Financial Institutions, Economic Policy and the Dynamic Behavior of the Economy

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I. INTRODUCTION

When Schumpeter asserted that there are only two "fundamentally different groups of Business Cycle theories" he undoubtedly had the then current formal theories in mind, which allowed for only damped (monotonic or oscillating) behavior on one hand and explosive (monotonic or oscillating) behavior on the other, with a border between the damped and the explosive. In one common form this border required that the accelerator coefficient equal one for the generation of a constant amplitude (non damped, non-explosive) cycle (Hicks, 1950; Minsky, 1959).

Schumpeter, in his obituary of Mitchell, associated his own position with Mitchell in holding that "cycles are the form of capitalist evolution". Schumpeter's Kitchen, Juglar, and Kondratiev cycles reflected his views that there are a number of facets to the generation of economic evolution, and that these cycles, along with their synchronization one to the other, reflected the special economic factors that were involved in the generation of a particular type of cycle. To Schumpeter Kitchen cycles were mainly inventory and investment cycles, Juglar cycles were investment cycles with monetary or financial market involvement, and Kondratiev cycles were the result of the rise and then decline of the exploitation of major technological innovations. Great depressions, such as that of the 1930s, occurred when the low points of Kitchen, Juglar, and Kondratiev cycles coincided. In this paper we integrate the intertemporal behavior of profits, investment, indebtedness, and interest rates: we are modeling what Schumpeter would have considered Juglar cycles (Schumpeter, 1939).

Even as we agree with Schumpeter in holding that cycles are the form of capitalist dynamics and evolution, we differ with him: we expand the alternative intertemporal behaviors to three. It is not necessary for the interactions of economic variables through time to yield either a non-oscillatory time series or a wavelike motion. The endogenously determined path through calendar time of the complexly interrelated sets of markets of a capitalist economy can take the form not only of non-oscillatory time series and wavelike motions, but in addition it can become incoherent. The incoherence of runaway inflations and debt deflations are facts of economic history. In general it is accepted that incoherent behavior of the economy has dire consequences,

and in modern economies incipient or realized incoherence will lead to governmental interventions. These governmental interventions can be by the government, strictly speaking, or by a "semi-independent" central bank. We can now visualize a third set of business cycle theories in which cycles result from the combination of endogenous interactions that can lead to incoherence and the impact of institutions and interventions that aim to contain these thrusts towards incoherence.

We note immediately that this third set of models finds that government sponsored institutions and government interventions can play a positive role, in that, if well used, they contain the degenerative tendencies of capitalist economies (Ferri and Minsky, 1991). We need but recall that the capitalism of the winter of 1932-33 was a rather complete failure, and that the capitalism of the main capitalist economies was quite successful in the first quarter century after World War II.

The starting point of our extension of Schumpeter's insight is the linear accelerator multiplier model, which had a run during the 1940's and 50's and then faded from the scene as growth theory replaced cycle theory as a focus of research. In the Hicks-Hansen-Samuelson linear accelerator multiplier model, the path through time of the system depended upon an accelerator coefficient that linked investment demand to the change in income and a consumption coefficient--the marginal propensity to consume--that linked consumption to income. The accelerator was taken to be a technical attribute of the economy, and the consumption coefficient was taken to be a deep-rooted psychological law.[1]

In a series of exercises, Minsky explored the properties of an accelerator-multiplier setup where the values of the accelerator and multiplier generated explosive time series. These explosive time series were constrained by floors and ceilings, which broke the ongoing process and established a new process with new initial conditions.[2] In one article (Minsky 1957a), ceilings and floors were determined by the behavior of the monetary system, i.e., an aspect of the institutional structure, which, by setting limits on the acquisition of assets by the banking system, determined the maximum rates of investment and disinvestment.

Because the power of computers enables us to discover aspects of the characteristics of time series that are generated by mathematically non-tractable systems, we can set up our analytical structure without being unduly concerned with mathematical tractability of the resulting model.

Schumpeter's assertion, which we use as a motto, reflected the state of knowledge at the time he was writing. Today's knowledge enables us to a take a third approach, in which the complex structure of an economy yields time series that can generate smooth growth and well-behaved cycles as possible transitory results of the economic process, but that also allows for intermittent conditions conducive to the emergence of incoherence or turbulence. Such emerging incoherent or turbulent behavior results from the cumulative effect of the ordinary behavior of the agents of the economy upon variables that affect the behavior of the economy. In the early stages of the process these cumulating variables are not a significant influence on the qualitative characteristics of the time series that are generated: their effect is, so to speak, suppressed. However, when the cumulative changes pass some thresholds, qualitative changes occur in the economy's performance.

In Section 2 some principles underlying the formulation are presented. In Section 3 we discuss the impact of institutions upon the behavior of the processes that generate our time series. In our argument, institutions can act as the equivalent of circuit breakers. If the system is very turbulent, then the time series actually generated can be dominated by the impact of institutional characteristics that set maximas and minimas to variables. In Section 4 the model is presented. We go over the 9 equations that make up our rather simple extension of the accelerator multiplier model. In Section 5 we examine the reduced form equations. In Sections 4 and 5 references are made to a series of figures that illustrate the equations and the simulations of the model. Section 6 draws out some implications of what remains an evolving work in progress.

II. SOME PRINCIPLES OF THE FORMULATION

As our agents possess incomplete (and in particular asymmetric) information, the hypothesis of complete and perfect markets, which is the cornerstone of the Arrow-Debreu general equilibrium framework, is rejected.[3] Once liberated from Arrow-Debreu we are free to emphasize the role of time and conditionality in the economy. Debt, that is promises made at one date by an economic unit (firm, household, government or financial institution) to pay a certain (or contingent) sum of money to specified other (or bearer) units at some future dates, provides a natural way to link time periods for capitalist economies.[4] Because, in the aggregate, the ability of units to fulfill the commitments on their debts depends upon the endogenously determined paths of profits and debts, the commitments on debts may or may not be fulfilled.

Debt is specialized to corporate debt to banks: the liability structure sets up a time series of gross cash payments that corporations must pay to banks. This is a great simplification of the debt structure of modern economies. Household and government debts, as well as a complex layering of debts, exist and undoubtedly affect the behavior of a modern economy.

In the following we explore the complex interrelations of financial and real variables with the help of an analytical framework that is a simplified (and slightly modified) version of a class of macrodynamic models published elsewhere (Delli Gatti, Gallegati, and Gardini, 1993 and 1994, Delli Gatti and Gallegati, 1994) which have been extensively analyzed and simulated in order to gain new insights about financially determined business fluctuations. A model *per se*, however, is nothing else than a device for organizing thoughts. When deemed necessary, our description of financial developments will be richer and more detailed than that incorporated into the model.

In macrodynamic models such as the one discussed here, we can obtain a wide range of different dynamic processes. Depending upon the parameter configuration, the reduced form can yield a whole array of time paths, ranging from oscillations of the Slutsky-Frisch-Lucas type, which are due to stochastic disturbances affecting an otherwise non-oscillatory framework, to more or less regular endogenously determined wavelike motion, from aperiodic dynamics to financial instability and time dependent fluctuations. The actual outcome depends not only upon

the behavior of firms, households, and financial institutions, but also upon the structural characteristics of the economy, ruling parameters, institutional regime, and policy interventions.

III. Institutional Structure

Schumpeter characterized the banker as the *ephor* of developing capitalist economies. At an earlier meeting of the Schumpeter Society, Minsky characterized central bankers as the *"ephor of the ephors"* of capitalism (Minsky, 1990).[5] The difficulties in getting capitalism well started in Eastern Europe centers around the problems of developing a financial system in societies where there are no significant financial institutions, and where the population is mainly non numeric in a financial sense.

The recognition that market economies are unstable did not wait for the demonstration that complex interactive non-linear equation systems can yield incoherent or turbulent time series. The historic experience of runaway inflations and debt deflations served as evidence that the behavior of market systems is not necessarily benevolent. As capitalism developed, responsible policy makers always took Adam Smith's dictum in regard to the power of the invisible hand with the proverbial grain of salt .

One of the most evident evils of the market economy way of organizing affairs was the periodic eruption of financial crises followed by hard times. To contain the evils that market systems can inflict, capitalist economies developed sets of institutions and authorities, which can be characterized as the equivalent of circuit breakers. These institutions in effect stop the economic processes that breed the incoherence, and restart the economy with new initial conditions and perhaps with new reaction coefficients.

Even though there are many devices in modern capitalist economies that constrain and regulate market processes, the guidance of the economy by participating in and constraining market outcomes is perhaps most evident in banking systems and financial markets. Without going into details, in recent years we have seen various effective and ineffective central bank

"lender of last resort" interventions, as well as some interventions that can be best interpreted as government equity infusions into financial institutions to prevent their liabilities from falling to a discount.[6] The deficits that big governments run, minimum wage laws, unemployment compensation, and government sponsored social insurance are further examples of devices that do not permit the unconstrained market determination of economic outcomes but set boundary values to the permissible values for some variables.

In the non-linear systems that can breed incoherence there are terms that initially have a small impact upon system behavior, but which accumulate as the processes "mature". As the accumulating variables approach critical values, incoherent behavior looms as a likely outcome. Whether such an incipient incoherence blossoms into realized incoherence depends upon the institutions, regulations, and government interventions that set or constrain the values of economic variables.[7]

The institutional structure at any date reflects legislation, administrative actions, and the evolution of institutions and usages that are due to the past behavior of market participants.[8] The legislation reflects the understanding of the economy (i.e. the maintained economic theory) that ruled among the policy establishment at the time the institutions were created. Administrative interventions, which aim to steer the economy or to contain what is believed to be incipient incoherent behavior, reflect the maintained economic theory of the relevant authorities at the time they intervene. It is worth noting that the two sets of theories can be markedly different. The institutions could have been set in place when the policy making agents of the economy believed that instability verging on incoherence is an inescapable attribute of a capitalist economy, whereas the interventions can be implemented by agents who believe in the inherent stability of capitalist economies.[9]

Thus the time path of economic variables reflects the behavior of self-seeking market agents, the impact of the institutional structure, and the interventions by policy authorities: the interventions reflect a maintained economic theory. The values of variables that the unconstrained and non-interventionist economy would generate are replaced by values that

reflect the immediate impact of interventions, controls and constraints: what happens reflects the impact of the economic thinking of different times. Such replacements of endogenously determined variables, which are formally equivalent to the imposition of new initial conditions, reset the dynamics of the economy.

Thus initial conditions are not set once and for all, but are imposed from time to time as institutional usages become binding or the authorities react to their view of the state of the economy and its future. So the behavior of the economy depends not only upon endogenous dynamic processes, institutional structures, and interventions by the authorities, but also upon the model of the economy that guides the authorities.

A ruling conjecture that follows from the above is that the aptness of institutions and interventions will largely determine the extent to which the path of the economy through time is tranquil or turbulent: progressive, stagnant, or deteriorating.

IV. The Model Stated

Our base model is a closed economy with four types of agents: firms, households, banks, and governments. Households supply labor services, demand consumption goods, and hold bank liabilities (demand deposits). Firms supply consumption and investment goods, and demand labor services, investment goods, and bank loans. Banks supply their liabilities (deposits) and demand financial assets (i.e. they supply loans).

Fiscal authorities and the central bank--which we lump together under the heading of the"public sector" or the government--perform the duties of supplying non market goods and services, underwrite minimum living standards, and guarantee, explicitly or implicitly, select private contracts. Government expenditures, underwritings, and guarantees are paid for either through tax collection, by selling government bonds or by the issuance of central bank liabilities.

There are balance sheet as well as income statement relations among the units. There can be no balance sheet loose ends in analyzing a capitalist economy: all financial instruments need to

appear as assets on one balance sheet and liabilities on another. A simplified balance sheet is shown in Table 1, where the symbol "+" represents assets, while "-" stands for liabilities.

Table 1. The balance sheet structure of the economy

Households*	**Firms**	**Banks**	**Government***
Deposits(+)		Deposits(-)	
Bank equit. (+)		Bank equit. (-)	
Corp.equit. (+)	Corp.equit. (-)		
Gov.bonds (+)		Gov.bonds (+)	Gov.bonds (-)
	Loans (-)	Loans (+)	
		Reserves (+)	Reserves (-)
Wealth (-)	Cap. assets (+)		

*The present value of tax revenues is the asset side of the government's balance sheet and an implicit liability on the debit side of households' balance sheets. The ability of popular governments to tax to support the funded debts and unfunded obligations is the main issue in the crisis of democratic welfare capitalism.

We postulate three markets: labor, credit, and goods. We do not deal explicitly with the labor market. We assume that employment is a positive function of effective demand at a given wage.

There is no stock market. Equity investment grows by means of retained earnings. Credit and the rate of interest are determined in the loan market. The price level is constant and normalized to unity: no distinction can be made between nominal and real variables.

There are 9 equations in our basic model.

According to the Kalecki-Levy equation, gross profits (P) at time t equals:

(1) $\Pi_t = I_t + G$

where I is gross investment and G is gross government deficit, which in our simplified framework coincides with gross government expenditure. Heroically, we ignore taxes and interest payments on public debt.[10] Therefore we can specialize on the impact of government deficit on gross profits.[11]

In this paper, current investment does not explicitly contribute to future capacity: it is a component of aggregate demand, a determinant of profits and an absorber of financing. In other words we rule out any capital capacity constraint to output: we are tracking the path through time of gross capital income, private debt and the interest rate. The demand for investment is:

(2) $I_t = av_t + b_t IF_t$

Equation (2) is an algebraic statement of Figure 1, a graph used by Minsky (1975, 1982, 1986) to explain the determination of investment. v is the price of capital assets--Minsky's P_K--and IF is the internal finance, to be defined in equation (3).

Since the price of current output (both in the consumption and investment goods sectors, by assumption) is constant and normalized to 1, v can be conceived also as the ratio of the price of capital assets to the current supply price of investment output,[12] that is, "average q" in Tobin's terminology.[13]

The (non negative) parameter "a" reflects the sensitivity of investment to v, the current evaluation of capital assets, while "b" reflects the extent to which firms lever retained earnings in the financing of investment. In other words, b is a *leveraging ratio* on the flow of equity capital in the form of retained earnings.[14]

Internal finance available at time t is the difference between lagged profits and lagged debt payments:

(3) $IF_t = \Pi_{t-1} - r_{t-1} D_{t-1}$

where r is the ratio of gross payments due on outstanding debt (interest and principal) to the stock of corporate debt (loans extended by the banking system). For the sake of simplicity, in the following we will refer to it as the "interest rate".

In principle, the price of capital assets reflects the stream of expected future profits. In this paper we adopt a simplifying shortcut, which consists in representing the price of capital assets by an autoregressive process:[15]

(4) $v_t = v_{t-1} + \varepsilon_t$

where e is a random variable with zero mean and finite variance.[16]

The propensity to lever internal funds is an endogenous variable. It is represented as a non linear increasing function of profits (Figure 2).[17]

(5) $b_t = b_0 + b_1 \operatorname{arctg}(\Pi_{t-1})$

The parameter b_0 represents "liquidity preference" on the part of firms. A decrease in b_0 can be interpreted as an increase in the liquidity preference of firms, and for every level of (lagged) profits a fall in b_0 lowers b.

Informational imperfections on capital markets (for instance: asymmetric information[18]) imply that investment is constrained by the availability of external finance. We assume that the supply of (external) finance on the part of banks, F, is an increasing function of the interest rate:

(6) $F_t = Hr_t$

The parameter H is assumed to be under the control of monetary authorities.[19]

The demand for loans equals the sum of corporate debt inherited from the past and the financing gap, i.e., the difference between total investment and the amount financed by internal funds:

(7) $D_t = D_{t-1} + I_t - IF_t$

Loan market equilibrium requires:

(8) $D_t = F_t$

From equations (6) and equation (8) we derive the following interest rate equation:

(9) $r_t = \frac{D_t}{H}$

In principle, present views of the future affect current investment financing, while past financing determines payment commitments due now. The willingness and the ability of banks

to commit their funds at any particular time depends upon the performance of the assets they own, i.e., whether commitments made in the past that are falling due today are being honored.

V. The Reduced form

A modern economy has to be viewed as a time-dependent system because virtually each unit makes financial decisions every today that come due in a myriad of tomorrows. Such decisions depend upon the performance of the economy "now," the current status of financing decisions made in the past that are maturing today, as well as the expected performance of the economy. Because of the financing connections among units, a part of spending is prior determined by the structure of liabilities. For debts and equity, internal finance,and investment, what happens during any today can more than validate, just validate, or to a greater or lesser extent fail to validate decisions made in the past.

Rational agents know that they lack perfect foresight: they know they may be wrong. This implies that their willingness to accept particular types of assets into portfolios or particular types of funding of their operations is subject to change as history unfolds evidence that their past decisions were right or wrong. When past investment and funding decisions are strongly validated by current and past outcomes, then the belief in the model of the economy that guides the decisions of potential debtors and asset-holding financing agencies is reinforced. When decisions taken in the past are being barely validated currently, then either no revision or minor changes of the belief in the model that guided past actions take place. When current cash flows are insufficient to validate decisions taken in the past, then the model that guided behavior is abandoned and defensive steps are taken by firms, financiers, and the ultimate owners of financial assets to contain the damage from their errors.

We study the behavior of three fundamental relations in a view of the economy that focuses upon profits, debts, and the cost of carrying debts, that is, the interest rate.

Substituting equations (2) and (4) into equation (1) gives us the following profit equation:

(10) $\Pi_t = av_{t-1} + a\varepsilon_t + b_t IF_t + G$

Other things being equal, an increase in the leveraging ratio increases investment and leads to an increase in profits.

Substituting equations (2) and (4) into (7), we get the debt equation:

(11) $D_t = D_{t-1} + [av_{t-1} + a\varepsilon_t + (b_t - 1)IF_t]$

The dynamic behavior of the interest rate is linked to that of corporate debt, as shown by equation (9) above. We are now ready to derive the reduced form of the system. Substituting equations (3) and (9) into (10) and (11), we get:

(10') $\Pi_t = \alpha + b_t \Pi_{t-1} - \frac{b_t}{H} D_{t-1}^2 + G$

(11') $D_t = D_{t-1} + \alpha + (b_t - 1)\Pi_{t-1} - \frac{b_t - 1}{H} D_{t-1}^2$

where $a=av_t$ is treated as an exogenous variable and b is represented by equation (5).The system of equations (10')(11') is characterized by two non-linearities: it is obviously non-linear in D, but it is also non-linear in P thanks to the interaction of the leveraging ratio--an increasing function of the profit level--and internal finance.

Systems of two non-linear difference equations of this type have been studied extensively elsewhere (see in particular Delli Gatti, Gallegati, and Gardini, 1993, 1994). The procedure is as follows. First of all, we compute the steady state of the system and assess its stability properties, treating b as a given parameter. The steady state is as follows:

$$\Pi^* = G + \frac{\alpha}{1 - b}$$

$$D^* = \sqrt{HG}$$

Then we simulate the model, allowing for the non-linearity induced by equation (5). Figure 3 illustrates how changes in b, as determined by equation (5), affect the dynamic properties of the system.

A relatively "low" value of b (that is, a value of b smaller than a critical (lower) crucial level b^H) leads to a monotonically or cyclically damped time series, converging to the steady state. On the contrary, a relatively "high" value of b (that is, a value of b greater than a critical (upper)

crucial level b^M) leads to a monotonically or cyclically explosive time series. Between b^H and b^M the time series that are generated evolve from bounded cycles to (purely deterministic or stochastic) chaotic behavior.[20]

In figure 4 a (bounded) cycle--a closed orbit--is depicted as reproduced by our simulation.

We can begin our examination in the second half of quadrant (i), where debts are falling even as profits are rising. This is a period of tranquil expansion, during which entrepreneurs are pleasantly surprised by actual profits exceeding their anticipations of profits. In quadrant (ii) debts rise, but through most of this phase profits rise even faster. At the transition from quadrant (ii) to quadrant (iii) profits stop increasing even as debts virtually explode. In quadrant (iii) debts continue to rise even as profits begin to fall: the financial structure becomes fragile. At the transition from quadrant (iii) to quadrant (iv) debts begin to fall even as profits continue to decline. In quadrant (iv) both profits and debts fall. At the transition between quadrants (iv) and (i) the fall of profits stops, but the fall of debts could very well be the almost vertical drop of a debt deflation. In our model profits are sustained by government deficit--in a modern society, government deficit can be expected to increase as a debt deflation threatens.[21] With the transition to quadrant (i) the debt decrease begins to taper off and profits begin to increase. The transition from a fragile to a robust financial system begins again.

Figure 5 is an alternative diagram of the processes represented in Figure 4.

During an initial or recovery period, profits are rising relative to debts and financial markets are slack: interest rates are falling. In the second phase, profits rise relative to debts and interest rates firm. During the third stage of the cycle, even as profits taper off and then begin to fall precipitously, debts rise and then explode. Interest rates may peak in a refinancing crisis. Debts are viewed as excessive, and a burst of non performing capital and financial assets appears. Whether or not a full-fledged deflation takes place depends upon the institutional structure and the aptness of interventions.

Figure 6 shows a closed orbit on the (P,D) plane, analogous to that of Figure 4 and two ceilings, a maximum debt-profit ratio (D') and full employment (P'), and one floor to profits as set by the government deficit (P_G).

The combination of the maximum debt-profit ratio and the floor to profits decreases the likelihood of a debt deflation and accompanying turbulence: the likelihood of an overshoot on the downside decreases. On the other hand, if financing ceilings prevent the exploitation of seemingly profitable opportunities, profit seeking agents will develop innovative financing techniques, which often catch central bankers asleep at the switch. The fragility of the financial system that results from the new ways can "force" central banks to ease their restrictions on available financing (Minsky, 1957b). Fiscal policy measures are also ways to contain debt deflations by supporting aggregate profits.

VI. Conclusions

The approach to business cycles and macroeconomic dynamics adopted here holds that the path of a capitalist economy through calendar time cannot be reduced to a dynamic process that started far in the past and will continue for the foreseeable future. This is so because the market processes that determine investment, employment, income, consumption, the composition of portfolios, and the myriad of individual prices and quantities take place within an institutional structure, which limits the movement and values of some of the variables of the system. Whenever such institutionally determined values dominate the endogenously determined values in what actually occurs, then the path of the economy, the ongoing dynamic process, is broken, and an interactive process, which starts with new initial conditions, generates future values.

In particular, whenever the economy behaves or even threatens to behave in an incoherent way, "stabilizers", which may be built in or require actions by authorities, kick in and prevent the economy from continuing on the prior endogenously determined dynamic path. At these times prior dynamic processes are superseded by a new process characterized by a combination of new

initial conditions and new reaction coefficients. This new process will have its run in the context of a new institutional structure which incorporates market adjustments and regulatory and legislative initiatives that were responses to the "crisis".

One of the advances in this paper is that b, the leveraging ratio, which plays a role analogous to the accelerator coefficient of the multiplier accelerator models, is an endogenous variable. Swings in b can be interpreted as what Keynes characterized as changes in liquidity preference on the part of firms. The ability of a businessman to finance investment, i.e., to become less liquid, requires a parallel willingness of the "external" financier to become less liquid. There is a type of self-fulfilling prophecy in the swings of liquidity preference. Cash flows, in the form of increased gross profits, accrue to business as financed investment increases, and cash flows to business, in the form of aggregate profits, decrease when some real or financial asset fails to perform, which leads to a shift towards an increase in desired liquidity by bankers, portfolio managers, and businessmen.

In Figure 1, which is a representation of equation (2), the leverage is determined by the way in which the external financing line falls away from the capital asset price line and the way the external financing line rises from the current price line. The first represents the reluctance of the firm to lever, and the second the reluctance of the "bankers" to lend. Such "risk" assessments are among the main drivers of capitalist economies, and their current status at any time reflects how the past of the economy affects bankers and businessmen. It is the combined animal spirits of bankers and businessmen that determine what in fact happens.

One simple assertion--that investment has to be financed either by capitalist retained profits or by external funds--has profound effects in making our model both time-dependent and non-linear. This opens a rich menu of possible system behaviors, even though we greatly simplified the financing relations: debt financing was by banks, and we really did not allow much influence to bank liabilities.

We assumed that the government deficit equals government spending, and we kept it constant throughout the exercise. This, of course, has the consequence that government

spending becomes an increasingly large (small) factor determining profits as investment falls (rises), but not to the same extent that would have been true if we had modeled contracyclical fiscal policy. Endogenizing tax revenues and government expenditures is an obvious extension of the work. Our intuition is that instead of only one *ephor* in banking that guides and directes the economy, there are at least two of them, because fiscal policy provides a second *ephor* complimentary to the banking one.

To a large extent the 45 years since Schumpeter died have been dominated by the results of Arrow and Debreu. We now are more aware of the limited applicability of general equilibrium theory than hitherto in the Arrow-Debreu era. We know that the results were based upon not only heroic but also profoundly unacceptable assumptions: utility functions over the reals and perfect foresight being two that are especially foreign to modern capitalist economies.

One implication of Schumpeter's *Theory of Economic Development* is that the analysis of capitalist economic processes will not lead to the relegation of money, credit, and finance to a pound of details that are irrelevant for an understanding of the fundamental rules of capitalism. The monetary and financial structures provide not only an essential set of links between the past, the present, and the future, but they also provide the economy with some of its most important aborters of incoherence. The dominating functions of central banking, deposit insurance, and fiscal policy are to sustain asset values and aggregate profits, and thus contain any thrust of the economy towards the incoherence of a deep debt deflation and depression. Schumpeter was never more relevant than when he identified bankers as the *ephor* of capitalist economies. In modern capitalism the central bank and the fiscal powers of governments are, so to speak, the *ephors* of the *ephors* of capitalism.

Thus the Schumpeterian monetary production innovative economy is a rich version of Keynes's monetary production economy (Keynes, 1933). This economy is a maze of cash flows, production is always an M>C>M' phenomenon--to use Marx's terminology--and profits exist not because capital assets are productive but because the composition of aggregate demand makes capital assets scarce.[22] Furthermore part of M is from and part of M' is to bankers.

Now that it is agreed that for the foreseeable future the world economy will be dominated by a set of financially complex capitalist economies, economists should turn from the contemplation of abstract economies to the study of the behavior of innovative monetary production economies. A marriage, not of convenience but of the shared insights, between the economics of Keynes and of Schumpeter seems to be a fruitful program for research.

Notes

1. Our taking-off point is that the accelerator and marginal propensity to consume coefficients are economic variables. In particular we model the economic determinants of the investment coefficient. We find ample reasons to believe that the resulting volatility of the investment coefficient leads to incoherent behavior in a system where investment determines profits, and the financing of investment prior commits future profit flows to the servicing of liabilities.

2. In the special case, where the ceiling's rate of change is less than the smaller of the two positive real roots that generate the explosive series (these roots are transformations of the accelerator and multiplier coefficients), the new initial conditions lead to a small negative coefficient for the larger (major) root and a large positive coefficient for the smaller (minor) root. As a result, the dynamic process begins by generating an increasing income but, as the large major root with its negative coefficient takes over, the rate of increase of income first decreases and then becomes negative: the income generated decreases. A setup which has two positive real roots can, with appropriate initial conditions, generate one turning point: the business cycle results from the system bouncing between "floors" and "ceilings."

3. Since information is asymmetric, agents differ one from another (Stiglitz, 1992), and therefore the representative agent assumption is not valid. Macroeconomic models cannot be built upon a representative agent microfoundation (Kirman, 1992).

4. This also implies that we cannot get meaningful results by abstracting from financial markets and then adding money or finance to the model. Note that, as debts are of private units, there is no certainty that commitments will be fulfilled. Also note that among the proximate holders of debts are banks: this implies that non fulfillment of debt contracts compromises the liquidity of the economy.

Fulfillment of private, and even public, debts is contingent upon outcomes whose likelihood cannot be known. Once the Arrow-Debreu hypothesis of complete and perfect markets is rejected, the world becomes Keynesian in that intractable uncertainty exists.

5. Ephors were elected magistrates of Sparta whose function was to keep the kings in line.

6. In the United States, the so called bailout of Savings and Loan Associations, as well as many commercial banks, is an instance of an equity infusion. Similar refinancings, perhaps not at the same scale and perhaps without similar systemic causes, took place in almost all advanced capitalist economies.

7. As interventions set off interactive processes with new initial conditions, the outcome depends upon interventions that occur at different dates. Thus the outcome, as determined by endogenous forces and the resetting of the process with new initial conditions, is time-dependent.

8. See Minsky (1957) for an application of these ideas to the interrelations between banks and central banks in determining the evolution of banking practices.

9. The legislation of 1935-36, which set up the basic structure of the financial system for the United States, was strongly affected by ideas that held that breakdowns are "normal" outcomes of "laissez faire" capitalism, whereas the various monetarisms, which influenced policy and institution building over the past two decades, are based upon the assumptions that market capitalisms, even intensely financial variants, are inherently stable and seek out an outcome that can be characterized as optimal.

10. An obvious extension consists in endogenizing taxes and introducing a government budget constraint. This is left to future developments of our research project.

11. Schumpeter's view that in the absence of investment profits are zero is consistent with the Kalecki-Levy equations after allowing that the impact upon profits of government deficits is equivalent to that of financed investment. As a "Walrasian" he had difficulty in explaining this view.

Perhaps the most difficult of the Keynes, Kalecki, Levy, and Schumpeter views to get across to a modern economist is that capital is a value term: it is the value placed upon the current expectations of mainly future income flows.

12. Since the price level of capital assets and the price level of investment output are determined by different sets of variables, we expect them to behave differently: in particular the former is expected to be more volatile than the latter (Minsky, 1975). For investment to take place, the expected cash flows from operating investment outputs as capital assets has to service liabilities that reflect what was paid for the investment: an implication of this is $v>1$.

13. Tobin (1989) believes Minsky's theory of investment to be indistinguishable from his own. As has been correctly pointed out by Dymski and Pollin (1992), Minsky's theory differ with Tobin's because he assumes the presence of private information, which means the Modigliani-Miller theorem cannot be applied.

Abel and Blanchard (1986) and Fazzari, Hubbard, and Petersen (1988) show that internal finance plays a central role in investment activity on the assumption that alternative sources of finance are not perfect substitutes: in an environment of asymmetric information, a financing hierarchy that ranges from internal funds to various types of external funds emerges. One difference between internal and external finance is that internal funds do not lead to a legal binding commitment of future cash payments. Managements may feel committed to paying dividends, but in principle and in practice dividends depend upon the realization of profits. In the hierarchy of hedge, speculative, and Ponzi finance, the greater the ratio of equity to debt financing the greater the chance that the firm will be a hedge financing unit. Note that Ponzi finance, the capitalizing of interest, involves an increase in indebtedness equal to the decrease in equity. By compromising the equity base of an organization, Ponzi financing increases the likelihood that future Ponzi financing will occur.

14. An investment equation such as (2), already present -- albeit implicitly -- in Minsky's works, has been put forward by the authors in Delli Gatti and Gallegati (1990). Since then it has been repeatedly used in different versions of the prototype framework (Delli Gatti and Gallegati, 1992, 1994 and Delli Gatti, Gallegati, and Gardini, 1993, 1994). The empirical literature on functional forms of this type starts with Fazzari, Hubbard, and Petersen (1988). For a survey of the literature on the econometric implementation of investment equations see Chirinko (1994).

15. This specification is consistent with empirical results found by Blanchard et al. (1990), according to which average Q is a white noise random process.

16. Laibson and Friedman (1989) model capital asset prices as a Poisson distribution where the heights of the tails are positively related to the debt-income ratio. As a result, crashes in the stock market and in the market valuation of firms become more likely as the fragility of the financial structure increases.

Equation (4) evades the issue of how expected future profits are transformed into the implicit price for capital assets. In the modern capitalist economies, capital assets are usually, but not always, transferred from one owner to another as a packet of assets combined with a market position. The transformation of such prices, which include a valuation of market position, into Minsky's Pk and Tobin's Q is an open question.

17. A pro-cyclical propensity to invest, or leveraging ratio, can be explained by a "composition effect". According to Fazzari's empirical investigation, small firms are characterized by small capital stock, high sales and capital growth rates, a high retention rate, and a high propensity to invest out of internal finance. Just the opposite is true for relatively large firms. As the aggregate propensity to invest is a weighted average of the propensities to invest of small and large firms, with weights equal to the share of the total cash flow generated by small and large firms respectively, when the population of small firms increases during the stage of the expansion of business cycles, the propensity to invest by leveraging internally generated funds increases.

18. Keynes's and Kalecki's notions of borrowers' risk and lender's risk -- which are incorporated into Minsky's diagrammatic representation of investment determination -- can be interpreted as informational imperfections in an asymmetric information framework.

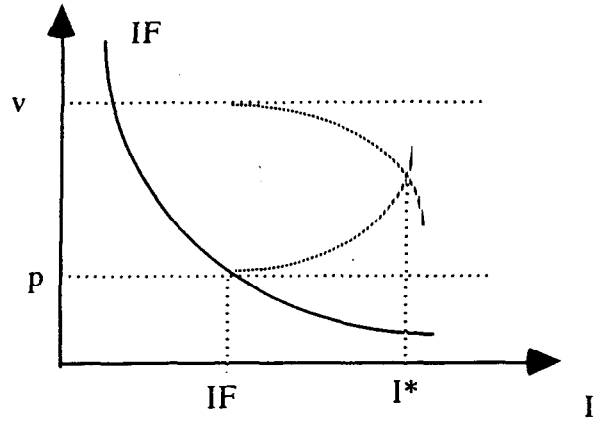
19. The Schumpeterian (and Keynesian) tradition, to which we adhere, views money as both endogenous and with an evolving composition. This is a simplifying assumption, which needs to be lifted as this program advances. See Minsky (1957b).

20. A stochastic disturbance affects investment through the autoregressive process that determines the price of capital assets.

21. Furthermore, as we just saw in the United States, the government may take responsibility for assuring that bank and near-bank liabilities are sustained at par.

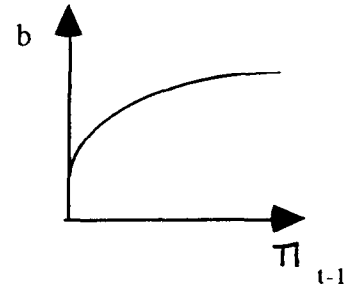
22. To Schumpeter, Keynes, Kalecki, and Jerome Levy, profits are determined by the composition of financed demand, not by any technical productivity of capital assets. They are closer to the Marshallian view, that profit income is a quasi rent, than to the "modern" view, which assumes that a marginal product of capital is a meaningful concept, so that profits are determined by the technical conditions of production.

Figure 1



equation 2: $I_t = a\, v_t + b_t\, IF_t$

Figure 2



equation 5 : $b_t = b_0 + b_1 \text{ arctg } \Pi_{t-1}$

Figure 3

Figure 4
(simulation)

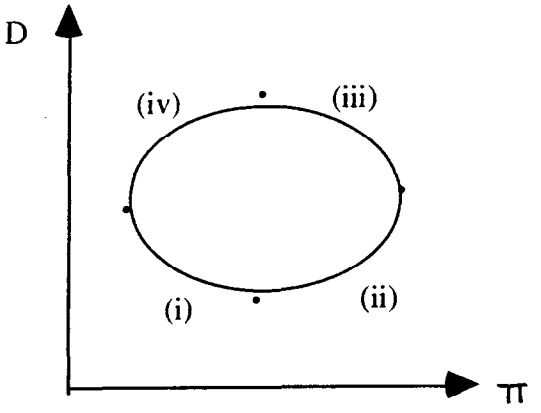


Figure 5
(simulation)

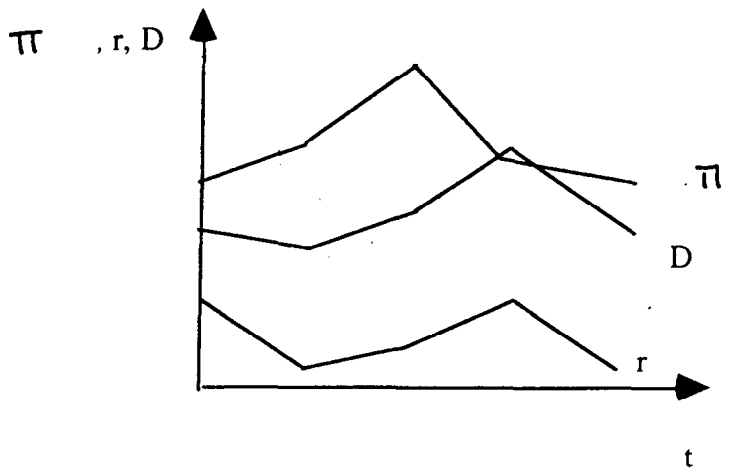
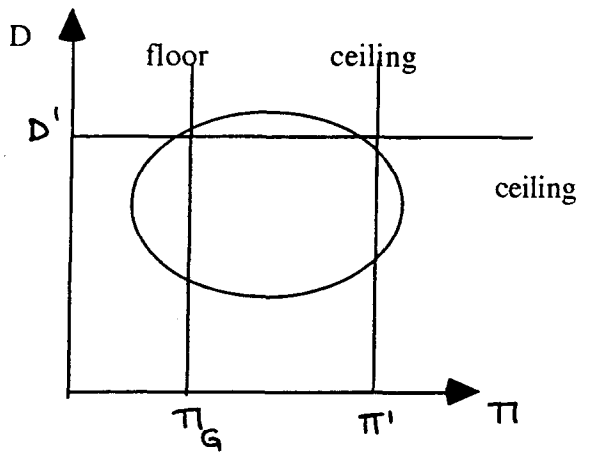


Figure 6



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