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A Contribution to the Theory of Financial Fragility and Crisis*

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* Without implicating them in my errors, I wish to record my intellectual debt to Ariel Wickerman, Duncan Foley, Dimitri Papadimitriou, Joanilio Teixeira, Martin Fitzbein, Massimo Riccottilli, Rune Skarstein, and Servaas Storm.

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ABSTRACT

The paper examines three aspects of a financial crisis of domestic origin. The first section studies the evolution of a debt-financed consumption boom supported by rising asset prices, leading to a credit crunch and fluctuations in the real economy, and, ultimately, to debt deflation. The next section extends the analysis to trace gradual evolution toward Ponzi finance and its consequences. The final section explains the link between the financial and the real sector of the economy, pointing to an inherent liquidity problem. The paper concludes with comments on the interactions between the three aspects.

Keywords: Capital Gains; Consumer Debt; Debt-driven Fluctuations; Effective Demand; Financial Fragility; Liquidity Preference

JEL Classifications: D84, E12, E21, E32, E41, E44, E51, G12, G18, G24, N22

I. INTRODUCTION

Each financial crisis reminds one of the saying of an ancient Greek philosopher, "It is never possible to step into the same river twice" (Heraclitus, circa 544 B.C). Yet the ever-changing river has some relatively unchanging attributes that make it possible to recognize it as the same river. Each financial crisis, too, has recurring features that remain similar, along with its own historical specificities that make each crisis different. The purpose of theory is to isolate these necessary characteristics, even if they might not be sufficient to adequately describe any particular crisis. Formal models are not historically accurate, but try to isolate the central mechanism that precipitates many financial crises.

At least two features typically recur in a crisis. The first is loss of confidence, either in or by the financial sector. Since the system of credit money and the entire edifice of financial institutions function largely on the basis of mutual confidence among the players in the market, this leads to abrupt changes in lenders' behavior as the proximate cause of the crisis. The second feature is the transmission of the crisis from the financial to the real economy through aggregate demand. In usual Keynesian analysis this typically operates through a sudden decline in real investment. However, at least in the recent financial crisis (starting in 2007), it seems the fragility of private consumption played the more crucial role. Thus, for simplicity of exposition we focus mostly on greater consumption expenditure sustained by rising asset prices (including housing) to examine the pattern of interaction between financial fragility and aggregate demand.[1]

Section II of the paper outlines a schematized model that explains how capital gains might drive debt-financed consumption expenditure resulting in fluctuations in both output and debt. Section III extends the argument to show how similarly fluctuating patterns prevail under more plausible assumptions about lending behavior of financial firms and banks, which takes into account borrowers' ability to meet debt obligations from their current income. A simplified one-period version of Ponzi finance is postulated

[1] Evidence accumulated (especially from the United States) on how debt-financed consumption expenditure becomes fragile over time. Despite some commentators sounding early warnings, this process continued unabated (see, for example, Baker [2006]; Campbell and Cocco [2006]; Dayan and Maki [2000]; Maki and Palumbo [2001]; Godley [2001 and 2002]; Gross [2004]).

to set the limit in this case. Section IV sets the argument in the context of financial fragility arising from increasing internal liquidity problems faced by the financial system itself. Its "fragility" is an expression of its inability to cope with the challenges of even relatively small, unanticipated defaults by means of the liquidity available within the system, leading to a reinterpretation of the Keynesian liquidity preference. In the present context it relates more to financial firms than to the general public (i.e., households and firms in the real sector). Section V concludes by bringing together different aspects of the argument. It explains how recurring liquidity problems and loss of confidence arise as a surface phenomenon of the deeper, evolving relationship between the financial and the real sector in developed-market economies. To avoid misunderstanding, it also comments on some additional complications that are important in many crises but not treated adequately in this paper.

II. A MODEL OF FLUCTUATIONS DRIVEN BY CAPITAL GAINS AND DEBT-FINANCED CONSUMPTION

From the expenditure side, gross national product (GNP) consists of,

$$GNP = Y = C + I + U \qquad (1)$$

Consumption, C, is assumed to be partly autonomous and partly induced by income. However, increases in wealth and the stock of inherited debt also influence the level of consumption, captured by,

$$C = c_1 Y + c_2 (dW/dt) - c_3 \rho D + K_1, \qquad (2)$$

with arbitrary constants $c_1, c_2, c_3 > 0$; K_1 = autonomous part of consumption; and W = wealth of the private consumers. Note that the wealth effect is shown as operating through rising asset values and capital gains, rather than the stock of wealth.[2] While the

[2] The assumption of continued capital gains based on information provided by an "efficient" capital market was indeed the essence of the model of "great moderation." On this basis, the Federal Reserve System

conventional real balance effect depends on the stock wealth, the emphasis here is on the increase in wealth on the assumption (substantiated by recent experience) that both higher borrowing as well as lending are particularly facilitated by rising asset prices. Borrowers can meet their debt repayment obligations without difficulty from their capital gains, while the lenders also lend more leniently with a more comfortable balance sheet, caused by rising asset prices. The increase in wealth (dW/dt) occurs mostly through higher prices of assets (including housing and real estates). In a macroeconomic sense, this is notional increase in so far as it cannot be realized on a macro scale without setting off strong bearish tendencies in the market. However, on the micro scale, higher wealth makes each individual wealth owner more creditworthy in the eyes of the lending institutions, while simultaneously expanding the credit base of individual lending institutions through an increase in the value of their assets on their balance sheets. This results in the expansion of actual credit against notional capital gains. Nevertheless, the stock of inherited debt, D, exerts a negative influence on consumption through the repayment burden. With ρ as the repayment coefficient, this explains its negative sign in equation (2).

Persistent current account deficit (U) is covered by increased foreign debt (D_F) as liabilities to foreigners denominated in the same currency, assumed to be a stable domestic currency. For simplicity of exposition we assume the current account deficit is partly autonomous (K_2) and the rest induced by net import as a function of GNP, i.e.

$$U = (dD_F/dt) = n_1 Y + K_2 \ , \qquad (3)$$

where $n_1 > 0$ is the net import propensity.

Similarly, keeping the exposition simple, investment (I) is assumed to have an autonomous part (K_3) and the rest is induced by income,

(Fed) refused to intervene in a situation of continuously rising asset (housing) prices and a consumption-led boom financed by rising indebtedness of households until the very end, which was marked by financial meltdown (staring around September 2007). This story is not unfamiliar. "... in the 1920s, convinced that skilled monetary management at the Federal Reserve and the rise of new professionally run investment trusts had reduced the riskiness of markets, Irving Fisher declared on 15 October that stock prices have reached 'what looks like a permanently high plateau.'" This was just before the Great Crash leading to the severest depression of the last century (Fox [2009a]; also Fox [2009b]).

$$I = n_2 Y + K_3,\ n_2 > 0. \tag{4}$$

The critical feature of the debt-driven economy is a positive relation between increasing (notional) wealth and increasing (actual) debt-financed consumption. We assume (for expositional simplicity) strict proportionality,

$$(dW/dt) = w(dD/dt), \tag{5}$$

with w>0, a positive constant.

Using (2), (3), (4), and (5) in (1), we obtain the time behavior of Y, governed solely by the dynamics of the flow and stock of debt and an autonomous term, K, i.e.,

$$Y = a(dD/dt) - mrD + mK, \tag{6}$$

where $a = mc_2 w > 0$, $r = c_3 \rho$, and $m = (1 - c_1 - n_1 - n_2)^{-1} > 0$; $K = (K_1 + K_2 + K_3)$ = an autonomous term, is assumed for simplicity to be a time-independent positive constant.

The transmission mechanism from debt to income generation in the real economy through effective demand is outlined by focusing first on a highly simplified case of lending behavior by financial institutions. We postulate that there is an arbitrarily given ceiling, E, to the stock of debt such that,

$$(dD/dt) = A > 0 \text{ for } D < E \quad \text{and} \quad (dD/dt) = 0 \text{ for } D = E. \tag{7}$$

On these assumptions, with positive borrowing supported by a steady flow of debt at the constant rate A > 0, Y would be at its maximum value when debt repayment burden is at its minimum, D=0, to yield from (6):

$$Y_{max} = aA + mK \quad \text{and} \quad D_{min} = 0 \tag{8}$$

On the other hand, a minimum value of Y is reached when debt repayment burden is at its maximum,

$$Y_{min} = aA+mK-mr.E \quad \text{and} \quad D_{max} = E \tag{9}$$

Under these assumptions, the economy fluctuates abruptly between the maximum and the minimum value of Y in a two-dimensional plane of the stock of debt (D) and income (Y). With the stock of debt initially assumed to be at zero, $D_{min}=0$, Y starts at its maximum, Y_{max}, with no repayment burden of debt in (8). However, as the flow of debt continues at a steady rate, A, the stock of debt accumulates over time to reach the ceiling $D_{max} = E$ over $t_1 = (E/A)$ periods. At that maximum burden of repayment of debt, with debt at its ceiling, E, Y is reduced to its minimum value Y_{min} in (9) with an abrupt switching off of all lending according to (7).

Y_{min} in (9) marks the beginning of a recession, when the positive wealth effect also ceases due to the switching off of all credit flows to private consumers. However, the situation can get worse, because all lending stops at D = E, but the obligation for repayment on accumulated debt—with its depressing effect on consumption—continues. Repayment obligation would generally be met largely through the forced sale of assets under distress. A gradual reduction of debt begins as (dD/dt) turns negative. This is the classic case of debt deflation as the economy slides into a deepening recession (Fisher 1933). Y falls even below its minimum level (Y_{min}) given in (9), as the flow of debt (dD/dt) and its associated wealth effect on consumption turn negative. However, the inherited stock of debt (D) also begins to decrease and the repayment burden on debt begins to falls gradually. This process continues until debt reaches a sufficiently low value for lending to start again and recover to begin.[3]

[3] With forced sale, asset prices might continue to fall, making the debt repayment burden increasingly heavier and recovery more difficult. In more extreme cases recovery becomes impossible without government intervention. This point is discussed at length in section 4 on financial fragility.

The possibility of debt deflation is incorporated in the formal analysis by assuming that the economy switches instantly to a debt retirement mode at the rate B as soon as all flow of debt stops at the debt ceiling, i.e.,

$$(dD/dt) = - B, B > 0 \text{ at } D = E. \qquad (10)$$

Combining (6) and (10) it is easy to see that Y falls below even its earlier specified minimum value in (9) due to the operation of a negative wealth effect to yield an even lower minimum value, which lies below $Y_{\min}$ in (9) and is given by,

$$Y_{Ext\,\min} = mK - aB - mrE. \qquad (11)$$

However, as the stock of debt also begins to fall at the rate B and the repayment burden gradually eases, income begins to rise from that lowest level given by (11).

The argument can be summed up algebraically. Using (7) and (10) we represent the increasing and decreasing phases in the stock of debt over time as,

$$D = tA, \text{ for } t \leq t_1, \qquad (12)$$

where $t_1 = E/A$,

$$D = (E\text{-}tB) = \text{ for } t \geq t_1. \qquad (13)$$

From (6) we depict the time paths of Y as,

$$Y(t) = aA - mr(tA) + mK \text{ , for } t \leq t_1 \qquad (14)$$

$$Y(t) = mK - mr(E\text{-}tB) - aB \text{ , for } t \geq t_1, \qquad (15)$$

with an instantaneous switch between the two modes at time $t=t_1$ at D=E.

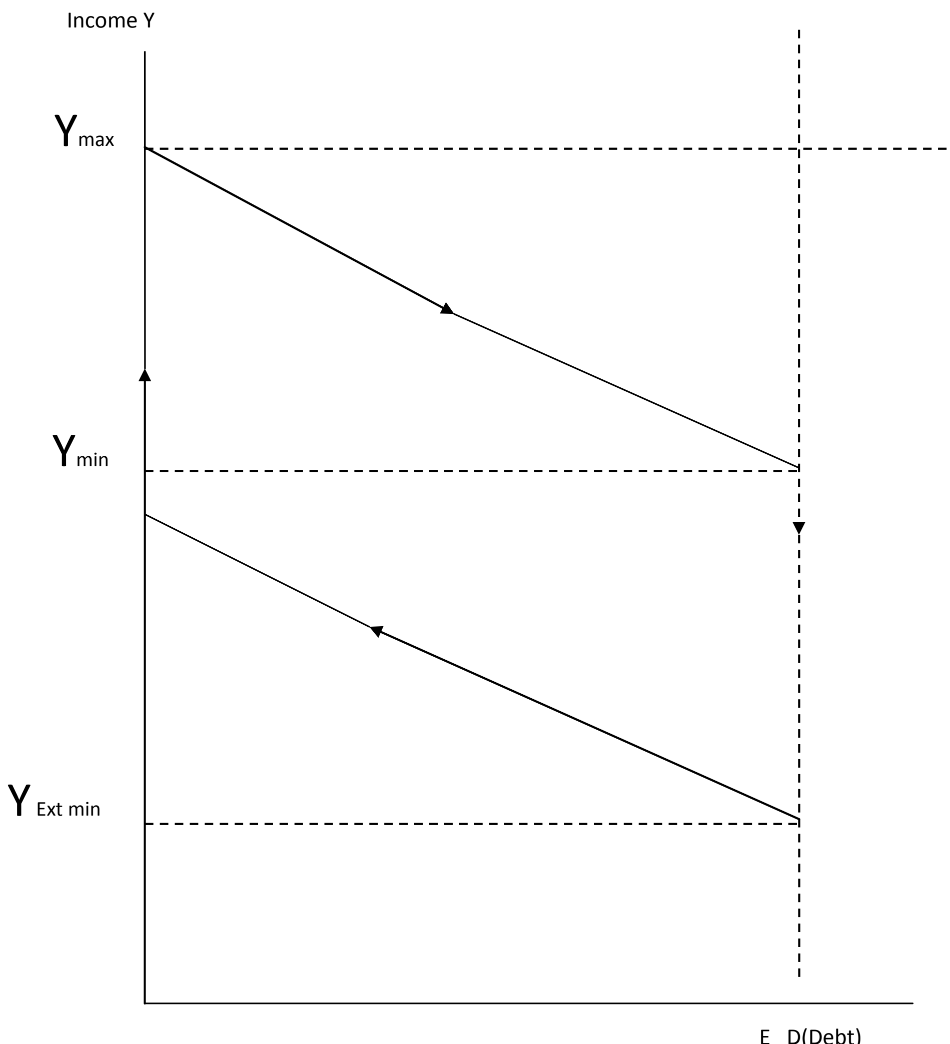
Since from (12) and (14), (dD/dt) =A and (dY/dt) = - mrA, whereas from (13) and (15), (dD/dt) = -B and (dY/dt) = + mrB, it follows from the chain rule of differentiation that in both the increasing and decreasing phase of the stock of debt, the same slope, z, obtains between D and Y, i.e.,

$$(dY/dD)= z = - mr. \tag{16}$$

The stock of debt increases for $(E/A) = t_1$ periods and then it decreases for the next $(E/B) = t_2$ periods. Since, in general, $A \neq B$, it follows that $t_1 \neq t_2$, implying the duration of the two phases of increasing and decreasing debt might differ.

Geometrically the analysis is summarized in figure 1. Starting initially at zero debt, the behavior of debt and income over time can be seen by moving along the direction of the arrow on a two-dimensional plane in D and Y.

Diagram 1



Notes on Diagram 1

Y_{max} from (8) ; Y_{min} from (9) $Y_{ext.\ Min}$ is from (11); tan Z = - mn from (16)

III. SOME MODIFICATIONS OF LENDING BEHAVIOR

Without pretense to realism, the above model schematizes a simple mechanism of fluctuations in debt and income based on a stock-flow approach. Higher positive flow of credit driven by capital gains stimulates consumption and income through higher aggregate demand, but, at the same time, exerts a depressing influence on demand through the repayment obligations on a higher stock of accumulated debt. This results in sustained oscillations similar to some earlier Keynesian models of endogenous business cycles, with the important difference that the present model emphases a mechanism working through consumption rather than investment (cf., Kalecki [1971], Kaldor [1960], and Goodwin [1951 and 1982]).[4]

The model postulates a crisis of confidence on the part of the lenders, as borrowers become overindebted and reach a debt ceiling. However, a most obvious flaw of the model lies in assuming that this ceiling to the stock of debt is arbitrarily given (at E) without any reference to either the ability of the borrowers to repay or the risk faced by financial institutions that leads to such a crisis of confidence. More plausibly the ceiling might be related to the ability of the borrowers to repay in relation to their income. In that case, the lenders face the risk of being caught in a debt trap, as the lending institutions fear that the borrowers can only service debt with further loans. When reduced to a single-period criterion for lending, the debt adjustment equation (7) can be reformulated defining a single-period condition for Ponzi finance as the credit ceiling, i.e.,[5]

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[4] In business cycle models in the tradition of Kalecki and Keynes, the positive impact on aggregate demand of the flow of investment through the multiplier mechanism is counteracted by the depressing effect of capital stock on investment. Mathematically they generate limit cycles (Arrowsmith and Place 1982) or fluctuations from delayed response through mixed difference-differential equations (Minorsky 1969). It might be mentioned in this context that Lavorie and Godley (2000) made an interesting distinction between debt-burdened and debt-financed effective demand. A similar distinction operates here with the flow of new debt contributing positively and the stock of inherited debt contributing negatively to aggregate demand.

[5] Minsky (1975 and 1986) introduced a perceptive distinction among the three stages in the evolution of the financial structure of a firm, as it transits from hedge to speculative to Ponzi finance. Hedge finance allows firms to meet their repayment obligations from their expected regular flow of anticipated revenue; in speculative finance, firms still meet their obligations, mostly from anticipated revenue flows, but may need the occasional injection of "bridge finance" in some periods; in Ponzi finance, continuous outside financial injections are needed to meet obligations (Taylor 2004: 261–263). Note the distinction between speculative and Ponzi finance has been blurred in our one-period formulation.

$$(dD/dt) = \theta(Y - \rho D),\ \theta > 0. \tag{17}$$

In this simple one-period specification, the flow of credit continues to be positive and adjusted to the extent of the gap between income and debt-servicing obligations of each period, i.e., (Y – rD) > 0. However, when this gap dwindles to zero, credit reaches its ceiling. Accordingly, the flow of credit stops and retirement of debt is governed by the equation,

$$(dD/dt) = \theta\ \left[Y - \rho\ \{D\max - (dD/dt)\}\right] \tag{18}$$

From (6) and (17), setting (dD/dt) =0, it can be seen that the maximum stock of debt is determined endogenously as,

$$D = D_{max} = mK/(\rho + rm). \tag{19}$$

Assuming that the initial stock of debt is minimum at zero, there is no repayment obligation. Consequently, the inflow of credit is maximum at that point and (6) implies income is maximum at $Y=Y_{max} = mK/(1-\theta a)$ when $D = D_{min} = 0$ at t=0. For an economically meaningful solution,

$$Y_{max} > 0 \tag{20}$$

implying, $(1-\theta a) > 0$.

Inserting (6) in (17), the phase of increasing debt is seen to be governed by a first-order differential equation,

$$(1-\theta a)\ (dD/dt) = -\theta(rm + \rho)D + \theta mK\ , \tag{21}$$

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having a solution

$$D = D_{max}(1\text{-}e^{-\lambda t}), \qquad (22)$$

where $\lambda = \theta(rm+\rho)/(1-\theta a)$.

Since in view of (20), $\lambda > 0$, it follows that at t =0, D= 0, but as $t \to \infty$, D $\to D_{max}$.

Similarly, inserting (6) in (18), the phase of decreasing debt is guided by the differential equation,

$$(1\text{-} \theta a \text{-} \theta\rho)\,(dD/dt) = -\,\theta rm D \text{-}\, \theta\rho D_{max} \;+\theta mK\,, \qquad (23)$$

which reduces on simplification to

$$(dD/dt) = \mu D - \mu D_{max}, \mu = \theta mr/[\theta(a+\rho)-1]. \qquad (24)$$

Theoretically, debt asymptotically approaches its maximum governed by (22). We approximate by assuming that for a sufficiently large value of $t = t_1$ debt is arbitrarily close to its maximum level and the system then goes into its debt repayment mode according to (24), until at $t=t_2$ when debt again reaches its initial minimum value D= 0. In this case the particular solution to (24) can be written as,

$$D = D_{max}[1\text{-}\, e^{\mu(t-t_2)}],\; t_2 \geq t > t_1. \qquad (25)$$

As t increases to t_2, the stock of debt, D, gradually decreases from its maximum to its minimum value of 0 at $t = t_2$ provided $\mu > 0$, implying

$$\theta(a+\rho) > 1. \qquad (26)$$

Thus starting initially (t=0) at D=0, debt asymptotically approaches its maximum level D_{max}, coming sufficiently close to it as t becomes arbitrarily large at $t = t_1$ when the phase of reduction in debt commences in conformity with (24) to return ultimately to the zero debt situation at $t = t_2$. Therefore, despite the postulated modifications in lending behavior, the qualitative nature of the debt cycle remains similar to the simpler case depicted in diagram 1, provided inequalities (20) and (26) are satisfied.[6]

These inequalities can be economically interpreted within the Keynesian framework of demand-determined output. Given the magnitude of the multiplier (m), the parameter a $(=c_2 w)$ captures the wealth effect operating through capital gains and the increase in debt-financed consumption, while θ governs the speed with which debt increases. Consequently, the product term θa governs the increase in debt and consumption, which has to be less than unity for the income-generation process to be stable (condition 20). Similarly, inequality (26), $\theta \rho > (1-\theta a)$, ensures that repayment has to exceed saving from the wealth effect on output for the process of debt reduction to be effective.

VI. FINANCIAL FRAGILITY AND CRISIS

During the alternating phases of expansion and contraction in economic activity depicted in the preceding sections, the financial system providing credit also undergoes simultaneous changes. Paradoxically, the fragility of the financial system usually increases during the phase of rising income and debt. The expansionary phase encourages a general state of economic optimism and "conventions" (Keynes 1937) gain ground that this is going to be the normal state of the economy that can be extrapolated into the future. Consequently, actors in the economy are encouraged to borrow and lend more freely. This tendency is further strengthened by the rising asset prices that typically accompany expansion. Not only the financial positions of firms and households in the real sector, but also various (especially nonbank) institutions in the financial sector

[6] The volume of debt switches from an increasing to a decreasing mode at t_1 and the abruptness is still present at that point t_1.

undergo change as they come to rely increasingly on sustained capital gains as the normal state of affairs.[7]

This may be viewed as a process of transition towards Ponzi finance for the macroeconomy (Minsky 1986).[8] The evolution towards Ponzi finance through rising asset prices affects both the real and the financial sector of the economy. Borrowers tend to overborrow in relation to their income because they hope to more easily meet repayment obligations out of capital gains. Financial firms, too, feel more solvent due to rising values of assets on their balance sheet and lend more liberally by relaxing the standards of scrutiny. This process is sustained on a macro scale so long as capital gains are not actually realized, but generate sufficient economic optimism for both borrowers and lenders to take increasingly fragile financial positions characterized by increased indebtedness.[9]

As the optimistic view of "business as usual" continues, even the fear of unforeseen negative shocks in the future tends to recede to the background and less liquidity is held by the financial firms as a precaution against an unknown future (cf., Chiarella and Flaschel [2000]). In more conventional terms, this results in a downward shift of the (Keynesian) liquidity preference, but with the important difference that it is mostly the liquidity preference of the financial firms—and not that of the general public—that begins to make the financial system fragile at its core. In particular, unregulated by a monetary authority capable of acting as a "lender of last resort," financial firms continue to expand their operations through various innovative arrangements characterized by increasingly interlocked assets and capital structures of

[7] As already stated (see note 2), the model of the "great moderation" of the Fed was based on this assumption. For a critical summary view of this received wisdom, see also Foster and Magdoff (2008). In a complex financial system, nonbank financial firms like mutual funds and mortgage banks may increase their leverage ratio and hold securities issued by other financial firms (guaranteed by credit rating agencies and insurance companies) in the capital base as a close substitute for liquidity. At the end of 2007, Fannie Mae and Freddie Mac had astoundingly high leverage ratios of 65 times and 79 times, respectively, while the leverage ratio of all the five big investment banks in the United States (Merrill Lynch, Lehman Brothers, Bear Stearns, Morgan Stanley, and Goldman Sachs) hovered anywhere between 33 and 26 times (Chitale 2008: 22).

[8] Minsky's explanation on this point runs mostly in terms of investment behavior of firms in the real sector, and many formal modeling exercises followed similar routes (e.g., Taylor and O'Connell [1985]). However, the recent crisis once more made clear a familiar pattern from several past experiences. Financial crisis often precedes a crisis of the real sector suggesting that the fragility of financial firms might proceed faster than that of households and firms in the real sector.

[9] Bhaduri, Laski, and Riese (2006) makes an attempt at modeling along these lines.

mutual guarantees and insurances without sufficient liquidity in reserve.[10] The situation of rapid expansion of credit further strengthens the boom conditions and the belief that this indeed is the normal state of affairs reflecting “economic fundamentals.” However, the possibility of a financial meltdown hovers below the surface, because even a relatively small (in relation to the total volume of credit advanced) unexpected default in obligations would force the concerned financial institutions to raise liquidity immediately to sustain the scheme of mutual guarantee. Paradoxically, a high degree of homogeneity in optimistic expectations formed by the ruling conventions of good times worsens the problem because most other firms (due to their homogeneity in expectations) are similarly overextended and are not in a position to provide short-term internal liquidity to the system as buyers of financial assets. The concerned financial firm trying to cover the defaulted loan is then forced to sell assets immediately, under distress, in a market with relatively few buyers.

We assume that some unanticipated fraction, q, of the volume of loans advanced is defaulted, resulting in additional demand for liquidity. We denote this additional amount of liquidity required by lending financial institutions as L, which would be larger the greater the extent of default (q) and the higher the leverage of the concerned financial firms facing default. Moreover, for any given state of uncertainty, when the level of asset prices (p) is lower, the substitution against liquidity in favor of assets in the capital base of lending firms is stronger. In turn, this results in an intricately interlocked capital structure among financial firms that is capable of creating a widespread “correlation effect.” While it raises the amount of liquidity required (L) in case of default, there would be fewer interlocked financial firms wanting to part with their liquidity. This complex financial structure is formally represented as,

$$L = \psi(\overset{+}{q}, \overset{+}{x}, \overset{-}{p}), \tag{27}$$

[10] For instance, an elaborate system of shadow banking populated by mutual funds, mortgage banks, brokerage institutions, etc. developed in the United States that provided credit substitutes without intermediation of banks. This shadow banking system has been described as having the characteristics of “complexity” and “tight coupling” (Bookstaber 2007). The former relates to the mutual interlocking of balance sheets and assets, and the latter resembles production on an assembly line where little time is left for correction or slow adjustment of portfolios and capital structures, mainly because of the interlocked nature of the assets.

where sign over the relevant variable indicates the sign of its partial derivative.

Assuming a composite asset for simplicity, the volume of that composite asset to be supplied to the market for sale is (L/p) where p = the price level of the composite asset. The additional supply of assets to the market for sale (due to default) is given by,

$$\Delta\ A_S = L/\ p \qquad (28)$$

A stylized representation of the demand for assets in the market would typically include two types of traders —the "value traders," who consider the current price level of asset (p) in relation to its long-term value guided by "fundamentals"(π), and the "trend traders," who focus on the short-term trends in the price of assets (dp/dt). Thus, if (p-π)>0, value traders consider assets to be overvalued and tend to be bearish. However, despite value traders' bearishness, the price may continue to rise if their bearishness is outweighed by the trend traders' bullish sentiment that prices would continue to rise in the near future.[11] When most value and trend traders share a similar bullish or bearish sentiment, market sentiments appear relatively homogeneous; when divided, guessing the average sentiment that prevails in the market becomes the central concern of traders in the stock exchange (Keynes 1930 and 1964).[12]

The demand for assets in the stock exchange is represented by the equation,

$$A_D = F\ [(p-\ \pi),\ (dp/dt)\ ], \qquad (29)$$

where, for reasons explained above, the partial derivative of the first argument pertains to value traders, F_1 <0, and that of the second argument relates to trend traders, $F_2 > 0$.

[11] Friedman (1953) ignored the role of trend traders in the market to claim that profitable speculation is always stabilizing.

[12] The averaging procedure followed by players in a market of divided expectations (according to Keynes) is analogous to guessing the winner of a "beauty competition." Each player chooses the prettiest face, not according to his own criterion, but by guessing what the "average" voter would consider to be the prettiest face and then, as further refinement, guessing the average of this average and so on. Taylor (2004) provides a lucid account.

We postulate (not necessarily realistically!) that the system has an equilibrium at $p = \pi$, a constant for simplicity of exposition. This implies $A_D = F[0,0] = A_S$ at $p = \pi$. Thus, in the equilibrium state so defined, trend traders are inactive and the value traders' demand price for assets at discounted future profits is π, which equals the supply of assets A_S (i.e., the market trades without expectations of capital gains or losses at prices determined exclusively by fundamentals).

The movement in an asset price around equilibrium depends on the excess demand and supply created by default, depicted by the asset price adjustment equation,

$$(dp/dt) = -\gamma\ [\Delta A_D - \Delta A_S],\ \gamma > 0. \qquad (30)$$

Inserting (27), (28), and (29) into (30) and totally differentiating, we obtain,

$$d(dp/dt)/dp = \gamma\ \{[F_1] + [L(1-\eta)/p^2]\}\ /(1-\gamma F_2), \qquad (31)$$

where $\eta = (p/L)(\partial L/\partial p) < 0$.

It might not be implausible to assume that the speed of asset price adjustment, γ, in a modern stock market is sufficiently high to make the denominator in the expression on the right-hand side of (31) negative, i.e. $(1-\gamma F_2) < 0$. Consequently the stock market would be stable around the postulated equilibrium provided the numerator of that expression is positive, i.e.,

$$[F_1] + [L(1-\eta)/p^2] > 0 \qquad (32)$$

Thus, the necessary and sufficient condition for stability boils down to,

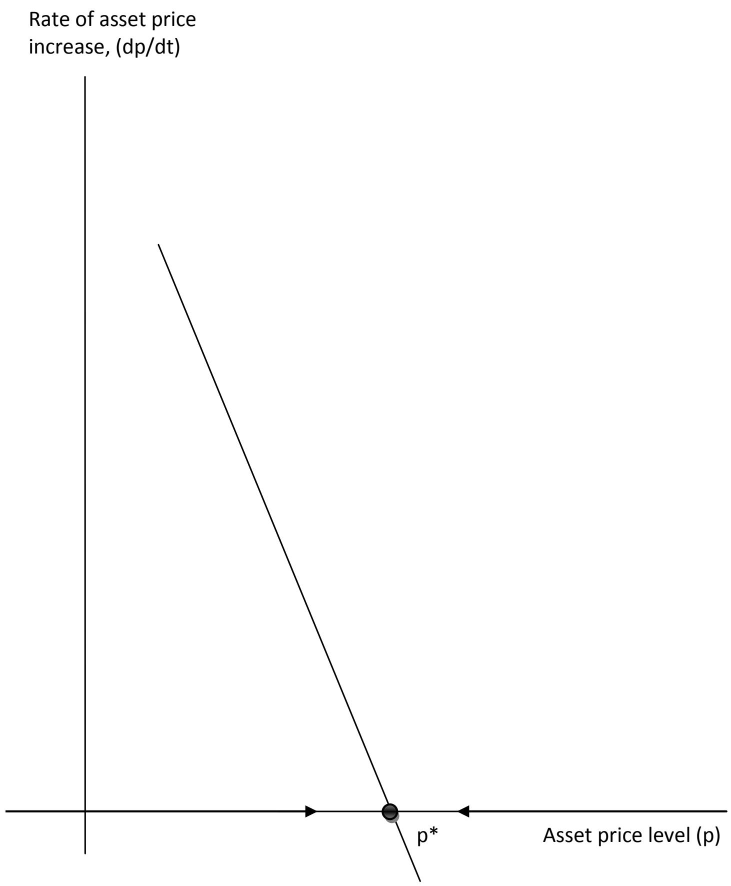
$$1 - \eta > -(F_1 p^2/L). \qquad (33)$$

Since η is negative, the left-hand side of (33) is unambiguously positive; so is the right-hand side because $F_1 < 0$. However, other things held constant, the right-hand side decreases in value as L becomes larger, i.e., higher demand for liquidity tends to destabilize the market. Similarly, lower asset prices also tend to destabilize.

The slope on the left-hand side of equation (31) measures the rate of change of price (dp/dt) in response to an increase in the price level (p). In other words, the stability of the asset market requires the rate of increase in asset prices to be lower as the price level of the asset goes higher.

The stability condition is easily seen in the one-variable phase diagram, below.

Diagram 2



Note on Diagram 2

The system is (locally) stable (unstable) at p* provided the slope at p* given by (31) or (35) is negative (positive)

V. SUMMING UP: MODELS AND REALITY

At the outset of this paper it was pointed out that loss of confidence either in or by the financial sector invariably emerges as the prominent symptom in most financial crisis.[13] This is hardly surprising because trust and mutual confidence are essential public goods for the smooth functioning of a modern financial system. This paper attempted to probe

[13] This experience of collapse of confidence has repeated itself many times in different episodes (Rogoff and Reinhart 2008).

deeper into this general idea by showing how loss of confidence can arise in two analytically distinct ways. The simple model constructed in sections II and III depict how the financial sector might lose confidence in an overindebted public that is increasingly overburdened with debt in relation to income. In contrast, the argument of section IV proceeds along a less traveled route. It traces the collapse of confidence to a "fragile" financial sector itself, as it becomes increasingly incapable of coping with its contingent liquidity requirements due to overlending. In reality, these two routes are intertwined because overborrowing cannot take place without overlending and vice versa; yet, it might be useful to separate them analytically both for a better understanding of particular events and for informed policy discussions.

To avoid misunderstanding it should be emphasized that the present paper does not deal with any other source of loss of financial confidence that might arise from growing international indebtedness. However, in some ways the country concerned resembles an overindebted borrower discussed in sections II and III, but it has several other dimensions, like exchange rate speculation, international power relations, etc., so that the analogy must not be misleadingly overstretched.

The loss of confidence in an overburdened borrower would arise in an extreme case when, as a special case of Ponzi finance, the borrower tries to borrow simply to repay loans, defining the credit ceiling in section III. Nevertheless, so long as income grows sufficiently, this credit ceiling might never be reached. The debt-financed consumption model developed here accommodates income growth mostly through the expansion of aggregate demand caused by credit expansion linked to capital gains. This underplays (for reasons of exposition) the role of credit and the possible impact of the "wealth effect" on investment. However, in so far as investment is also influenced by changing asset values and impacts on the growth of income, the model is incomplete and extension in this direction might be crucial for characterizing a crisis, even one of exclusively domestic origin.[14] While several important issues (like the impact of the

[14] Valuation of real, as well as financial, assets influence investors' decision of acquisition versus physical investment in new capacity. This original suggestion by Keynes's "two price theory of investment" was reformulated subsequently by Tobin (1969), but without complications arising from capital gains. Minsky (1975 and 1986) reinterpreted it by accommodating the possibility of capital gains and changing expectations, which, in turn, affect investment. The present analysis does not try to model investment behavior in any serious way.

wealth effect on investment affecting income growth or problems of external indebtedness affecting, in particular, the stability of the exchange rate) have been deliberately left out of our formal analysis, the usefulness of a limited model of this kind should perhaps be judged differently. Its intention is not to represent reality—even imperfectly—but to isolate analytically the working of some crucial mechanisms. The mechanism highlighted in this paper suggests that the fragility of the financial system emerges for the very prosperity of the real economy placing the goods- and services-producing real sector and its accompanying financial sector in an awkward juxtaposition in the unregulated market economy.

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