An Outline of the Theory of Growth and Crisis in a Financialized Economy

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Abstract: The paper captures through a stylized macro-economic model the interaction between the real and the financial sector in a stock-flow consistent accounting framework. The stock equilibrium of the dynamic model resembles the generic neoclassical and the flow equilibrium generic post-Keynesian model of economic growth. However, the combined stock-flow dynamics has the unusual property of generating in some circumstances sudden, catastrophic change in the stock market. The macroeconomic conditions for such abrupt change and the early warning signals emanating from them are explored.

1

Classical physics succeeded in explaining a range of macro-scale physical phenomena through a formalization based on the assumption that small causes have small effects leading to gradual change. And yet, abrupt changes do occur; earthquakes and tsunamis destroy and transform landscapes in moments, volcanoes erupt suddenly, and sand piles that slowly build up gradually over a long time suddenly tumble. In economics their pre-eminent counterpart is the sudden financial crash, e.g. the last one that occurred about 10 years ago (2007-08), and from which the world is still recovering.

It is not always true that these hugely abrupt changes are entirely unexpected. The mechanisms may be known in broad outlines, but we have almost no way of predicting when they will occur, i.e. the triggering off mechanism and the 'tipping points' are largely unknown. We understand even less about financial crashes, although financial fragility of firms and households due to overextended debt positions (Minsky 1975, 1986), as well as massive mood swings in stock markets caused by speculative activities (Keynes 1936) are known partial explanations. However, without adequate understanding of the inter-action between the real and the financial economy we cannot hope to characterize either the 'critical tipping points' or the circumstantial evidence that might provide an 'early warning system'. In short, like the proverbial "last straw that broke the camel's back" we need to have a simultaneous understanding of why the camel's back broke and exactly at what weight. This paper is an attempt in that direction.

2

Consider an economy with a 'real sector' consisting of sectors producing consumption and investment goods, and, a 'financial sector' consisting of banks and financial firms which generate credit and produce various income bearing financial assets and claims in the form contracts. The latter is like a virtual shadow of the real production and consumption economy which creates temporal and inter-temporal claims and counter claims over the stream of real goods and services that are produced over time. This gives rise to two different measures of 'capital': capital used for production of goods and services in the real sector which firms and their accountants measure as the book or replacement value of capital (K) related to the discounted present value of future stream of earnings. The other measure of capital originates in the network of claims and counterclaims, and is summed up as wealth (W). Its valuation in the stock market in a financially sophisticated economy provides the basis for distribution of profit[1]. From this aggregative point of view, the average share price is given by the ratio of wealth to book value of capital[2], i.e.

$$v = \left(\frac{W}{K}\right) \quad \dots (1)$$

While equation (1) is a stock ratio, the flow equilibrium balance between expenditure and income (or investment and saving) in a closed economy without any economic role for the government may be written as Kalecki's profit realization condition under the assumption that all wage and a constant fraction, $1 > s > 0$ of profit is saved (Bhaduri/Raghavendra 2017)[3],

$$I + B + F = sR = s(P + \Pi) \quad \dots (2)$$

Equation (2) extends the familiar investment saving equality incorporating two types of expenditures, on real investment goods (I) as well as financial products(F), leading to realized profits,P and Π, in the two sectors with a uniform propensity to save out of profit ($1 > s > 0$) in both sectors. On the assumption that the total expenditure of banks equals their revenue B earned exclusively from interest income, a reduced form of equation (2) is more convenient to use. By eliminating B from (2) we obtain,

$$I + F = s(P + \Pi) \quad \dots (2a)$$

where all variables in (2a) need to be interpreted as net of interest payments to the banking sector. Equation (2a) may be rewritten as[4],

$$I - sP = s\Pi - F \quad \ldots (3)$$

Equation (3) shows the possibility that the excess investment of a sector would be matched by excess saving by the other sector on account of netting out interest income of the banking sector. Thus, if T and T^f denote the interest payments of the real and finance sectors with total banking revenue $B = T + T^f$, and C^{bf} denotes total consumption expenditure of wage and profit earners in the financial (banking and finance) sector, the profit realization condition for the real sector in isolation would be satisfied if

$$P + T = I + (1 - s)P + C^{bf}$$

which reduces to

$$T - C^{bf} = I - sP \ldots (4)$$

Thus, withdrawal of demand due to interest payment by the real sector (T) unless exactly compensated by injection of demand due to consumption by the banking and finance sector (C^{bf}) to make the left hand side of the above equation zero, must lead to shortfall or excess of saving from realized profit on the right hand side.

Introducing stocks in the flow equilibrium equation (3), a relation is obtained between the rates of growth of the stocks, and the rates of profit on the stocks of the two sectors as,

$$\frac{I}{K} - \frac{sP}{K} = \frac{s\Pi}{W}\frac{W}{K} - \frac{F}{W}\frac{W}{K} \quad \ldots (5)$$

which is rewritten as,

$$(g - sr) = (s\rho - G)v \ldots (6)$$

where, $g = \frac{I}{K}$ and $G = \frac{F}{W}$ are the growth rates of the real and the financial sectors given by their respective flow to stock ratios, and $r = \frac{P}{K}$ and $\rho = \frac{\Pi}{W}$ are their respective profit rates. Equation (6) resembles but does not coincide with the so-called 'Cambridge equation', which determines from the demand side the rate of profit through the rate of growth with a given savings propensity.[5] Equation (6) is more complex as it involves stock equilibrium through the average share price level (v) in the capital market along with inter-sector transfer of expenditure, shown in equation (4), and, therefore, of realized profit.

Provided $(s\rho - G) \neq 0$, (6) implies,

$$v = \frac{g - sr}{s\rho - G} \ldots (7)$$

In a stock-flow consistent macroeconomic equilibrium of the economy, along with the flow equilibrium condition (3), stock equilibrium in (1) is also maintained as v has to remain constant.

A difference between the growth rates of the real (g) and the financial (G) sector leads to changing value of the stock ratio v, i.e. logarithmic differentiation of (1) with respect to time yields,

$$\frac{\dot{v}}{v} = G - g, \qquad v \neq 0 \qquad \ldots (8)$$

Assuming the flow equilibrium (6) holds by some unspecified mechanism, we eliminate g from (6) with the aid of (8) to obtain,

$$\dot{v} = (G - s\rho)v^2 + (G - sr)v \ldots (9)$$

Equation (9) represents adjustment along a dynamic path that is brought about entirely by changes in the stock ratio v. Assuming both $(G - sr)$ and $(s\rho - G)$ are non-zero, a positive value of v requires the expressions in the numerator and the denominator of (7) to be of the same sign. If both $(G - sr)$ and $(s\rho - G)$ are positive, the graph of the above quadratic equation in the $(v, \dot{v})$-plane is inverted U-shaped, and intersects the horizontal axis at two rest or equilibrium points: a trivial one at $v = v_0 = 0$, and at $v = v_1 = [(G - sr)/(s\rho - G)]$ (Diagram 1).[6]The equilibrium at $v_1$is stable with the curve negatively sloped at$v = v_1$. On the other hand, if both $(G - sr)$ and $(s\rho - G)$ are negative,by parallel reasoningthe stable equilibrium is at $v = 0$. Thus, the existence of a unique stable equilibrium with a positive value of v at,

$$v_1 = \frac{g - sr}{s\rho - G}, \qquad where g - sr > 0 \; and s\rho - G > 0 \quad \ldots (10)$$

Moreover, since $g = G$ in equilibrium with v constant, (10) implies,

$$\rho > \frac{1}{s} g > r \;\; at \; g = G \qquad \ldots (11)$$

DIAGRAM 1 HERE

3

The more general stock-flow consistent equilibrium would be subject to not only a stock equilibrium condition in the form of constancy of v over time but also, to a flow equilibrium condition which was simply assumed rather than explained. The flow equilibrium condition need not hold when investment decisions are undertaken by firms independently of the saving decisions by households. The general stock-flow consistent equilibrium model has to introduce independent investment functions in the flow equilibrium, and combine it with the stock equilibrium condition of constancy of v.

Consider a simple case where the rate of accumulation in each sector is a function only of the profit rate in that sector, i.e.

$$G = G(\rho), \qquad G' > 0 \qquad \ldots(12)$$
$$g = g(r), \qquad g' > 0 \qquad \ldots(13)$$

Stock equilibrium with a constant value of v over time implies $G = g$ so that total differentiation of (12) and (13) yields the slope of the stock equilibrium locus in the (ρ, r)-plane (denoted by *SS* in Diagram 2 below) as,

$$\frac{d\rho}{dr} = \frac{g'(r)}{G'(\rho)} > 0 \qquad \ldots(14)$$

With v constant over time at an arbitrary positive level $\bar{v}$, in view of (12) and (13) the slope of the locus representing the flow equilibrium condition (6) (shown as *FF* in Diagram 2)in the (ρ, r)-plane becomes,

$$\frac{d\rho}{dr} = \frac{g'(r) - s}{[s - G'(\rho)]\bar{v}} < 0 \qquad \ldots(15)$$

(15) is negative if *both* the real and the financial sector satisfy the Keynesian stability condition *in isolation*, i.e. $(g'(r) - s) < 0$ and $(s - G'(\rho)) > 0$.

Diagram 2 shows a unique stock-flow consistent equilibrium at $r^*$and ρ^*. Moreover, if the equilibrium at $\bar{v}$ is stable, inequalities $(g - sr) > 0$ and $(G - s\rho) < 0)$ hold

from (10). Usual comparative static exercises may be carried out essentially by shifting the two curves *SS* and *FF* for variation in values of parameters s and v.

DIAGRAM 2 HERE

In the more general case, the investment-driven growth rate of each sector becomes a function of the profit rates in both sectors indicating the presence of externalities[7] to modify the investment functions as,

$$G = G(r, \rho), \qquad G_\rho > 0 \qquad \dots (16)$$

$$g = g(r, \rho), \qquad g_r > 0 \qquad \dots (17)$$

Assuming the functions G and g are regular and smooth with all first-order partial derivatives existing (denoted by G and g with the appropriate arguments r and ρ as subscripts), from the stock equilibrium condition (15) the slope of the locus in the (r, ρ)-plane in this more general case becomes,

$$\frac{d\rho}{dr} = SlopeSS = \frac{g_r - G_r}{G_\rho - g_\rho}, G_\rho \neq g_\rho \dots (18)$$

Similarly, assuming$\bar{v}(s - G_\rho) - g_\rho \neq 0$, from (6) we obtain the slope of the locus for the flow equilibrium condition in the (r, ρ)-plane as,

$$\frac{d\rho}{dr} = SlopeFF = \frac{g_r - s + \bar{v}G_r}{\bar{v}(s - G_\rho) - g_\rho} \dots (19)$$

If a point of intersection between the *FF* curve and the *SS* curve, with respective slopes (18) and (19), exists, the pair of values for r and ρ at that point represent a stock-flow consistent equilibrium for the economy. Moreover, if the equilibrium is stable, similar comparative static exercises can be carried out. From more detailed computations it can also be shown that the comparative static results of the simpler model with no 'externalities' given by the investment functions (12) and (13) generally hold so long as the externalities are relatively 'small'. Smallness may be defined formally in the present context as the direct effect of the own rate of return in each sector being greater than the indirect effect of the rate of profit of the other sector in absolute value(because externalities can be positive or negative), i.e. $|g_r| > |g_\rho|$ and $|G_\rho| > |G_r|$.

4

The complete dynamics of the stock-flow consistent dynamical model is simplified by assuming that the investment function $G(r, \rho)$ in (16) is linear and homogeneous, i.e.

$$G(r, \rho) = b_1 r + b_2 \rho, \qquad 0 < b_1 < b_2 < s \ldots (20)$$

The last inequality restriction in (20) satisfies the Keynesian stability condition, while the second inequality shows stronger direct compared to indirect effect through 'externalities' of profit ability on investment in the financial sector.

We introduce a definitional parameter for inter-sector distribution of profit (m) such that,

$$x.v = m = \frac{h}{1-h}, \qquad 0 < h < 1 \qquad \ldots (21)$$

where, $x = \left(\frac{\rho}{r}\right)$,$h = \left(\frac{\rho W}{R}\right)$ and $(1-h) = \left(\frac{rK}{R}\right)$, i.e. m is the relative share of profit of the two sectors.

Insertion of equations (20) and (21) in the stock adjustment equation (9) incorporates both an independent investment function as well as the inter-sector pattern of distribution of profit. This yields on simplification a quadratic equation,

$$\dot{v} = r[b_1 v^2 - \{(s - b_1) + (s - b_2)m\}v + b_2 m] \ldots (22)$$

For positive r, the bracketed middle term in (22) is unambiguously negative due to the inequalities specified in (20).The quadratic expression in (22) has a minimum and may have a maximum of two positive roots. From an examination of the discriminant of the quadratic equation obtained by setting this expression to 0, it can be shown that, for inducement to invest in financial assets sufficiently weak in relation to the inducement to save, so that $\left(\frac{s}{b_1} - 1\right)\left(\frac{s}{b_2} - 1\right) > 1$, two distinct real roots exist for all sufficiently large values of m. In the opposite case of the inducement to invest sufficiently strong with$\left(\frac{s}{b_1} - 1\right)\left(\frac{s}{b_2} - 1\right) < 1$, two distinct real roots would exist for all sufficiently small and sufficiently large values of m. Consequently, there is an intermediate range of values of m for which roots are

conjugate complex with no real root. In the borderline case, where $\left(\frac{s}{b_1}-1\right)\left(\frac{s}{b_2}-1\right)=1$, there are two real roots for all values of m except one, for which there exists a single root at the two boundary points of the interval.

The nature of the relationship between m and the stable equilibrium value of v is shown in Diagram 3. To the left of the first vertical line, for values of m less than m_1, stable equilibrium values of v may be traced outthrough variation in the values of the parameter m with a positive relation between them. In an intermediate range shown by values of m lying between $m_1$and m_2, and represented by the two vertical lines, v is always increasing with time and no stable equilibrium exists. To the right of this range, for all values of $m > m_2$, stable equilibria exist with a negative relation between m and v.

DIAGRAM 3 HERE

Diagram 3 suggests a possibility of abrupt change in the equilibrium value of v due to variation in m as an exogenous parameter on account of the emergence of conjugate complex roots for a range of values of v.

While abrupt change in the equilibrium level of the stock price$v$ occurs in this case through exogenous parametric variation in the pattern of profit distribution between the sectors (m) brought about by factors like monetary or fiscal policy, such abrupt change might become endogenous to the model through a feedback mechanism between the level of stock prices v to the inter-sector distribution of profit, m. And, the feedback mechanism might incorporate turning point behavior due to differences in the movements between v, r and ρ affecting m. Logarithmic differentiation of m with respect to v in equation (21) yields,

$$\frac{dm}{dv}=\frac{m}{v}\left(1+\eta_\rho-\eta_r\right) \qquad \ldots(23)$$

where η_ρ and η_r are elasticities of ρ and r with respect to v. It shows that even when both the elasticities are positive, m might increase or decrease as v increases depending on the values of the elasticities. The resulting turning point behavior of$m$in relation to$v$ is represented by a general quadratic equation with unspecified signs of the coefficients,

$$m=a_2v^2+a_1v+a_0 \qquad \ldots(24)$$

In (24), the existence of a maximum at $v > 0$implies$(a_2 < 0, a_1 > 0)$. Moreover, since $v = \left(\frac{a_0}{a_1 + a_2 v}\right)$ at $m = 0$,the requirement of non-negative values of $v$imposes an upper or lower bound on $v <$ or $> -\left(\frac{a_1}{a_2}\right)$ according as a_0 is positive or negative.[8]

Since the behavior of m with respect to v postulated in (24) has to be compatible with the stock flow consistent dynamic model outlined above, this is ensured by inserting (24) into (22). This results in a cubic equation depicting the dynamics of v as,

$$\dot{v} = r(v^3 + Av^2 + Bv + C) = 0 \qquad \ldots (25)$$

where, $A = \frac{(s-b_2)a_1 - b_1 - b_2 a_2}{(s-b_2)a_2}$, $B = \frac{(s-b_1) + (s-b_2)a_0 - b_2 a_1}{(s-b_2)a_2}$ and $C = -\frac{b_2 a_0}{(s-b_2)a_2}$.

For $r \neq 0$, the stationary or equilibrium values of v is given at $\dot{v} = 0$ in (25), which admits one or three real roots. We reduce (25) to the standard 'depressed' cubic form by eliminating the quadratic term through the substitution $y = \left[v - \left(\frac{A}{3}\right)\right]$ to obtain,

$$\dot{y} = f(y) = y^3 - py - q = 0 \qquad \ldots (26)$$

where, $p = \frac{A^2}{3} - B$ and $q = \frac{AB}{3} - \frac{2A^3}{27} - C$.

The nature of the roots of (26) is characterized by Cardan's discriminant, $D = -4p^3 + 27q^2$. The equation has only one real root if $D > 0$; all roots are real and at least two equal if $D = 0$; and, there are three distinct real roots if $D < 0$ (Poston, Stewart 1978). Therefore ,$p > 0$, i.e. $\left[\frac{A^2}{3} - B\right] > 0$, is a necessary condition for the existence of three real roots which is satisfied sufficiently if$B = \frac{(s-b_1) + (s-b_2)a_0 - b_2 a_1}{(s-b_2)a_2} < 0$.

Since $a_2 < 0$ in case of a maximum in (24), the denominator of B is negative. Therefore, the numerator of B has to be positive, i.e. $[(s - b_1) + (s - b_2)a_0 - b_2 a_1] > 0$, for $B < 0$. Examination shows that for $a_0 > 0$, if b_2 is sufficiently small, i.e. the impulse to invest in the financial sector is weak, $B < 0$, satisfying the necessary condition for the cubic equation (26) to have 3 real roots.[9]

The algebraic analysis of the necessary condition, i.e. the possibility that one or three roots of the cubic equation may be related to a geometric view of the problem (Strogatz 1994) by noting that the roots of the equation $f(y) = 0$ are given by,

$$y^3 - py = q \qquad \ldots(27)$$

The expression $y^3 - py$ has a maximum positive value, $\frac{2p}{3}\left(\frac{p}{3}\right)^{\frac{1}{2}}$, at the negative value of $y = -\left(\frac{p}{3}\right)^{\frac{1}{2}}$, and a minimum value of opposite sign but equal magnitude at the same positive value of $y = \left(\frac{p}{3}\right)^{\frac{1}{2}}$. Assuming that $p > 0$ while q can be positive or negative, the left hand side of (27) defines a symmetrical S-shaped curve passing through the origin and the right hand side of (27) defines a line parallel to the horizontal axis with a positive or negative intercept. The intersection points give the roots of the equation (Diagram 4).

DIAGRAM 4 HERE

As seen from the diagram, the equation can have one or three real roots, and at the critical point of bifurcation the horizontal line is tangent to the curve (i.e. two roots identical), and we can divide the parameter space (p, q) in terms of whether it permits one or three roots (fixed points). Within a critical interval of values of q spanning a positive to negative range, the dynamical system can have three real roots. Diagram 5 is a transformation of Diagram 4, and may be visualized as a 90^0 clockwise rotation with translation back from $y$to$v$, as $y = \left[v - \left(\frac{A}{3}\right)\right]$. The diagram shows, for a given value of p, two disjoint loci of stable equilibrium points depicted by unbroken curves on the (q, v)-plane that are separated by unstable points shown by the broken curve. Any slight increase in the value of q from less than the threshold value $+q_{critical}$ to more than that value can tip the average level of stock prices from above v' to below v''. However, this diagram is heuristic in so far as p and q are not independent parameters (i.e. it is not strictly a case of co-dimensional bifurcation). Instead, p and q might move simultaneously for variations in some parameter values, and we need to imagine both $y^3 - 3py$ and q moving simultaneously while retaining their shapes. Notwithstanding this problem, the model shows the possibility of sudden and abrupt change in stock price for some configuration of parameter values. At the same time, it has not identified the entire set of parameter values, nor can it predict how long a normal state of gradual change lingering on points of the stable locus might last.

DIAGRAM 5 HERE

5

In some ways the present paper can be seen a contribution in the Classical and Marxist tradition of political economy, set in the context of a modern financialized economy with its increasingly complex notion of property. It analyses how surplus is realized into money profit, and distributed according to ownership rights to property assigned by the stock market. The notion of property gets continuously redefined by a large private financial sector through various financial products and services provided by it. The paper places the functioning of the real commodity producing economy against this background of extensive notion of property, where the main link between the real and the financial sector is provided by relation between two notions of 'capital', one relevant for production in the real sector (K) and the other for distribution of profits as wealth (W) evaluated by the capital market (equation 1).

The model begins with a fourfold classification – a consumption (C) and an investment (I) good producing sector on the real side and, on the financial side a normal banking sector (B), and a largely unregulated private financial sector (F). The theory of effective demand determined profit and output due to Kalecki and Keynes is extended to show how monetary profit is realized and saving investment equilibrium obtains. It is seen that the financial sector, like all other sectors also has a role in the realization of profit through its contribution to aggregate demand (equations 2-3). Normal banking sector receives interest income as its purchasing power which is also withdrawal of purchasing power from other sectors. The discrepancy between the two creates the possibility of transfer of purchasing power and profit between the real and the financial sector (equation 4). When the volume of profit of the sectors are normalized through their respective measures of capital (K and W) as rates of profit (r,ρ), the saving investment equality involving profit transfer appears as an equation that inter-connects growth rates (g, G) to their respective profit rates, adjusted for profit transfer between sectors and the average stock price v, i.e. the ratio of wealth in the stock market (W) to the book value of capital of firms(K) (equations 1 and 5-7).

Since the average share price, v, is the ratio of two measures of capital stock, any difference in the growth rates of the two sectors results in a changing value of v (equations 8, 9). This fact is used in the saving investment equation to trace out the dynamic path of adjustment in v (equations 10, 11) when the flow equilibrium between investment and saving is assumed to hold throughout this path without explanation. Such exclusive adjustment of the stocks of the two measures of capital

resembles the generic saving driven neo-classical growth model which ignores problems of flow adjustment between investment and saving (Solow, 1956; Swan, 1956).

In contrast to the neo-classical growth theory, investment and saving decisions are taken by firms and households as two largely independent categories of economic agents, and the mechanism by which investment saving equality is maintained becomes central to the Kaleckian theory of profit and the Keynesian theory of income determination. The condition for flow equilibrium incorporating independent investment functions first without (equations 12, 13) and then with (equations 16,17) externalities between sectors is combined with the stock equilibrium condition of constancy of v to obtain stock flow consistent equilibrium. It is shown how equilibrium values of the two rates of profit, r^* and ρ*, are obtained in this framework. Moreover, using the stability properties of stock flow consistent equilibrium, comparative static exercises may be conducted through perturbation of parametrical values of v or s equations.

'Externalities' introduced as operating through one sector's profit rate affecting the rate of accumulation the other sector are seen to have similar comparative static results in case of 'relatively small' externalities as no externalities. However, 'sufficiently large' externalities might upset these results. This fact may be used to provide justification for bailing out large financial institutions assuming they have large external effects despite the risk of moral hazards. Conventional wisdom often captures this as "too big to fall".

Adopting the simplifying assumption of linearity of the investment functions with small externalities in (20) and combining it with the definition of the distribution of profit between the sectors (m) in equation 21, the model works out the complete dynamics of stocks and flows (section 4). It is shown by means of a quadratic equation (22) that, if the parameter for the pattern of distribution of profit between the financial and the real sector m is used as an exogenous bifurcation parameter, it has a curious property. For a range of values, m generates a locus of stable positive equilibrium values of stock price v and then again, for another range of higher values of m. However, for an in-between range of values of m, no equilibrium exists because roots are conjugate complex. This foretells the possibility of endogenous abrupt change in the stock price v, if m is treated not as an exogenous parameter but determined endogenously in the model.

Endogenous change in m is induced through variations in v which incorporates usually observed turning point behavior of the stock market turning from 'bullish'

to ‘bearish’(23,24). For such cases, for certain configuration of values of the parameters, it is shown that the conditions necessary for producing abrupt change in a canonical form of ‘cusp catastrophe’ involving a cubic equation are satisfied by the model. This also points to an early warning system for sudden changes in share price. If v and m begin to move in opposite directions, the possibility of drastic change in share price becomes more probable by satisfying some necessary conditions in accordance with the model. However, since many parameters are involved even in this highly stylized and simplified model, all possibilities producing similar or different results could not be exhausted. However, the model provides a framework for systematically dealing with them and more importantly, shows the possibility of drastic change in the level of stock price.

Future research can begin to make such analysis empirically more useful in at least two ways. First, the savings behavior may be generalized by distinguishing between propensities to save out of profit (property income) and, out of wage and salary income. Since the richer sections generally have a greater proportion of their income from property, with sufficiently detailed data on wealth distribution by decile groups, one might be able to infer statistically from the higher saving propensity of the richer people, the implied saving propensity out of property income as a statistical and not as a behavioral parameter. This would also provide a way to link class distribution of income with personal distribution of income.

Second, along with high frequency data on stock prices, it is necessary to have data of changing distribution of profit between the real and the financial sector. The need for such data is increasingly becoming pressing as they are needed not merely for developing the early warning system indicated in this paper but, also for tracking the changing balance of power between the real and the financial sector. This indeed resurrects an old theme – the relative importance of Industry and Finance. As capitalist economies become financially increasingly sophisticated, that old theme assumes great importance.

ENDNOTES

1. The controversy over capital theory (Harcourt 1969) was essentially about the irreducibility of two measures of 'capital' in production and distribution. While distribution between profit and wage was the earlier focus, the present paper focuses on the distribution of profit between the real and the financial sector.

2. Keynes (1936: 150-51) suggested a similar flow measure, namely the ratio of 'buy'(acquisition) to 'make' (construction) as relevant for investment decisions of entrepreneurs. Tobin (Tobin 1969; Brainard and Tobin 1977) used it as investment criterion q in a competitive set-up, while Minsky (1975,1986) brought in explicitly the possibility of capital gains and losses in this 'two price theory of investment'.

3. If $1 > s > 0$ is the fraction of profit interpreted as property income saved, this formulation becomes quite general while the assumption is more limiting if interpreted as the saving behavior of the profit earning class. On this point of linking class and personal distribution of income see observation in the last section.

4. Consider a two country analogy with the former producing exclusively real and the latter exclusively financial products. With investment expenditure on real and financial products as investment in each country, current account transactions between them consist of export of consumption goods from the real sector, equal in value to the consumption expenditure out of wages and profits earned in the financial sector(C^{bf}) and interest payments (T) from the real sector to banks in the financial sector. Assuming investment goods are non-tradable and zero public expenditure and taxes, for either country,
$GNP = C + IE + (X - M) + NFIA$,
where, $IE =$ investment expenditure and $NFIA =$ net factor income from abroad.
National savings, $S = GNP - C = IE + (X - M) + NFIA$, i.e.$S - IE = (X - M) + NFIA$.
Since for the real sector,$IE = I, NFIA = -T$, $X = C^{bf}$ and $M = 0$, it follows,

$$S - IE = sR - I = C^{bf} - T$$

Similarly, denoting $F =$ investment expenditure on financial products, $NIFA = T$,$E = 0$ and $M = C^{bf}$,for the financial sector,

$$S - IE = s\Pi - F = -C^{bf} + T$$

It follows therefore, $I - sR = s\Pi - F$, as stated in the text.

5. Originally the theory of determination of profit through investment is due to Kalecki (1933/1971), which essentially was also as Keynes' theory of income

determination (Keynes 1936) with a different assumption about saving. It was developed subsequently in various ways by Kaldor (1955-1956), Robinson (1956, 1962), Pasinetti (1962) and Hicks (1965) among others.

6. Formally, $v = 0$ is not an admissible solution directly from (8) but, can be inferred from (6).

7. There are other ways of introducing externalities in this model like using v as an argument in the functions (16) and (17).

8. Depending on the turning point being a maximum or minimum for positive values of v we can sign a_2, a_1 and set upper or lower bounds to a_0 for considering many more possibilities not considered here.

9. Although the behavior of equilibrium values of v may be analyzed directly from studying the roots of (25) (e.g. Nicolis, Prigogine1978:168-177), geometric analysis may provide greater transparency(Strogatz 1994: 69-73).

REFERENCES

Bhaduri, A., Raghavendra, S. (2017): Profit and Wage-Led Regimes under Modern Finance: An Exploration, in: *Review of Keynesian Economics*, 5(3), 426-438.

Brainard, W., Tobin, J. (1977): Asset Markets and the Cost of Capital, in: Balassa, B., Nelson, R. (eds.), *Economic Progress: Private Values and Public Policy, Essays in Honour of William Fellner*, New York: North Holland.

Harcourt, G.C. (1969): Some Cambridge Controversies in the Theory of Capital, in: *Journal of Economic Literature*, 7(2), 369-405.

Hicks, J. (1965): *Capital and Growth*, Oxford: Oxford University Press.

Kaldor, N. (1955-1956): Alternative Theories of Distribution, in: *Review of Economic Studies*, 23(2), 83-100.

Kalecki, M. (1933/1971): A Theory of the Business Cycle, in: *Review of Economic Studies*, 4(2), 77-97. Reprinted in: Kalecki, M., *Selected Essays on the Dynamics of the Capitalist Economy 1933-1970*, Cambridge: Cambridge University Press.

Keynes, J.M. (1936): *The General Theory of Employment, Interest and Money*, London: Macmillan.

Minsky, H.P. (1975): *John Maynard Keynes*, New York: Columbia University Press.

Minsky, H.P. (1986): *Stabilizing an Unstable Economy*, Yale: Yale University Press.

Nicolis, G., Prigogine, I. (1977): *Self-Organization in Non-Equilibrium Systems*, New York: J. Wiley and Sons.

Pasinetti, L.L. (1962): Rate of Profit and Income Distribution in Relation to the Rate of Growth, in: *Review of Economic Studies*, 29(4), 267-279.

Poston, T., Stewart, I. (1978): *Catastrophe Theory and Its Applications*, London: Pitman.

Robinson, J. (1956): *The Accumulation of Capital*, London: Macmillan.

Robinson, J. (1962): *Essays in the Theory of Economic Growth*, London: Macmillan.

Solow, R.M. (1956): A Contribution to the Theory of Economic Growth, in: *Quarterly Journal of Economics*, 70(1), 65-94.

Swan, T.W. (1956): Economic Growth and Capital Accumulation, in: *Economic Record*, 32(2), 334-361.

Strogatz, S.H. (1994): *Non-Linear Dynamics and Chaos*, Reading, Massachusetts: Perseus Books.

Tobin, J. (1969): A General Equilibrium Approach to Monetary Theory, in: *Journal of Money, Credit and Banking*, 1(1), 15-29.

DIAGRAMS

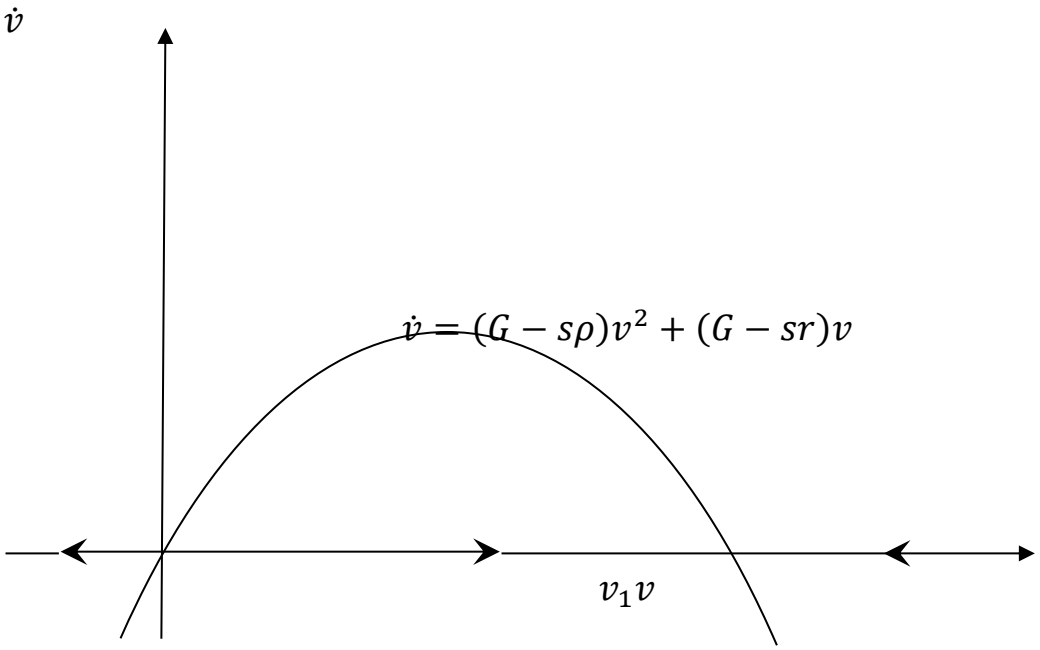
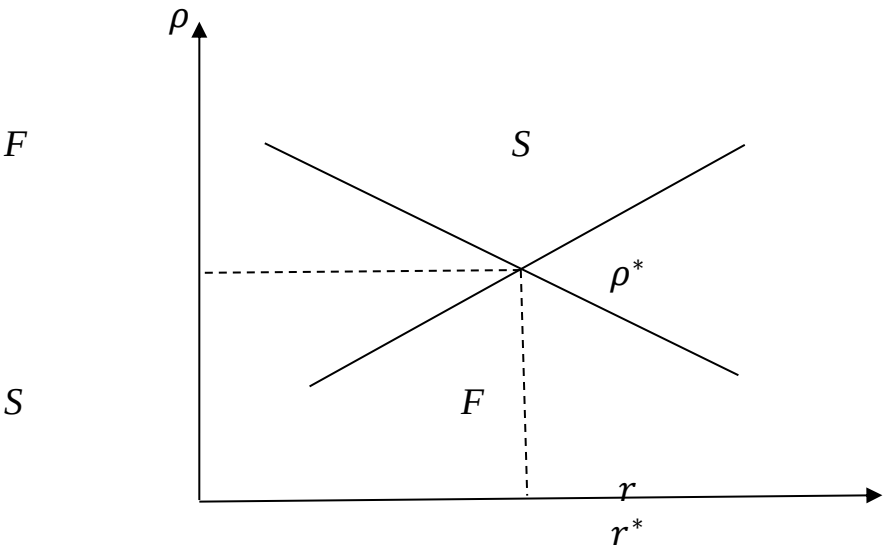


Diagram 1



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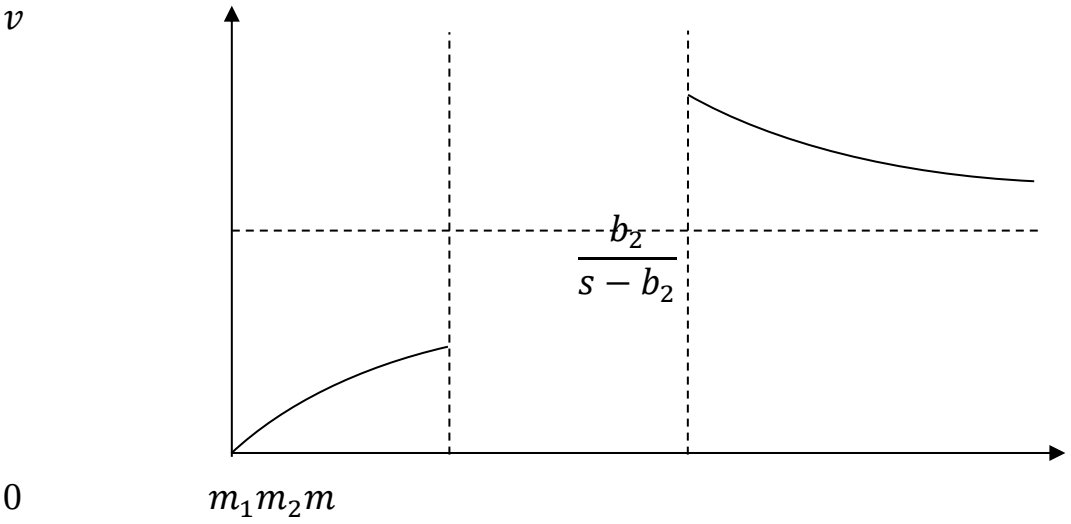

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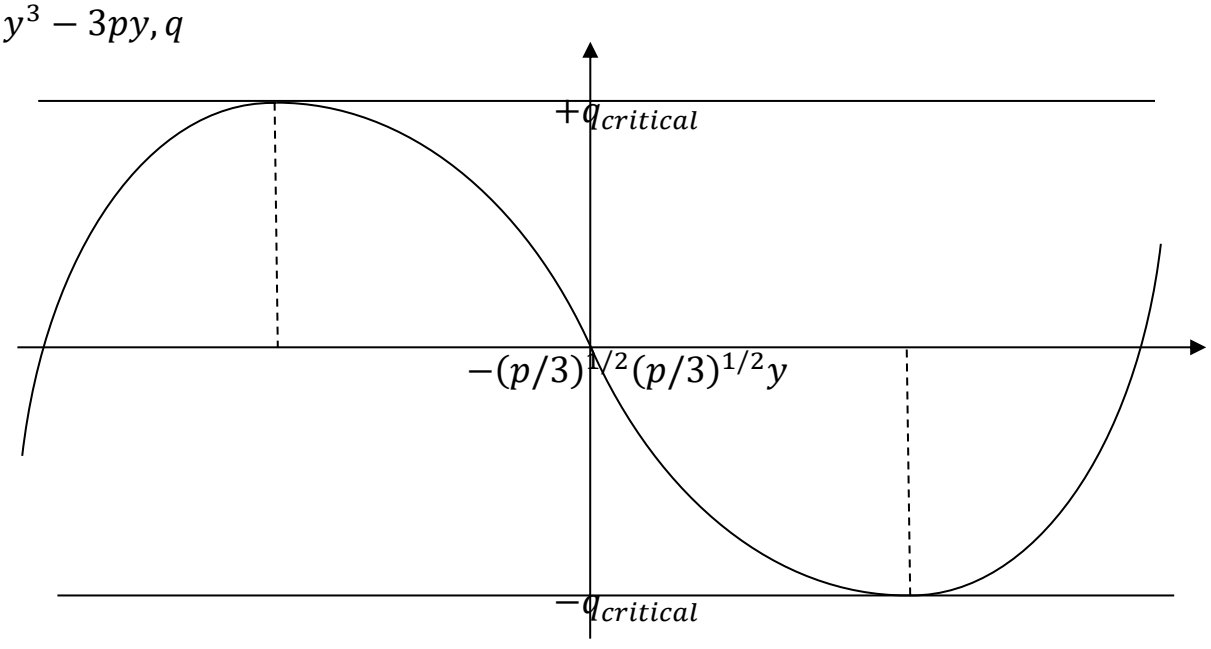

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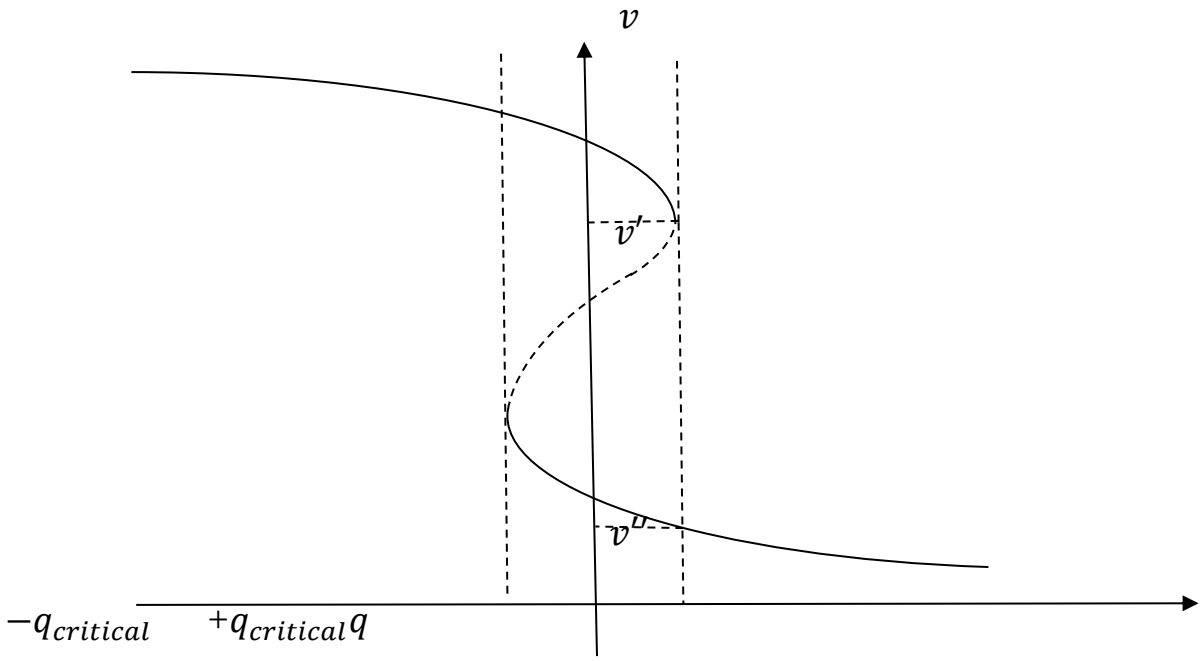

Diagram 5