dynamics are very much in the tradition of Kalecki and Minsky.

While the rate of profit remains the ultimate regulator of the path of accumulation, the question is what impacts do fiscal policy and foreign trade have on both growth and cycles? In the above simulations, the impact of fiscal policy on the warranted path has been deliberately side-stepped as it depends on the composition of government spending. These issues along with policy implications are formally investigated in a series of forthcoming papers (Moudud, 1998b, 1998c).

APPENDIX A

Ex Ante Social Accounting Matrix in a Closed Economy with the Government Sector

1. Note that the row sum of the last column (ex ante gaps) will not be zero unless the row sum of every other column is zero. For households, firms, and government the row sum = 0 implies total uses - total income = total external funds (bank loans for HH and firms and bonds plus high powered money for government). But for banks, this does not hold directly. The separately derived aggregate constraint $M = L^{//} + H^{//}$ must be added in here.

A1.1 $\Delta M_s \equiv \Delta Cu + \Delta D = \Delta L + (\Delta H - \Delta BR) + \Delta BG_{bk} + \Delta BP_{bk}$

$= \Delta L + \Delta H^{//} + \Delta BG_{bk} + \Delta BP_{bk}$

The change in money supply $\Delta M_s = \Delta L^{//} + \Delta H^{//}$, where $\Delta H^{//} = \Delta H - \Delta BR$, BR = borrowed reserves (discount window loans), and $\Delta H = \Delta Cu + \Delta R$. The change in aggregate loans extended by banks is $\Delta L^{//} = \Delta L + \Delta BG_{bk} + \Delta BP_{bk}$ in which the first term on the right is new bank credit to the private sector (which directly creates new money as in the endogenous money literature) and the second and third terms are respectively the purchase of government and private bonds out of bank excess reserves. For simplicity, it will be assumed that only *all* government bonds purchased by banks are done so through excess reserves Note that M_s comprises demand and time deposits, i.e. it is "broad money". Thus

A1.2 $\Delta D = \Delta L + \Delta BG_{bk} + \Delta BP_{bk} + \Delta R - \Delta BR$

or

A1.3 $\Delta D^{e} = [\Delta L^{e} + (\Delta BG_{d})_{bk} + (\Delta BP_{d})_{bk}] + (\Delta R_{d} - \Delta BR^{e})$

This is a crucial result that describes the behavior of banks in their role of *banks-as-banks* as discussed below. The term ΔBR^{e} is the expected increase in bank reserves through discount window borrowing from the central bank, i.e. it is expected sale of this particular asset by banks to the central bank.

In operational terms one can analytically distinguish *banks-as-banks* from *banks-as-businesses.* The former role has to do with the those kinds of activities that specifically distinguish banks from other sectors. These activities pertain to the supply of deposits and loans, borrowing from the discount window and maintaining an adequate level of reserves. From the endogenous money framework, the provision of loans is not related in some mechanical fashion to reserves (as in the exogenous money approach) but is determined by banks' desired balance sheet liquidity. One would therefore not expect the variables pertaining to *banks-as-banks* to be part of a budget restraint since they are in the final instance determined by other factors (desired balance sheet liquidity, the pace of accumulation etc.). However these variables are related to one another via the equation (A1.3) which is derived by taking into account not only the *forms* in which money is kept (currency plus a broad range of deposits) but also the *sources* of money.

All the other variables in the banking sector column describe the normal activities of *banks-as-businesses* which means that the sum total of these sources and uses of funds has to equal zero, as with non-banking firms. One would thereby obtain the result that the sum total of the entire banking sector column is equal to zero.

One can use the discussion of Brunner and Meltzer (1990) to derive an equation for the money supply. Concentrating on a system comprising banks, government and the public in a closed economy the balance sheet of the consolidated banking system is

A1.4 $$L_b + vS_b = D_p + T_b - (R - A) + W_b$$

where L_b = loans to the private sector, vS_b = bank reserves held as government debt (T-bills etc.), $D_p + T_b$ = demand and time deposits, R = reserves, A = discount window borrowing and W_b = net worth.

Now they define money as

A1.5 $M = C_p + D_p$

The source base SB is defined as

A1.6 $SB = C_p + R - A$

so that $(R - A) = SB + (D_p - M)$. Therefore,

A1.7 $L_b + vS_b = D_p + T_b - SB + M - D_p + W_b = T_b - SB + M + W_b$

Assuming that $W_b \approx 0$ (bank net worth = 0)

A1.8 $L_b + vS_b = M + T_b - SB$

Thus

A1.9 $M + T_b = L_b + vS_b + SB \Rightarrow C_p + D_p + T_b = (L_b + vS_b) + (C_p + R - A)$

If M_s is "broad" money so that $M_s = C_p + D_p + T_b$, $L^{//} = L_b + vS_b$ = aggregate bank loans to the private and public sectors and $H^{//} = C_p + R - A$ = currency + total reserves - discount window borrowing then we obtain

A1.10 $M_s = L^{//} + H^{//} \Rightarrow \Delta M_s = \Delta L^{//} + \Delta H^{//}$

which is the same result as the one above. But note that we did not make any assumptions about bank net worth in deriving this expression for the money supply.

2. In the above matrix, the central bank has been incorporated into the government sector. Thus the injection of total high powered money ΔH^p originates from both fiscal and monetary policies. The component that arises from fiscal policy has already been described before.

Here we discuss the implications of open market operations and discount window operations on high powered money and the money supply.

In terms of its open market operations, the central bank's purchases of bonds from commercial banks and the non-bank public need to be distinguished.

1. ***Purchase of Bonds from the Non-bank Private Sector***

The sale of bonds by the non-bank public to the central bank leads to an injection of money ΔM since the checks issued by the central bank can (i) either be deposited so that deposits expand ($\Delta D > 0$) thereby expand bank reserves ($\Delta R > 0$) or (ii) encashed ($\Delta Cu > 0$). In situation (i) $\Delta M = \Delta D = \Delta R = \Delta H$ since $\Delta C = 0$ while in situation (ii) $\Delta M = \Delta Cu = \Delta H$ since $\Delta R = 0$. In situation (i) the increase in bank reserves will have further impacts, the nature of which depend on the theoretical standpoint. For monetarists, there will subsequent be a proportional increase in loans and thus the money supply. For endogenous money theorists, bank balance sheet liquidity will increase so that the interest rate will fall and banks' *desired* loan supply will increase. Note that whether the *actual* loan supply expands depends on the demand for loan and therefore on the stage of accumulation.

2. ***Purchase of Bonds from Commercial Banks***

This produces an expansion of commercial bank reserves so that $\Delta H = \Delta R$ which may produce further effects as discussed above.

Finally, discount window loans to commercial banks expands their borrowed reserves so that $\Delta H = \Delta R = \Delta BR$.

In the general case, all the above cases expand the system's high powered money while only open market operations between the central bank and the non-bank public have as their *immediate effect* changes in the money supply. The basic point is that when high powered money enters the system directly in the form of bank deposits and currency, it expands the money supply immediately. If however it does so via an increase in bank reserves, there is no reason why the money supply would increase immediately though subsequently it *may* depending on the pace of economic activity.

Finally, note that in fiscal policy operations the purchase or sale of bonds by the non-bank public has no impact on the money supply whereas in open market operations it does. On the other hand, in fiscal policy operations the purchase or sale of bonds involving commercial banks affects the money supply if these operations involve excess reserves whereas in open market operations it does not.

Since the central bank has been merged in with the government sector, the term ΔH^p is the planned introduction of high-powered money which is the net result of fiscal policy and monetary policy (open market operations + discount window loans). The deduction of borrowed reserves ΔBR^e from ΔH^p leaves the amount of high-powered money $\Delta H^{//}$ that adds to the money supply.

3. This section deals with the aggregate *ex ante* budget restraint. We first begin by deriving an expression for aggregate savings. For firms, if Y_s^e = net output, P^e = profits net of taxes, DIV^p = planned dividend payment and RE^p = planned retained earnings then

A1.11 $$Y_s^e - w.N_d - T_f^p = P^e = DIV^p + RE^p$$

For the household sector,

A1.12 $$DIV^e + w.N^e - C_d - T_h^p = S_h^p$$

Adding these two equations

A1.13 $$Y_s^e - w.N_d - T_f^p + DIV^e + w.N^e - C_d - T_h^p = DIV^p + (RE^p + S_h^p)$$

Let $T^p = T_f^p + T_h^p$ and S^p = aggregate private savings = $S_h^p + RE^p$ so that

A1.14 $$Y_s^e + w.(N^e - N_d) - T^p - C_d = (DIV^p - DIV^e) + S^p$$

Let $E = Y_d - Y_s^e = (C_d + I_d + G_d) - (C^e + I^e + G^e)$. Then

A1.15 $(C^e + I^e + G^e) - (C_d + I_d + G_d) + (T^e - T^p) + w.(N^e - N_d) = - E + (T^e - T^p)$
$+w.(N^e - N_d)$

A1.16 $Y_s^e - C_d - (I_d + G_d) + w.(N^e - N_d) = - E + (T^e - T^p) +w.(N^e - N_d)$

But from equation A1.13

A1.18 $=> (DIV^p - DIV^e) + S^p - I_d - G_d + T^e = -E + (T^e - T^p) + w.(N^e - N_d)$

A1.17 $Y_s^e + w.(N^e - N_d) - T^p - C_d = (DIV^p - DIV^e) + S^p$

where equation A1.18 is obtained by combining equations A1.16 and A1.17

A1.20 $E + (T^p - T^e) + w(N_d - N^e) + (DIV^p - DIV^e) = (I_d - S^p) + (G_d - T^e)$

A1.19 $\Rightarrow -E + (T^e - T^p) + w.(N^e - N_d) = (DIV^p - DIV^e) - [(I_d - S^p) + (G_d - T^e)]$

If the expectational error terms are approximately zero then

A1.21 $E = (I_d - S^p) + (G_d - T^e)$

From the SAM

A1.22 $\{- E + (T^e - T^p) + w.(N^e - N_d) + [\delta.(EQ_{t-1})^e - \delta.(EQ_{t-1})^p]\} + [i_b.(BG_{t-1})^e - i_b.(BG_{t-1})^p] + [i_d.(D_{t-1})^e - i_d.(D_{t-1})^p] + [i_L.(L_{t-1})^e - i_L(L_{t-1})^p] + [i_{dw}.(BR_{t-1})^e - i_{dw}.(BR_{t-1})^p] + [\Delta H^p - (\Delta Cu_d + \Delta R_d)] + (\Delta BR^e - \Delta BR_d) + (\Delta D^e - \Delta D_d) + (\Delta EQ^e - \Delta EQ_d) + (\Delta BG^e - \Delta BG_d) + (\Delta BP^e - \Delta BP_d) + (\Delta L_d - \Delta L^e) = 0$

Assuming that the expectational error terms with respect to the planned and expected income receipts are approximately zero (at least in the short run)

A1.23 $E = [\Delta H^p - (\Delta Cu_d + \Delta R_d)] + (\Delta BR^e - \Delta BR_d) + (\Delta D^e - \Delta D_d) + (\Delta L_d - \Delta L^e) = \Delta H^p + \Delta L_d - (\Delta Cu_d + \Delta D_d) - \Delta R_d + (\Delta D^e - \Delta L^e) + (\Delta BR^e - \Delta BR_d)$

But since $\Delta D^e - \Delta L^e - \Delta R_d + \Delta BR^e = (\Delta BG_d)_{bk}$

A1.24 $E = (\Delta H^p - \Delta BR_d) + \Delta L_d + (\Delta BG_d)_{bk} - (\Delta Cu_d + \Delta D_d)$

A1.25 $\Rightarrow E = (\Delta H^p - \Delta BR_d) + [\Delta L_d + (\Delta BG_d)_{bk}] - (\Delta Cu_d + \Delta D_d) = \Delta M_s - \Delta M_d$

Therefore if ΔM_d = desired change in money reserves relative to initial money stock = $M_d - M_{s0}$ then

A1.26 $E = M_s - M_d$

Note that the term $\Delta H^p - \Delta BR_d = \Delta H^{p''}$ is the net injection of high-powered money into the system originating from the government budget restraint (fiscal policy) and from open market operations of the central bank (monetary policy). It expand the money supply directly. The part that originates in the government budget restraint is also the exogenous component of the money supply and is called "government money creation" (Burdekin and Langdana, 1992, p.3). The total change in high-powered money is $\Delta H^p = \Delta H^{p''} + \Delta BR_d$.

Recall that the first term in the above equation is

A1.27 $\{- E + (T^e - T^p) + w.(N^e - N_d) + [\delta.(EQ_{t-1})^e - \delta.(EQ_{t-1})^p]\} = \{- E + (T^e - T^p) + w.(N^e - N_d) + (DIV^e - DIV^p) = (I_d - S^p) + (G_d - T^e)$

Thus provided that all expectational error terms are roughly zero then from A1.25

A1.28 $(I_d - S^p) + (G_d - T^e) = (\Delta H^p - \Delta BR_d) + [\Delta L_d + (\Delta BG_d)_{bk}] - (\Delta Cu_d + \Delta D_d) = \Delta M_s - \Delta M_d$

This equation shows that the private sector deficit and the government budget deficit are financed by the series of terms on the right hand side. Simplifying,

A1.29 $(I_d - S^p) + (G_d - T^e) = M_s - M_d$

Glossary of Terms in the Social Accounting Matrix

C: private consumption

I: private investment

S: savings

G: government expenditure

T: tax revenue

w: wage rate

N: quantity of labor

EQ: equity

Y: output

i_d, i_b, i_{dw} and i_L: deposit, bond, discount window and bank loan rates of interest respectively

D: deposits

BG: government bonds

BP: private bonds

L: bank loans

BR: borrowed reserves (discount window loans)

H: high-powered money

Cu: currency

R: bank reserves

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