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ON THE SYSTEMIC FRAGILITY OF FINANCE-LED GROWTH

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ABSTRACT

The paper sets up a model of economic crisis by investigating the role played by movement in asset price as a driver of the dynamic interaction between the real and the financial sectors. Such movement influences income determination in the real economy in the short period through aggregate demand leading to the emergence of two macroeconomic regimes. A short period flow model, underpinned by the stock flow consistent accounting framework, is developed to formalize the dynamics of interaction between real and financial sectors mediated by movement in asset price, generates bistability, abrupt crashes, and systemic fragility in the macroeconomic regimes.

1. INTRODUCTION

The aim of this paper is to investigate the role played by asset price as a driver of the intertwined dynamic between the real and the financial sector and whether this leads to increasing financial fragility and proclivity toward systemic crises. A schematized formal model constructed for this purpose examines the role of changing asset price in mediating the dynamic interaction between the level of real economic activity and endogenous expansion of credit through financial innovations. The model developed in this paper supports the argument that such expansion leads to increased financial

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fragility and threatens sudden freeze and meltdown of the credit system due to a catastrophic collapse in asset price.

A simple Keynesian aggregate demand model is set up in section 2 for an economy without a government or external sector to show how different macroeconomic regimes emerge under capital gain through its influence on different components of aggregate demand, viz., consumption and investment expenditures. Endogenous credit creation facilitated in a modern financialized economy by continuous financial intermediation and innovation magnifies the effects on expenditures as abilities to borrow and lend are enhanced by capital gain expected from higher asset price. The model developed in section 2 describes the emergence of various aggregate demand regimes under such expansive credit systems in a flow equilibrium model with capital gain.

Using a 'stock-flow consistent' (SFC) accounting framework, section 3 examines the process of credit creation by the modern financial sector in the light of some recent experiences in several advanced capitalist economies and track the interaction among different sectors of the economy. This is exhibited in the accounting matrices by dividing the financial side of the economy into three broad sectors: (1) the central bank, (2) the so-called 'bank' sector consisting of commercial banks and some other financial intermediaries like mutual funds, savings institutions, etc., that are regulated on the one hand and supported on the other by the central bank, which acts as their lender of last resort. Together, they create available liquidity or 'money' because the central bank in addition to providing cash stands as their 'lender of last resort', and (3) the other financial sector comprises of entities like investment banks, hedge funds, financial insurance companies, etc., which enhance the credit creation process often through financial innovation, but they are thinly regulated and their credits are not guaranteed by the central bank. We lump the latter together and simply call it the 'finance' sector, distinguishing it from the 'bank' sector. Thus, the stock-flow consistent accounting framework elaborated in section 3 shows the financial interconnectedness of the whole economy comprising of five subsectors, viz., (1) households, (2) productive firms in the real sector, (3) the central bank, (4) well-regulated banks, and finally, (5) thinly or unregulated financial entities collectively called the 'finance' sector.

The credit advanced by the finance sector is of varying quality, subject to capital and default risk, which give rise to serious risk of illiquidity at times. However, this tends to be compensated usually by higher return and particularly from short-term capital gain. Against this background, the capacity of the financial sector to expand endogenously is immense, as if it operates on an infinitely elastic or horizontal supply curve enabled by new credit instruments that support both credit and asset price growth in a mutually reinforcing manner. However, this virtuous cycle of positive feedback between credit supply and asset price growth often makes financial investment more attractive than real investment and alters the *composition* of total investment of the economy in favor of financial investment directed toward acquisition of total or partial ownership claim on existing productive capacity instead of creating new capacity. This distinction between financial and real investment is captured through our accounting framework. The *composition effect* in favor of financial investment drives both growth and systemic fragility of a financial structure that it helps to expand without corresponding expansion of existing capacity.

With the underpinning of the SFC accounting framework developed in section 3, the formal model developed in section 4 provides an analytical characterization of the interaction between the real and financial sectors of the economy and shows how it might lead to an intertwined situation of rapid financial expansion and sudden collapse within even the short period. Section 5 concludes with some observations about the usefulness as well as limitations of our formal analysis.

2. TWO REGIMES OF FINANCE-LED GROWTH

Aggregate demand in the real economy without government and the external sector depends on private consumption by households and private investment by firms. However, in a highly financialized economy, both households and firms hold on their balance sheets' bonds, bills, and other interest-bearing assets and equities (of other firms) apart from cash, tangible capital like housing, real estate or machinery. Increasingly, aggregate consumption and investment decisions not only depend on their wages and profits but also on borrowing against capital gain raising the value of their assets. In particular, when the assets held by the debtor serve as a collateral for the lender in a credit agreement, capital gain on the asset enhances the repayment capacity of the borrower and boosts the purchasing power for additional borrowing.

However, capital gain that accrues to asset-holding households remains mostly potential rather than actually realizable because attempts by many asset holders to realize their gain at the same time would drive price down and make the gain disappear. A modern financial system circumvents this problem by advancing loans against actual or expected rise in the price of assets owned by households to allow debt-financed expenditure.[1] Since rise in asset price enhances the value of the underlying collateral, the extent of capital gain becomes a crucial variable in determining household expenditure in addition to income.

A modified consumption function which includes capital gain $\left[x = \left(\frac{dp}{dt}\right)\right]$ along income is given by

$$C = C(Y, x); C_Y > 0, C_x > 0 \tag{1}$$

Consumption expenditure (*C*) increases with current income (*Y*) of households as well as increase in asset price. The analysis is simplified vastly by assuming static expectations in continuous time, which makes actual and expected asset price coincide. Note that capital gain expected 'now' is a break between the inherited past price and the expected future price, represented in discrete time notations as $\Delta p_t = p_{t+1} - p_t$. The capital gain in the past period may be assumed to determine the influence of past wealth on the current flow of income Y_t, while the future expected value of wealth is determined by capital gain in the current period.

In other words, the influence of the level of asset price on consumption is dependent on the future expectation about income generative capacity of the asset. For example, in situations when a consumer entering the housing market with no equity and borrowing 100 per cent for his house, further borrowing is not dependent on the level of asset price but on the rate of change of asset price (as in the case of many subprime loans). Alternatively, for a consumer entering the housing market with full equity, and therefore not borrowing to acquire the house, his/her borrowing capacity is limited to the value of the level of the asset price, i.e. the amount of equity introduced

[1] In modern financialized economies, capital gain on the asset is a major channel through which the stock of debt can influence consumption and investment expenditure. An example would suffice to illustrate this point. Consider the case of a residential property purchased by a consumer using a house loan provided by a bank and suppose that the term of the mortgage is 20 years with the house held as collateral by the bank until the loan is fully repaid. In the case where the price of the house rises, the value of the collateral held by the bank has risen, and to enhance earnings and to disincentivize the household from realizing the potential gain by selling the house, the bank would be willing to give either an overdraft or open a new credit line, may be at a cheaper interest rate, to the household. In other words, the rise in the house price gives the consumer the ability to leverage the stock of debt, the total amount of loan (principal plus interest) lent by the bank. Thus, in a modern financialized economy, the wealth effect arising from the rise in the asset price works through further borrowing against the illiquid asset to facilitate consumption, as an alternative to de-cumulating the existing assets. Hence, it seems plausible to us that in the short run, the influence of the stock of debt on the flow of consumption and investment can be captured through capital gain or rate of change in the asset price.

in this case, but this can happen only once because the same asset cannot be used as collateral twice. Thus, even in this case, any additional borrowing above the value of the level of the asset price or the level of equity is influenced only by either actual or expected capital gain on the asset.

Turning to investment expenditure, firms finance their investment through internal savings from retained profits, issuing equities and paying dividends or taking loans from the financial sector. Although the particular source of finance influences the financial structure of firms, this complication is avoided here to focus on how capital gain influences investment decision. We assume that loans from banks constitute the main source of finance obtained usually in advance of starting investment projects. This allows us to focus on a critical portfolio choice typically faced by firms between 'construction' and 'acquisition' linking inextricably the real with the financial sector (Keynes, 1936, pp. 150–1), elaborated later by Minsky (1975, pp. 119–20) as the 'two price theory of investment' and by Tobin's $q\left[i.e.\left(\frac{p}{\pi}\right)\right]$ theory (Tobin, 1969) with the difference that the latter's discussion is set in the framework of a competitive model avoiding discussions of the influence of capital gain.[2] Investors compare the ratio of current construction (or replacement) cost of an asset (π) with its 'buying' or acquisition price (p). Since acquisition merely transfers the total or partial ownership right of an existing asset through exchange mostly in the secondary stock market, unlike real investment, it does not create additional employment for expanding productive capacity and may be considered incapable of generating expansion through the multiplier mechanism.[3]

Assuming the construction price (π) to be given in the short run by real production and setting up cost, the ratio q differs from unity mainly on account of anticipated capital gain and losses affecting the acquisition price (p). Since higher expected acquisition price makes acquisition cheaper today by buying forward, the attractiveness of acquiring rather than constructing an asset increases with capital gain. As a result, higher capital gain shifts the

[2] There is a large literature on various aspects of portfolio choice in influencing investment decision (Brainard and Tobin, 1977). Palley (2001) points out the limited role of arbitration without a perfect second hand market for capital goods, while Crotty (1990) and Hein (2012) discusses the implications of owner–manager dichotomy for q—theory of investment.

[3] Given that the volume of transaction in the secondary stock market generally vastly outweighs their volume in the primary market for most financial assets, their price is typically set in the secondary market (Scitovsky, 1994). Moreover, one of the characteristics of the short period is that the productive capacity flowing from real investment lies beyond its time scale. Therefore, in the absence of a market for work-in-progress, the option of selling the completed capacity creation of an asset (say a new machine) for capital gain is ruled out.

composition of total investment expenditure in favor of financial acquisition against real investment. Incorporating the level of income as a proxy for the capacity utilization effect and the composition effect arising from capital gain, a function for real investment (I) is postulated as

$$I = I(Y, x); I_Y > 0, I_x < 0 \tag{2}$$

where I_Y represents the capacity utilization effect and I_x captures the composition effect. Note that the borrowing and lending capacities of firms and banks respectively might increase with higher capital gain to raise total and real investment, but this consideration is postponed until later in equation (5).

Equality between saving (S) and investment (I) from equations (1) and (2) yields

$$Y - C(Y, x) = S(Y, x) = I(Y, x) \tag{3}$$

Total differentiation of equation (3) yields

$$\frac{\mathrm{dY}}{\mathrm{dx}} = \left[\frac{(I_x - S_x)}{(S_Y - I_Y)}\right] = n \tag{4}$$

The usual stability condition for the convergence of the Keynesian income adjustment process, namely $S_Y > I_Y$, ensures that the denominator of equation (4) is positive and the sign of the numerator which captures the net effect of capital gain (x) through investment and saving on output (Y) determines the sign of the slope (n).

In this short-period framework, both the stock of capital goods and debt are given, and within this period, investment affects output solely through effective demand via the multiplier mechanism, but neither change in productive capacity nor repayment obligation on debt is considered. The critical factor determining the sign of the multiplier n boils down to the relative strength of the contractionary composition effect in relation to the expansionary consumption effect, measured by the absolute values of I_x and S_x, respectively, both of which operate through the financial structure without change in productive capacity in the short period. A positive relation between income and capital gain implying $n > 0$ describes the regime where the positive effect of higher capital gain on consumption (reducing saving) outweighs the relatively weak negative composition effect favoring financial over real investment. Thus, aggregate demand expands through the dominant consumption (i.e. negative saving) effect. However, in the opposite case, although the positive effect of capital gain on consumption remains, it is outweighed by a stronger negative composition effect leading to a contraction in aggregate demand. When I_x is sufficiently small, i.e. the composition effect in favor of financial investment is weak in relation to the absolute value of S_x, the positive consumption effect dominates implying $n > 0$; we may describe the regime as *consumption led*. On the other hand, if the negative composition effect dominates, i.e. I_x exceeds S_x in absolute value implying $n < 0$, the regime may be described as *financial investment led*. This distinction captures the influence of finance on the real economy in the context of a modern financialized economy (see Bhaduri, 2011b, p. 13).

However, a finer classification exists differentiating various shades within the consumption-led regime. Throughout the consumption-led regime, the slope n is positive but its magnitude depends on the difference between I_x and S_x. Holding S_x constant, a relatively *weak composition effect* implies the absolute value of I_x is much smaller than the absolute value of S_x, which results in a relatively large positive slope, n. In the opposite case of a regime driven by a *strong composition* effect, the absolute value of I_x is relatively large making n relatively small but still remains positive. Geometrically, we can visualize the slope n moving clockwise as the composition effect gets stronger until the composition effect (I_x) dominates the consumption effect (S_x) in absolute value (see figure 1). These finer distinctions within the

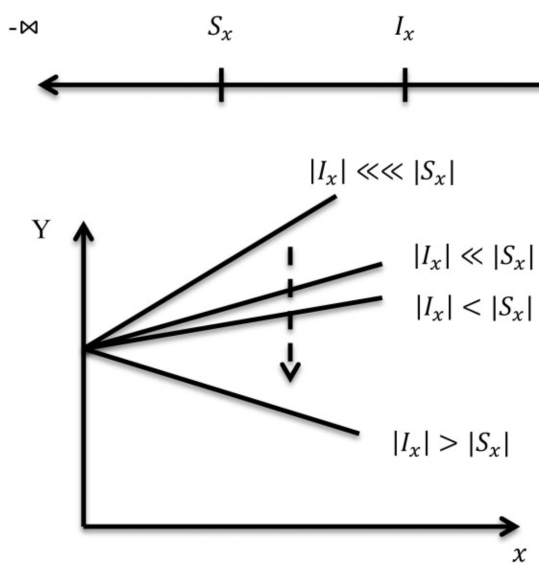

Figure 1. Macroeconomic regimes: consumption-led regime with strong and weak composition effect (upward sloping lines) and financial investment-led regime (downward sloping line). The dashed line shows the clockwise movement of the regimes.

consumption-led regime become important, as we shall see later (see particularly discussion of equation (11)) for determining financial outcomes, especially for explaining formally sudden change (see equation (23)). Finally, the slope n turns negative in the financial investment-led regime when the usually assumed positive relation between the performance of the asset market and of the real economy breaks down.

Since the government or the external sector is assumed to play no economic role in this skeleton model, active monetary policy by the government or arbitrage through capital flows influencing the rate of interest have to be ruled out. However, changes in the balance sheet of the banks due to capital gain can still influence endogenously the interest rate. Higher capital gain improves the balance sheet to increase the lending power of banks, which in turn may lower the rate of interest. A lower interest rate also encourages both households and firms to borrow more and increase their consumption and investment, respectively. This has a positive effect on aggregate demand in both the consumption and the investment-led case. Formally, the balance sheet effect can be incorporated in the above model by introducing interest rate (i), which is related negatively to capital gain, i.e. $i = i(x)$, $i_x < 0$ (e.g. through refinancing option discussed in footnote 1). With this additional argument in the consumption and the investment functions (equations (1) and (2), respectively), the modified consumption and investment functions yield on simplification of the revised output multiplier with respect to capital gain, replacing equation (4) as

$$\frac{\mathrm{dY}}{\mathrm{dx}} = \left[\frac{(I_x + I_i \cdot i_x) - (S_x + S_i \cdot i_x)}{(S_Y - I_Y)} \right] = n \tag{5}$$

Note that the additional terms involving interest rate effect via balance sheet in the numerator of equation (5) in the revised expression of n are unambiguously positive. However, their relative difference affects the value of n and in more extreme cases might even affect the sign of the slope n in equation (5).

By treating the relevant partial derivatives defining n as constant in equation (4) or (5), we may integrate the expression to obtain two well-defined linear output regimes given by

$$Y = nx + N \tag{6}$$

where n is given by equation (4) or (5). As before, $n > 0$ represents the consumption-led regime of different strengths depending on the magnitude of n and $n < 0$ represents the financial investment regime; the integration constant N is positive ensuring $Y > 0$ at $x = 0$.

The assumption that the relevant partial derivatives in equation (4) or (5) are constants was imposed for expositional simplicity of linear characterization of the regimes. However, with these partial derivatives as variables, endogenous transition from one regime to another becomes possible. This can be seen by considering different values of I_x, which gives rise to changing value of the slope n in equation (6) making transition possible from strong to weak consumption-led regime and ultimately to financial investment-led regime (see figure 1).

This simple short period model suggests a crucial lesson often forgotten in celebrating the efficiency of the financial market. It points out how real income and asset price need not necessarily move in the same direction in all situations. Due to a sufficiently strong composition effect favoring financial over real investment, the real economy and the financial market may move in opposite directions making the stock market a misleading indicator for judging the health of the real economy.

3. FRAGILE EXPANSION OF CREDIT

The skeleton model of the closed economy of the last section is now extended to incorporate the financial side of the economy, which comprises of three subsectors: (1) the central bank, (2) commercial banks and financial institutions like pension funds, mutual funds, etc., that operate under the supervision and 'lender of last resort' guarantee of the central bank, and (3) a subsector 'shadow banking institutions', simply called 'finance' sector consisting of investment banks, insurance companies, hedge funds, etc., which are at best thinly supervised without 'lender of last resort' guarantee from the central bank.

Apart from their relationship with the central bank, the separation between the 'bank' and the 'finance' subsector arises from the 'securitization' process in modern financialized economies. Securitization permits banks to off-load some of their loans from balance sheets. Since the 1990s, there has been an explosion in the use of financial entities such as 'special purpose entities' (SPE) or 'structured investment vehicles', which issue securities backed by the underlying assets' cash flows. When backed by mortgages or a pool of mortgages, known as asset-backed or mortgage-backed securities (ABS and MBS, respectively), they represent claims to the cash flows from the portfolio of assets held by the SPE. Such securities are also repackaged and *sliced* (or *tranched*) according to varying risk profiles or maturities, and these tranches are 'products' sold in the financial markets. Similarly, Collateralized Debt Obligations (CDO, CDO *squared*, etc.) repackage in various ways the ABS to represent claims on the principal and interest generated by the underlying assets.[4] Pooling and tranching of securities help in reallocating risks and reduction of regulatory capital requirements of banks imposed by Basel accords thereby freeing up cash for new loans, while tranching also makes it possible for underwriters to customize securities with different risk profiles suited to specific investors.

As the thinly supervised finance subsector expands and diversifies, the use of its own financial securities in place of cash, government bonds and bills as collaterals, particularly in the derivative market, becomes a norm.[5] The demand for collateral arises in derivative markets by the requirement to post collateral when a loss is incurred.[6] The use of two-way collateral agreements to mitigate counterparty risk especially in over-the-counter derivative trading between two private parties outside regular banking regulations has greatly propelled the use of such financial securities (e.g. Gorton and Metrick, 2012, p. 25). Thus, on the one hand, the demand for various financial asset-based securities as collaterals creates a strong incentive to issue them, and on the other, it raises their price creating capital gain to stimulate further their demand. This sets in motion a powerful self-reinforcing mechanism of positive feedback for endogenous credit expansion.

Yet despite reallocation of risk of individual players, financial securitization in this manner tends to increase the overall systemic fragility of the finance sector on several counts. It creates an avenue for commercial banks to transfer lenders' risk (essence of the 'Originate and Distribute' model of risk management) by taking some inconvenient loans off their balance sheet, which increases their lending capacity and appetite for financing riskier projects. The management of their balance sheet buttressed by financial innovations (e.g. credit default swaps) minimizes the requirement for regulatory capital fueling further growth in demand for securitized assets and leads to building layers of securitization on a wafer-thin liquid reserve base. As the credit system grows disproportionately in relation to a narrow reserve base of central bank guaranteed liquidity and tangible assets, the vulnerability can remain hidden until default happens somewhere in the system. Typically, the

[4] It was estimated that between 1999 and 2007, publicly traded structured finance ABS CDOs accounted for roughly $641 billion with write-downs estimated to be around $420 billion (Cf. Cordell *et al*., 2012, p. 14).

[5] The International Swaps and Derivatives Association estimates show that 65 per cent of over-the-counter (OTC) derivative trades worldwide were subject to collateral agreements at the end of 2008 compared with 63 per cent the previous year and 30 per cent in 2003. The notional value of collateral used in connection with OTC derivatives was almost $4.0 trillion during 2008 (ISDA, Margin Survey (ISDA, 2009, p. 1)).

[6] See BIS Report (2001).

finance sector faces a double squeeze in terms of its cash flows as cash inflow from the banks (SPE) tends to evaporate while it simultaneously faces collateral cash outflow on its insurance contracts.[7] With little liquid reserves to tide over the situation, some vulnerable firms in the finance sector are forced to resort to fire sale its assets (Bhaduri, 2011a, p. 1002). In a densely intertwined network of financial contracts, such distress sales threaten to spread easily to other financial institutions increasing the risk of widespread fire sales. Consequently, the possibility of a massive crash in asset price cannot be ruled out.

It is useful to identify differing financial pathways through which the process of securitization described above proceeds within the structure of assets and liabilities and their changes in an SFC accounting framework. By extending the work of Godley and Lavoie (2007), Taylor (2004) and Hudson (2006), the stock-flow accounting framework is specified for our model economy consisting of five subsectors, namely, households, firms, banks (commercial banks), central bank and finance. Abstracting from the complexities that the process of securitization introduces for the relation between banks and the finance subsectors, in table 1, we assume that banks invest their underlying assets (Ua) with the financial sector, and the latter in turn creates financial securities (F) and sells them to the rest of the economy.

The item underlying assets may represent, for example, a covered bond referenced to a mortgage or a pool of mortgages, or other loans, issued by the bank and sold to the finance sector instead of holding them in the asset side of the balance sheet for their whole maturity enabling the finance sector to create ABS packaged into various tranches and sell them in turn to institutional or retail investors within or outside the finance subsector. In this case, the return on the MBS is paid to the depositors (retail investors, banks and firms) for their investment in the finance subsector. Thus, the finance subsector creates financial securities based on the underlying assets invested by the banks and sells them to the households (F_h), firms (F_f) and banks (F_b). The other entries in table 1 are self-explanatory, e.g. loans are assets (prefixed with a plus sign) for banks and liabilities (prefixed with a negative sign) for the households (L_h) and the firms (L_f).

Equities and securities are accounted in terms of the issue prices (op) because the entity issuing them is liable only up to the issue price. The issuing entity's liability at any point in time is given as the value of equities and securities issued at the issue price, denoted in table 1 as ($-E.op$) and ($-F.op$).

[7] As of June 2008, the maximum potential loss to CDS market participants, after offsetting collateral flows, was estimated to be approximately 5.5 per cent of the notional value of the CDS market, or $3.2 trillion (BIS Report, 2008, pp. 4–6).

Table 1. Sectoral balance sheet

	Households	*Firms*	*Banks and FIs*	*Finance sector*	*Central Bank*	*Total*
Tangible capital	$+Kh$	$+Kf$				$+K$
Securities	$+Fh$	$+Ff$	$+Fb$	$-F.op$		$(F - F.op)$
Underlying assets			$-Ua$	$+Ua$		
Cash	$+Hh$		$+Hb$	$+Hfs$	$-HM$	0
Deposits	$+Mh$		$-M$			0
Loans	$-Lh$	$-Lf$	$+L$			0
Equities	$+Ef + Eb$	$-Ef.op$	$-Eb.op$			$(\mathrm{E} - E.op)$
Bank liquidity line					$+BLL$	
Networth	$-NWh$	$-NWf$	$-NWb$	$-NWfs$	0	$+K + (E - E.op) + (F - F.op)$

Thus, the market value of equities, net of issue price, denoted by $(E - E.op)$, reflects the increase (appreciation) or decrease (depreciation) in value of equities since the date of issue;[8] similarly, for securities, $(F - F.op)$ reflects the increase (appreciation) or decrease (depreciation) of the value of securities since the date of issue. As a result, the net worth of the economy is not just the market value of tangible capital (K) but also the market value of equities and securities over issue price. Therefore, the overall net worth of the economy at any point in time is given by the value of tangible capital plus the value of financial capital, which is the net value of equities and securities.[9] For this reason, even with given a stock of physical capital and no accumulation of capital, the net worth of a financialized economy can change dramatically in the short period.

[8] The market price of equities at any point in time is assumed to reflect (or encapsulate), among other things, the opening price, undistributed profits (i.e. as estimated by the investors) and investor's expectation on the future performance of the issuing entity. It is this latter element that is captured here in the expression $(E - E.op)$ on the assumption that any undistributed profits of the issuing entity is not material to the functioning of the model in explicating the role of the finance sector.

[9] The last item in the balance sheet is the 'bank liquidity line', which is an emergency credit line for the banks set up by the central bank who acts as the lender of last resort for cash in our model.

Table 2. Income–Expenditure matrix

		Business sector		*Finance sector*		
	Households	*Current*	*Capital*	*Current*	*Capital*	*Total*
Consumption	$-C$	$+C$				0
Gov Exp		$+G$				0
Investment		$+If$	$-If$	$+Ifs$	$-Ifs$	0
Investment trading		$-IT$		$+IT$		
[GDP (memo)]		[Y]		[Y]		0
Wages	$+W$	$-WB$		$-Wfs$		0
Net profits	$+FDB$	$-F + FDfs$	$+FUB$	$-Ffs$	$+FUfs$	0
Interest payments	$+INTh$	$-INTf$		$-INTFS$		0
Total	$SAVh$	0	$+FUB - If$	0	$+FUfs - Ifs$	0

Table 2 provides the corresponding income–expenditure flow matrix. Note that we have combined both the sectors firms and banks into one and called it *business sector* for simplicity. The entry $+I_f$ represents the real or productive investment undertaken by the firms, which are funded by their retained earnings in the business sector ($+FUB$). The entry investment trading is the profits made by the financial sector on their securities trade, i.e. $IT = (+\Delta F - \Delta U_a)$, based on the underlying assets invested by the business sector. Thus, the entry ($-IT$) in the current account of the business sector represents the amount of investment made by that sector in the finance subsector. The entry $+I_{fs}$ in the current account of the finance subsector represents the internal investment undertaken, which is funded by the retained earnings ($+FU_{fs}$) of the finance subsector. It is assumed that some part of profits of the finance sector is distributed to the business sector, particularly to the banks, represented here by the entry $+FD_{fs}$ in the current account of the business sector. In a similar vein, part of profits of the business sector is distributed to the households ($+FDB$), and part of it is retained within the business sector ($+FUB$), which funds the investment expenditure carried out by the sector.

An important point emerges from the categorization used in table 2 as it provides a consistent accounting method for distinguishing between real and financial investment, which played an important role in the model in section 2. The macro sectoral balance becomes $SAV_h + (FUB_f - I_f) + (FU_{fs} - I_{fs}) = 0$ or the savings of the overall macro economy are equal to both the real and financial investment, that is

$$(S_h + FUB_f + FU_{fs} = I_f + I_{fs}) \tag{7}$$

Equation (7) provides the macroeconomic saving investment equilibrium condition for the economy with a modern finance sector. It restates the overall saving in the economy as finance available to match the acquisition of both real and financial investment, including all higher-order financial investments like securities and derivatives generated by the finance sector. Rearranging terms in equation (7), the saving investment equilibrium condition for the economy can also be written as

$$[(S_h + S_f) - I_f] = [I_{fs} - S_{fs}] \tag{8}$$

From equation (8), we can infer if the left hand side is zero, i.e. when the real sector is in equilibrium, the financial sector equilibrium is achieved simultaneously either through quantity adjustment (issuing more financial securities) or price adjustment (revaluation of net worth). We further note that the financial investment comprises of not only securities based on real tangible collaterals from the real sector but also securities based on collaterals of various debt obligations (CDOs). Therefore, accumulation of financial capital need not have any counterpart in terms of real tangible capital. Consequently, the equilibrium adjustment in the finance sector impacts the real economy through changes in the volume of transactions (credit supply) and revaluation of asset price (price change). The impact of the saving investment equilibrium adjustment of the finance sector to the rest of the economy is captured in the change in net worth matrix given in Appendix A, which provides a more detailed calculation of change of net worth for each sector caused by change in volume of transactions (quantity change) as well as by revaluations (price change).[10]

Notwithstanding the static nature, the change in net worth matrix clearly brings out the argument postulated earlier about the route by which the process of securitization impacts on the expansion of credit supply in the economy. For instance, consider the net worth of the households sector, which can be read from the respective column in table A1 (Appendix A) as

$$NWh = [\Delta Eh + \Delta Fh + \Delta kh + \Delta Mh + \Delta HM - \Delta Lh] \tag{9}$$

[10] The transaction flow matrix between the sectors is also being constructed, which is not included here for want of space, and is available on request from the authors.

where

$$\Delta Eh = ((\Delta ef)\cdot pef + (\Delta eb)\cdot peb) + ((\Delta pef)\cdot(ef-1) + (\Delta peb)\cdot(eb-1))$$

$$\Delta Fh = +\Delta Fh\cdot ps + ((\Delta ps)\cdot(Fh-1));$$

$$\Delta kh = +(\Delta Kh)\cdot pk + (\Delta pk)\cdot(kh-1)$$

Note that Δpe denotes change in the price of equities with letters *f* and *b* at the end standing for equities issued by firms and banks, respectively. The letter *e* denotes the volume of equities, and Δe denotes change in the volume of equities. Similarly Δps, Δpb, and Δpk denote for change in the price of securities (*F*), bonds (*b*) and tangible capital (*k*), respectively.

Equation (9) states that the change in net worth of the household sector is determined by the change in net assets, both financial and tangible, and change in liabilities. Suppose for instance, the equity price increases, i.e. (Δpe) increases. As a result, the net worth of the household sector increases implying their leverage falls (leverage is defined as the ratio of assets to equity or net worth). If the households maintain their leverage matching the increase in their net worth with further loans provided by banks (equity financing), then household leverage is restored back by taking additional liability of loans from the bank, and the increased stock of household debt is matched by higher net worth of households.

The implication for banks' balance sheet owing to the additional loans given to the household arising from the rise in their net worth can be read from table A1. The additional loans that are represented as ($+\Delta L$) for banks in table A1 are sold or invested in the finance sector as underlying assets ($-\Delta Ua$). Thus, the banks' leverage is maintained at the same level prior to the rise in asset price, i.e. banks target a leverage ratio and actively maintain it by investing the additional assets in the finance sector.

Similarly, the finance sector adjusts its balance sheet by creating additional securities. The finance sector absorbs all the additional loans given to the households by the banks through acquiring these as underlying assets ($+\Delta Ua$) and creates securities ($-\Delta F$), and sells these in the securities market. As we discussed in the beginning of section 3, the finance sectors' supply of securities in to the market is not just equal to the amount of underlying assets that it has acquired from the banks. Given that ABS are used as collateral in the derivative market, the finance sector has the ability to create securities over and above the amount of underlying assets acquired. Thus, the finance sector acts as a source for securities, as if it has an infinite elastic supply curve using the underlying assets. In that process, it severs the relation between the amounts of credit available in the economy and the underlying assets including the physical tangible capital stock in the economy. The issue price of securities need not be kept low to create enough demand for it because the issue price of securities is determined not just by the price of the underlying assets but also expected cash flow arising from its potential use as collateral in the derivative trade. Thus, higher expected cash flow would drive the issue prices up, and higher issue price returns higher cash flows for the owners of the securities, i.e. a self-referential process of asset price revaluation in the finance sector leads to a self-reinforcing positive feedback mechanism for financial expansion in the overall economy.

Thus, this mechanism that keeps security prices high is further reinforced when sufficient capital gains over and above interest payments inflate the financial subsector's net earnings. As a result, creation of financial securities increases with the expected value of capital gain, which in turn increases the collateral value of the underlying assets for banks. In addition, in the next round, by being accepted as collateral in the derivative trade, some of these securities themselves become underlying for further securitization via products like CDOs. Thus, the actual or expected capital gain of the value of the collateral, or the underlying asset, seems to play a crucial role in the self-reinforcing dynamic between the process of securitization and credit expansion in the economy. In the following section, this dynamic and its implications for output in different aggregate demand regimes is formalized using a short-run model where the total stock of tangible or physical capital as well as the inherited total stock of debt remains fixed. In such a short-run scenario, movement in asset price is shown sufficient to bring about a range of complex dynamic patterns of change arising from the interaction between the finance and real sectors by generating multiple equilibria and abrupt crashes in asset price and credit freeze for the real economy.

4. THE MODEL

The model in this section combines properties of demand-determined output under capital gain formulated in section 2 with endogenous expansion of credit through capital gain through devices like securitization of loans and derivatives by modern finance described in the SFC framework of section 3. In the shortened form presented here, the process of securitization has several steps. Securitization expands credit in the economy initially using the loans advanced by the commercial banks to household sector and firms mostly against tangible collaterals and expected income streams as the base in the first round. Some of these loans become the subsequent base (underlying assets) for the creation of securities by the finance sector. Some of these financial securities in turn again become the underlying assets for the creation of derivatives in the next round including various forms of fixed income and credit derivatives and derivative swaps among financial firms. The cash flows of the finance sector on account of trade in securities and derivatives usually propel further issuing of securities to absorb investment from the commercial banks, which are in search of higher capital gain for strengthening their balance sheet by off-loading inconvenient loans.

This process of expansion of credit through securitization is captured here by starting from an initial situation of zero capital gain ($x = 0$), implying, from equation (6), $Y_0 = N$. Any injection of additional credit over this initial level on account of transaction and speculative motive is given by

$$dL = l_o dY + l_1(dp - ip), \quad l_o, l_1 > 0 \tag{10}$$

where the first and second term on the right hand side represents increased transaction demand and speculative demand arising from capital gain.Using equation (6), equation (10) is rewritten as

$$dL = [l_o n + l_1]dp - l_1 ip \tag{11}$$

Assuming interest rate to be zero for simplicity and using equation (6), integrating equation (11) over time yields the total stock of loans issued by commercial banks (i.e. L_h, L_f to households, firms and other sectors in table 1) as

$$L = mp + H \tag{12}$$

where $m = [l_o n + l_1]$ and H is the integration constant.

The demand-determined income in equation (6) and transaction and speculative demand determined bank credit flow in equation (11) could be linked. Assuming no interest rate effect ($i = 0$) as discussed in section 2, the consumption-led regime occurs when $n > 0$, implying $m > 0$ in equation (12). On the other hand, the financial investment-led regime occurs when $n < 0$ leading to $m < 0$ only when $n < -\left[\frac{l_1}{l_0}\right]$. Consequently, within the consumption-led regime, with n positive leading to $m > 0$, we can distinguish two subregimes depending on the strength of the composition effect which determines the magnitude of the positive slope of n until finally the slope turns negative leading to $m < 0$ giving rise to the financial investment-led regime. In the following analysis, for the sake of clarity, only the parameter m is used to characterize the regimes.

The flow of securities during a period is created from the existing stock of loans in that period (held constant as a slow-moving variable). Consequently, it has a time dimension like any flow to stock ratio, e.g. output–capital ratio. As pointed out in section 3, the extent of securitization undertaken by the finance sector is influenced positively by the extent of capital gain anticipated. As a result, the flow of securities is related to the stock of loans by a variable proportion related positively to capital gain, which makes it analogous to the idea of a variable output–capital ratio.

Let f_1 denote this capital gain-dependent propensity to undertake securitization by finance. The flow of securities during a period in time generated from the existing stock of loans up becomes

$$dF_1 = f_1(x)\int_0^t dLdt = f_1(x)L, \quad f_1'(x) > 0 \tag{13}$$

Assuming a linear function with the same average and the marginal propensity to securitize that is proportional to x, i.e. $f_1(x) = ax$, $a > 0$, and inserting it in equation (13), the stock of securities (F_1) is obtained by integrating the flow (dF_1) over time, that is

$$F_1 = \left(\frac{1}{2}am\right)p^2 + (aH)p + a(mc + Hc') \tag{14}$$

where c, c' are integration constants.

Since the quality of the securities created in this manner depends on the rating accorded by private credit rating agencies without any guarantee by the lender of last resort (central bank), they usually carry significant default and other risks (e.g. volatility in spreads). To provide a way to manage such credit risks through mostly privately innovated insurance devices, the credit derivative market develops new methods for distributing credit risk among participants, e.g. the two-way collateral cash flows depending on the value of the underlying assets. For derivatives, mostly financial securities of the finance subsector themselves act as underlying assets in a self-referential manner. Proceeding as before, the flow of derivatives (dF_2) during a period is related to the existing stock of securities (F_1) by a variable factor that depends on x, that is

$$dF_2 = f_2(x)\int_0^t dF_1dt = f_2(x)F_1, \quad f_2'(x) > 0 \tag{15}$$

Assuming a linear function for $f_2(x) = bx$, $b > 0$ and inserting it in equation (15), we derive the total stock of derivatives (F_2) as the time integral of the flow (dF_2) which yields

$$F_2 = \left[\left(\frac{1}{6}abm\right)p^3 + \left(\frac{1}{2}abH\right)p^2 + (ab(mc + Hc'))\,p + Q\right] \tag{16}$$

where $Q = \frac{1}{2}abmd_o + abHd_1 + ab(mc + mc')d_2$ and d_o, d_1, d_2 are integration constants.

The process of securitization described provides a way of calculating the total stock of debt in the economy related to the stock-flow matrices in section 3 (tables 1 and 2). The total stock of debt is simply the total stock of loans (L) plus the total stock of securities ($F = F_1 + F_2$) created by the finance sector. However, since some part of loans act as underlying assets for securities (F_1), and some part of those securities act as underlying assets for derivatives (F_2), the total debt is calculated as

$$D = [(L - \beta_o L) + (F_1 - \beta_1 F_1) + F_2)];\ \beta_o, \beta_1 < 1 \tag{17}$$

The first term in equation (17), ($L - \beta_o L$), calculates the quantity loans minus the proportion (β_o) of the loans that form the underlying assets for the commercial bank's investment in the finance sector. Similarly, the term ($F_1 - \beta_1 F_1$) calculates the value of securities minus the proportion (β_1) of securities that form the underlying assets for the derivatives created by the finance sector.[11] However, without serious loss of generality, it would suffice to simplify equation (17) assuming (1) the increase in the value of the securities relative to the underlying asset is not significant, and (2) every security generates some form of derivative. Thus, the total debt becomes

$$D = [L + (F_2 - \beta_1 F_1)];\ \beta_o, \beta_1 < 1 \tag{18}$$

If we assume the default rate to be linear at least in the relevant range than under linear transformation, we may shift the origin without affecting the

[11] Consider a fraction of the loan ($1 > l_2 > 0$) advanced by commercial banks acts as initial underlying for creation of securities by finance. A fraction of securities thus created becomes underlying for the next round (e.g. the derivative trade), and successive layers of leveraging of financial securities as underlying lead to a self-referential modern finance subsector. If the fraction l_2 remains constant, the total expansion of credit created on the basis of loans advanced L becomes $(1 + l_2 + l_2^2 + l_2^3 + \ldots + l_2^q)$, where q is the maximum number of layers in the leveraged pyramid of the financial sector. The summed up geometric series of credit creation $\{[(1 - l_2^q)/(1 - l_2)]L\}$ provides an alternative way of exploring credit expansion.

argument. The origin may be placed at some normally anticipated rate of default. A rise in the default rate above this normal by a constant (h) and applying it to the total stock of debt given by equation (18) (on the assumption that it can happen anywhere in the system with equal probability), the total default (U) to be covered yields

$$U = h\left\{[mp+H]+\left[\left(\frac{1}{6}abm\right)p^3+\left(\frac{1}{2}abH\right)p^2+(ab(mc+Hc'))p + Q-\beta_1\left(\left(\frac{1}{2}am\right)p^2+(aH)p+a(mc+Hc')\right)\right]\right\} \tag{19}$$

$$= h\left\{\left[\frac{1}{6}abm\right]p^3+\left[\frac{1}{2}[abH-\beta_1 am]\right]p^2+[ab(mc+Hc')-\beta_1 aH+m]p+Q_1\right\}$$

where $Q_1 = \left[H+\frac{1}{2}abmd_o+abHd_1+ab(mc+Hc')d_2-\beta_1 a(mc+Hc')\right]$

The finance sector uses as collateral both liquid reserves (e.g. cash) and securities (section 3). The unregulated finance sector tends to reduce its liquid reserve requirement lured by higher capital gain.[12] As a result, the demand for liquid reserves in the financial sector falls as they are substituted by less liquid securities created within the finance sector with prospects of higher capital gain. Assuming the rate of decrease in liquid reserve as a simple linear function of capital gain,

$$dM_f = -v_1 x \tag{20}$$

where the parameter v_1 captures the extent to which liquid reserves decreases due to increase in asset price during a period.

The total liquid reserves (R) in the economy can be obtained by integrating equation (20) over time, which yields

$$R = \int dM_f\,dt = -v_1 p^2 + v_0 \tag{21}$$

The integration constant v_o in equation (21) can be interpreted as cash reserves in the system, similar to high-powered money issued by the central Bank (HM in table 1).

We define the dynamics of asset price as

$$\left[\frac{dp}{dt}\right] = \alpha[R-U] \tag{22}$$

[12] See footnote 5.

Substituting the relevant expressions from equations (19) and (21) and simplifying yields

$$\left[\frac{dp}{dt}\right] = \alpha\left\{-\left[\frac{h}{6}abm\right]p^3 - \left[\frac{h}{2}[abH - \beta_1 am] + v_1\right]p^2 \right. \\ \left. - [h[ab(mc + mc') - \beta_1 aH + m]]p + v_o - hQ_1\right\} \tag{23}$$

This final equation (23) describes the movement of asset price on the assumption that asset price rises (falls) depending on whether there is excess (shortage) of liquid reserve in relation to the requirement to cover anticipated default (h). The asset price equation (23), which is a cubic equation, may possess single or multiple positive real roots as equilibria. Although we can use the Cardano discriminant (Abramowitz and Stegun, 1964) to verify whether the system has multiple real roots, the range of parameters involved in equation (23) makes such qualitative analysis cumbersome and inconclusive. Nevertheless, without resorting to numerical analysis, we can to a limited extent investigate the qualitative nature of the dynamics by determining the geometry of the cubic equation (23).

In the consumption led regime with $m > 0$, the cubic term is negative with the coefficient being unambiguously positive, and hence, the curve falls for very large value of the asset price (p). However, at a lower range of values of asset price, the quadratic p^2 term and the linear p term come into play in determining whether the system could generate bistability in so far as the former determines the curvature of the parabolic element and the latter the slope of the cubic equation. The possible existence of bistability is economically important because it is this property that leads to abrupt transition and sudden collapse of asset price typical in financial meltdowns.

If the cubic equation (23) is negatively sloped, as shown in figure 2, and possesses three distinct real positive roots, then the system would have two stable roots and one unstable root between them for generating bistability. From equation (23), we can infer that the positivity of the p^2 term depends on the sign of its coefficient, and it is negative when the following condition is satisfied,

$$m > \frac{1}{\beta_1}\left[\frac{2v_1}{ha} + bH\right] \tag{24}$$

While the negativity of the p term is ensured by the condition,

$$m > \frac{\beta_1 H}{b(c + c')} \tag{25}$$

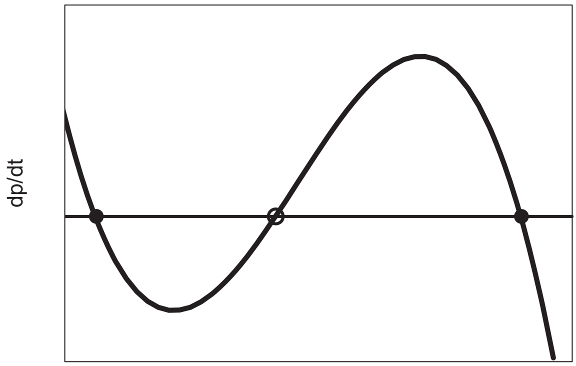

Figure 2. Consumption-led regime ($m > 0$). The open circle represents unstable equilibrium, and the filled circles represent stable equilibria.

When these necessary conditions (equations (24) and (25)) are satisfied, the geometry of the cubic equation reveals that the system in the consumption-led regime could generate bistability and hysteresis since the system has two stable fixed points and one unstable fixed point in the middle (see figure 2).[13]

More general qualitative analysis of the geometry of the dynamical system (23) suggests that it would have one or two or three fixed points as the curve shifts up or down depending on various parameter values of the constant terms of the equation. The shifts in the curve induced by parametric variations could also generate the possibility of *critical slowing down* in the movement of asset price. Thus, consumption-led regime is quite rich in terms of generating a wide range of dynamics.[14]

Thus, from the above qualitative analysis, it can be conjectured that the consumption-led regime generates bistability and abrupt transition or

[13] To ensure that equation (23) has two turning points for distinct positive values of p, i.e. maximum and minimum exists for distinct positive values of p, we differentiate the dynamic asset price equation (23) with respect to p and analyze the resulting slope function of the cubic equation. If the resulting quadratic slope function has two distinct real positive roots, which are the turning points of the cubic equation, it would indicate the possibility of bistability and hysteresis in the consumption-led regime. The derivations are given in the Appendix B.

[14] However, further analysis is needed to locate the bifurcation parameter (or two parameters in case there exists codimension two bifurcation) and determine the critical values of these parameters where hysteresis happens in the case of investment-led regime. The complexity of the dynamical system (23) makes it a higher dimensional problem as there are more than eight parameters and it is not easy to locate the bifurcation parameters purely through algebraic analysis. We need recourse to numerical methods for further analysis to calculate the bifurcation point or bifurcation surface in case of codimension two bifurcation.

catastrophic bifurcation in the system when conditions (24) and (25) are satisfied. Furthermore, it can be inferred from condition (24) that the consumption-led regime tends to exhibit abrupt transition when the responsiveness of output is greater than the responsiveness of reserve to securitization ratio on account of change in capital gain. This can be interpreted to mean that in the consumption-led regime, the dominant positive effect of capital gain on consumption demand expands aggregate demand through higher consumption expenditure and thus expands output and growth, which leads in turn to further expansion of credit through the process of securitization owing to the presence of the composition effect. Thus, the composition effect that is present in this regime channels additional investment flow into the finance sector, which makes the expansion fragile paving the way to a possible collapse of the economy in case of bistability.

According to our analysis, debt-driven consumption-led aggregate demand expansion is generated by higher capital gain, which causes further securitization supported by derivatives for managing risks. This in turn necessitates and promotes additional investments in the finance subsector. Hence, as the total investment in the economy increases due to expansion in output and credit, its *composition* becomes more skewed toward the financial sector. Since the composition effect diverts additional investment disproportionately in favor of the finance sector generating in turn additional demand for financial products, it drives up capital gain leading to further expansion of credit and income. The whole edifice is built on the belief of rising capital gain promoting expansion of credit on an increasingly narrow foundation of liquid reserves in the self-referential modern financial sector. Proclivity to sudden financial collapse is hardly a surprise in these circumstances.

On the other hand, in the financial investment-led regime, when $m < 0$, the signs of the coefficients of the cubic equation suggest the opposite case because the relevant curve is upward sloping with both $p^3$and p terms becoming unambiguously positive and the p^2 term turns negative under the reverse inequality of condition (24).[15] As a result, the financial investment-led regime exhibits at most one stable fixed point in the middle between two unstable fixed points as shown below in figure 3. This may turn out to be a deep recessionary equilibrium of stable asset prices with no easy escape provided by the financial market itself.

[15] The sign of the intercept of equation (23) at $p = 0$ is negative if

$$\frac{1}{2}am[bd_o + 2(1-\beta_1)c] > v_o + H[1-\beta_1 ac' + ab(d_1 + c'd_2)]$$

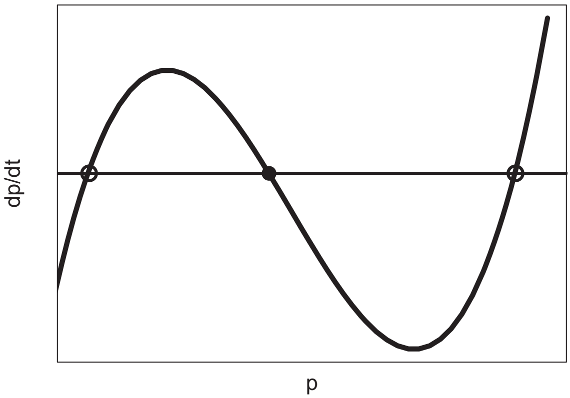

Figure 3. Financial investment-led regime ($m < 0$). The open circles represent unstable equilibria, and the filled circle represents stable equilibrium.

The regime is stable in so far as the dominant negative effect of capital gain on investment outweighs the stimulating consumption effect making the aggregate demand contract. The reversal of inequality of condition (24) suggests lack of credit growth due to contraction of aggregate demand and leaves less scope for securitization, even though the propensities for securitization remains the same. This in turn makes the financial investment regime stable within the neighborhood of the equilibrium point (or the region defined by the basin of attraction of the stable fixed point) and implies the economy will be stable if the initial conditions are in this region. In other words, for a range of parameter values, the financial investment-led regime would be stable because the contraction in aggregate demand weakens credit growth and snaps the link between securitization in the financial subsector and credit expansion. In spite of having a strong composition effect, the stability of the financial investment regime is governed by how weak or strong the flow of credit is through the process of securitization. In so far as falling aggregate demand weakens the self-reinforcing dynamic between the process of securitization and credit flow in the economy, the financial investment-led regime may turn out to be more stable than the consumption-led regime.

5. CONCLUSIONS

Without trying to be descriptively accurate, the present paper tries to identify the main channels through which the real and the financial sector interacts within the simplified framework of a closed economy with a large financial sector which includes both a regulated banking and a mostly unregulated finance subsector. The former has the central bank as a lender of last resort while the latter mostly fends for itself with access to credit through various private financial arrangements and insurance devices. The mechanisms used by the unregulated finance sector for credit creation through securitization and derivative generation are mostly endogenous and by accommodating its own demand generates demand for new credit.

As a prelude to understanding financial crisis, a model is set up to investigate how aggregate demand behaves in the real economy under anticipated capital gain (section 2). It is shown that two different aggregate regimes might emerge, either consumption or financial investment led. In the former, the positive effect of capital gain on consumption more than outweighs its negative effect on real investment (equations (4) and (5)). However, the consumption-led regime also has two subregimes because the impact of investment on demand is influenced by the composition of real and financial investment in total investment under anticipated capital gain. Until section 3, we keep the national income accounting simple by just postulating that financial investment means change in partial or total ownership of existing assets while real (productive) investment entails creation of additional productive capacity. As a result, within the consumption-led regime, the composition effect can be strong or weak depending on how strong real investment is in relation to financial investment.

The stock-flow consistent accounting framework developed in section 3 provides greater definitional clarity to the distinction between real and financial investment. Table 1 (balance sheet matrix), table 2 (income–expenditure matrix) and table A1 in Appendix A (change in net worth matrix) provide a mutually consistent account of the interaction between the real and financial sectors. It incorporates the process of securitization and implication for saving investment interaction in a financialized economy (equations (7) and (8)) and its consequent impact on net worth arising from capital gain for the households (equation (9)) and firms in the real sector.

Section 4 formally analyzes the system of endogenous credit created by the finance sector as well as its expansion under securitization and derivative trade. This process of credit creation has powerful expansionary self-reinforcing properties but it is also fragile precisely because of its self-reinforcing nature built on a progressively narrowing reserve or real asset base.

Through the formalism of section 4, we show how in the consumption-led regime aggregate demand expands through higher consumption expenditure, which in turn expands demand for credit in the economy. This is met through the process of securitization enabled by financial innovation and creation of new financial products. A crucial link between the demand and the supply side is the composition effect, which ensures that part of total investment is channeled to the finance sector propelling the self-reinforcing dynamic between credit expansion through securitization and derivative trade and the real economy. However, as more and more investment gets diverted to the finance sector, the asset price increases further to strengthen the composition effect, which intensifies the process of securitization. As the process of securitization intensifies, the liquid reserves with the finance sector decreases due to substitution in favor of less liquid securities with higher anticipated capital gain. Even with an anticipated normal level of default as part of the business, the financial system becomes increasingly fragile, often heading toward a crisis not only because of debt-driven expansion of output and debt in the real sector (as many economists seem to believe) but also because of the internal fragility of the finance sector arising from its growing internal scarcity of liquidity (equations (20), (21), (23)).

Conditions (24) and (25) try to capture formally the implication of the above argument. The consumption-led regime generates the dynamics of abrupt transition from bistability when expansion in output owing to capital gain outweighs the response of securitization to capital gain. In other words, the expansion of aggregate output owing to capital gain stimulates demand for credit more than the available supply of credit provided by the finance sector via the composition effect. Securitization via financial innovation in various forms expands credit in the economy as demand and income grow in the consumption-led regime; however the finance sector with its narrow reserve base supporting an expanding financial architecture in an inverted pyramid like structure becomes increasingly fragile. This leads to a rich range of possibilities of unstable dynamics, as in the case of bistability giving rise to 'hysteresis' and proclivity to sudden collapse (e.g. Poston and Stewart, 1978, pp. 374–5).

It is better understood when contrasted against the case of the financial investment-led regime in which aggregate demand does not grow to stimulate demand for bank credit that creates the base for additional investment in the finance sector. As a result, the financial investment-led regime fails to exhibit such abrupt transition and sudden collapse but is caught in a stagnant or declining level of real economic activity despite higher anticipated capital gain. In the highly financialized free enterprise capitalist economy, the price of unregulated freedom for finance seems to be a choice between stagnation or decline on the one hand and highly unstable growth with crisis on the other.

APPENDIX A

Table A1. Change in net worth

		Households	*Prod firms*	*Banks/FIs*	*Finance sector*	*Central Bank*	*Total*
	Net worth, end of previous period	$NWh-1$	$NWf-1$	$NWb-1$	$NWfs-1$	0	$K-1+\Delta pe.e-1+\Delta ps.s-1$
Change in net assets arising from transactions	Change in loans	$-\Delta Lh$	$-\Delta Lf$	$+\Delta L$		$-\Delta HM$	0
	Change in cash	$+\Delta Hh$		$+\Delta Hb$	$+\Delta Hfs$		0
	Change in deposits	$+\Delta Mh$		$-\Delta M$			0
	Change in equities	$+((\Delta ef).pef+(\Delta eb).peb)$	$-(\Delta ef).pef$	$-((\Delta eb).peb+(\Delta efs).pefs)$	$-(\Delta efs).pefs$		0
	Change in underlying assets			$-\Delta Ua$	$+\Delta Ua$		0
	Change in securities	$+\Delta Fh.ps$	$+\Delta Ff.ps$	$+\Delta Fb.ps$	$-\Delta F.ps$		0
	Change in tangible capital	$+(\Delta Kh).pk$	$+(\Delta Kf).pk$				$+(\Delta K).pk$
	Change in bank liquidity line			$-\Delta BLL$		$+\Delta BLL$	
Change in net assets arising from revaluations	Capital gains in equities	$+((\Delta pef).ef-1+(\Delta peb).eb-1)$		$-((\Delta pefs).efs-1)$			$+(((\Delta pef).ef-1)+(\Delta peb).eb-1)+(\Delta pefs).efs-1))$
	Capital gains in securities	$+((\Delta ps).Fh-1)$	$-((\Delta ps).Ff-1)$	$-((\Delta ps).Fb-1)$			$+(((\Delta ps).Ff-1)+(\Delta ps).Fb-1)+(\Delta ps).Fh-1))$
	Capital gains in tangible capital	$+((\Delta pk).kh-1)$	$-((\Delta pk).kf-1)$				$+(((\Delta pk).kh-1)+((\Delta pk).kf-1))$
	Net worth, end of period	$\boldsymbol{NWh}$	$\boldsymbol{NWf}$	$\boldsymbol{NWb}$	$\boldsymbol{NWfs}$	**0**	$\boldsymbol{+K+\Delta pe.e+\Delta ps.s}$

APPENDIX B

To ensure that equation (23) has two turning points for distinct positive values of p, i.e. maximum and minimum exists for distinct positive values of p, the dynamic asset price equation (23) is differentiated with respect to p, and the resulting slope function of the cubic equation is analyzed. The slope function, which is a quadratic equation, is given by

$$\frac{dx}{dp} = -\left[\frac{h}{2}abm\right]p^2 - 2\left[\frac{h}{2}(abH - \beta_1 am) + v_1\right]p - h[ab(mc + mc') - \beta_1 aH + m] \tag{B1}$$

The roots of the equation (B1) would confirm whether hysteresis is possible at all in the consumption-led regime. As noted above, conditions (24) and (25) are necessary for the cubic equation to exhibit the geometry shown in figure 2.

First, the sign of the discriminant of (B1) is analyzed and is given by

$$\Delta = \sqrt{2\left[\frac{h}{2}(abH - \beta_1 am) + v_1\right]^2 - \left[-\left(\frac{h}{2}abm\right)\right][h[ab(mc + mc') - \beta_1 aH + m]]} > 0 \tag{B2}$$

Conditions (24) and (25) make the discriminant (B2) positive, which implies that there are two distinct real roots. Second, using Descartes' sign rule on B1, applying both ($f(x)$) and ($f(-x)$), we can confirm that the equation (B1) possesses two positive roots and no negative roots. The roots of the equation (B1) would provide the exact values of p, the turning points for the cubic equation. Thus, the geometry of the cubic equation (23) and the distinct positive roots of its slope function (B1) provide basis to believe that bistability and hysteresis are possible in the consumption-led regime.

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