Leverage and Asset Bubbles: Averting Armageddon with Chapter 11?

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Abstract

The current financial crisis poses severe challenges for central bank policymaking; but the widely-used DSGE paradigm - designed to help control inflation - seems ill-suited to understanding the origins of the crisis or designing measures to resolve it.

The relevant macroeconomic framework must surely include high leverage and overvalued collateral assets, with capital restructuring the key to crisis resolution. The usual 'bankruptcy' procedures for doing this are not, however, designed to handle macro shocks hitting the whole economy : they would fail to internalise the price effects of asset 'fire-sales' required to satisfy margin calls. We use a simple model of credit-constrained borrowers to show how "super" Chapter 11 procedures can play a crucial role in preventing an asset price correction triggering widespread economic collapse. (Timely cuts in interest rates - which act as transfers from lenders to borrowers - can also help.)

To cope with the financial shock, balance sheets need 'restructuring': what about the micro-foundations of conventional macroeconomics?

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Introduction: Financial crisis – and intellectual challenge

Some observers see the meltdown threatening Western financial markets as the price to be paid for distorted incentives in the financial system which have encouraged excessive risk-taking. If financial institutions convince their creditors that high returns due to tail risk are riskless and pay out the excess returns as bonuses, then it is only a matter of time before disaster strikes, Foster and Young (2008), Rajan (2008). Others trace the problem to industry-wide externalities. If bank equity rises with asset prices, the size of the balance sheet consistent with a given value-at-risk also rises, and financial intermediary balance sheets will vary pro-cyclically, with periods of heady expansion followed by fierce deleveraging, Adrian and Shin (2007).

These views are not inconsistent, of course - and their interaction may be the source of market mayhem. Moral hazard and externalities need to be combined to analyse the issues and assess plans for avoiding financial collapse, it seems. How is this to be done? Is the current DSGE paradigm[2], developed as a framework for macroeconomic and monetary policy, robust enough to handle current issues?

Curdia and Woodford (2008) clearly believe it is fit for purpose – with due allowance for 'financial frictions'. All that is needed, apparently, is to adjust the Taylor rule for interest rate setting in the light of unusual spreads in financial markets, lowering the policy rate when the Libor spread widens[3]. "The effects of a worsening of financial intermediation, they tell us, are likely to be limited. Changes in the wedge have important distribution effects, but small aggregate effects. Monetary policy still works. Indeed, optimal monetary policy remains simple" - to quote Blanchard's summary. They argue for adjusting interest rates: but, as Goodhart pointed out in discussion, no account is taken of default.

Though the DSGE paradigm focuses on inter-temporal aspects of behaviour, nevertheless - with common knowledge and rational expectations built in, and credit flows and leverage left out - it seems peculiarly ill-suited for analysing current

[2] i.e. Dynamic Stochastic General Equilibrium with a representative agent possessed of rational expectations, as in Woodford's *Interest and Prices* for example.
[3] So as to offset the effect of the spread on market rates.

developments in capital markets - as Paul DeGrauwe pointed out in mid-2008 , before the dramatic bank rescues of October. He chided fellow macroeconomists in academia as well as those working in central banks on their 'cherished myths fallen victim to economic reality' and warned:

> There is a danger that the macroeconomic models now in use in central banks operate like a Maginot line. They have been constructed in the past as part of the war against inflation. The central banks are prepared to fight the last war. But are they prepared to fight the new one against financial upheavals and recession? The macroeconomic models they have today certainly do not provide them with the right tools to be successful. (De Grauwe, 2008)

One of the current authors has, indeed, explored an alternative macroeconomic paradigm that puts asymmetries of information at centre stage, Greenwald and Stiglitz (1990), Hellman et al. (2000), Stiglitz and Greenwald (2003). For the purpose at hand, however - to study the dangers posed by 'excessive leverage' and how emergency capital reorganisation can help - we turn instead to a model of heterogeneous agents - wealth-owners with 'deep pockets' who face diminishing returns and productive borrowers who have constant returns but need to secure their debts by collateral for reasons of non-contractabilty.

As an iconic representation of a highly leveraged economy, we use the Kiyotaki and Moore (1997) framework where the dumping of collateral generates significant negative externalities. It was originally designed to show that technology shocks would have more persistent real effects than foreseen in the Real Business Cycle literature. To accommodate current developments, we add an asset bubble whose collapse can threaten industry-wide liquidation: and we study the role of wholesale capital restructuring in 'averting Armageddon'.

We preface our analysis with a sketch of key ingredients of the current crisis and some of steps being taken by central banks and treasuries in their 'fight against financial upheavals and recession'.

1 Financial Developments – and Rescue Plans

A decade or so of low interest rates and steady economic growth encouraged rapid expansion in the balance sheets of highly leveraged institutions (HLIs). In the US, for example, the 'shadow banking system' expanded so swiftly that by 2006 "the combined balance sheets of investment banks and hedge funds was over 50% of commercial banks' balance sheets", Adrian and Shin (2007, p.15). Much of this expansion was, however, based on rising asset prices increasing the equity base of the HLIs: and the authors cited warned of severe de-leveraging if and when asset prices were to fall.

Among the assets acquired in this lending boom were securitised subprime mortgages designed to ensure that poorer families could get on to the housing ladder.

> The basic idea of a subprime loan recognizes that the dominant form of wealth of low-income households is potentially their home equity. If borrowers can lend to these households for a short time period, two or three years, at a high, but affordable interest rate, and equity is built up in their homes, then the mortgage can be refinanced with a lower loan-to-value ratio, reflecting the embedded price appreciation. … So, the mortgages were structured so that subprime *lenders effectively have an (implicit) option on house prices.* After the initial period of two or three years, there is a step-up interest rate, such that borrowers basically must refinance and the lender has the option to provide a new mortgage or not, depending on whether the house has increased in value. *Lenders are long real estate, and are only safe if they [are correct in the belief] that house prices will go up.* Gorton (2008). Italics and square parenthesis added.

By buying securities backed by subprime loans (so-called ABSs), shadow banks were acquiring assets with substantial 'tail risk'. But if house prices were substantially above equilibrium - as Case and Shiller (2008) argued was the case and current developments confirm - a process of correction in housing prices would wipe out the option values embedded in the tranches of ABSs, leading to bank-runs driven by fears

of insolvency[4]. This, according to Gorton (2008), is how the bursting of a house price bubble creates systemic crisis.

How is the crisis being handled? Initially by *ad hoc* crisis management, with investment banks in the US being taken over with government support or allowed to fail - and key mortgage granting institutions both in the US and the UK being nationalised and/or taken over. Subsequently, however, systemic solutions are being implemented in the US and elsewhere[5].

The first step was the Paulson TARP (Troubled Asset Relief Program) proposal - for the US taxpayer to provide funds to purchase troubled assets from financial institutions. By contrast, the UK alternative involved tax-payer financed capital injections for the banks. Eight eligible banks committed to raise capital to the tune of £48 billion, with three quarters being made available from the government[6]. To give banks the incentive to repay the taxpayer in a reasonably short order, a quarter of the capital raised was in the form of preference shares paying a dividend of 12%. (As later revised, the Paulson plan also allowed for capital injections, though the preference shares only carry a charge of 5%.) In both countries there are also substantial government guarantees available on inter-bank lending and on the value of toxic asset assets, so as to unfreeze this market and bring down Libor.

In his influential critique of the original Paulson proposal, Zingales (2008) argued that the best way to think of managing the US financial crisis is through the lens of US bankruptcy law. 'In Chapter 11, companies with a solid underlying business generally swap debt for equity: the old equity holders are wiped out and the old debt claims are transformed into equity claims in the new entity which continues operating with the new capital structure. Alternatively, the debt-holders can agree to cut down the face value of debt, in exchange for some warrants.'

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[4] And a freeze of interbank lending to boot.

[5] In addition there has been unprecedented liquidity provision by central banks, together with sharp cuts in interest rates, particularly in the US.

[6] Figures taken from M. Wolf (2008): full details available in *Financial Stability Report* (2008, Box 5).

What of the fact that financial firms are based on confidence and can ill brook the law's delays? 'Since we do not have time for a Chapter 11 and we do not want to bail out creditors', he continued, 'the lesser evil is to do what judges do in contentious and overextended bankruptcy processes, to cram down a restructuring plan on creditors….As during the Great Depression and in many debt restructurings, it makes sense in the current contingency to mandate a partial debt forgiveness or a debt-for-equity swap in the financial sector.' In short, what Zingales proposed - and what is now being implemented in the US and elsewhere – is a type of "super Chapter11".[7]

In what follows, credit constraints provide an explanation of why financial shocks can lead to exaggerated behaviour of asset prices, and how the risk of financial meltdown can be checked by "super" Chapter 11 intervention. The same framework also highlights the potential contribution of monetary policy: interest rate cuts can assist Chapter 11 operations by transferring resources from lenders to credit-constrained borrowers in crisis.

2(a) Asset Allocation and Pricing in the Presence of Credit Constraints

In the Kiyotaki and Moore (1997) framework (hereafter KM) used as the vehicle for our policy analysis, heterogeneity of tastes and technology as between borrowers and lenders plays a central role.

Borrowers are relatively impatient, poor, but highly productive small businesses who want to acquire capital assets ('land') as a factor of production[8]; patient wealth-owners with 'deep pockets', but declining marginal productivity, are willing to finance small businesses by supplying them with short-term, roll-over funding on a fully collateralised basis. The reason for the collateral constraint is that the idiosyncratic skill of small businesses entrepreneurs is non-contractible – it cannot be taken over by the creditor in payment of debt: this has the interesting consequence that it is the productivity and time-preference of 'deep-pocket'

[7] As a procedure for crisis resolution in East Asian countries in 1997/98, Miller and Stigliz (1999) proposed a type of Super Chapter 11: the same medicine is now needed for financial hegemons.

[8] KM label the borrowers farmers: in the present context it seems more appropriate to think of them as Small and Medium-sized Enterprises (SMEs) - which in the UK, for example, employ more than half the workforce in the private sector – or Small Businesses for brevity.

arbitrageurs that determine the price of land. It is assumed that the fixed endowment of land is always fully employed: by whom is the issue. A more complete treatment would identify an intermediary banking sector[9]: but here we make do with two.

Before turning to detail, Figure 1 shows the process of land acquisition by small businesses, or SBs, indicating how the path to equilibrium holdings at k^* is determined, starting from an initial holding of $k_t < k*$. The horizontal line in the figure measures the (constant) marginal productivity of land, α, in the SB sector while the upward-sloping line DE indicates the opportunity cost (or 'user cost', its discounted productivity in the other sector).

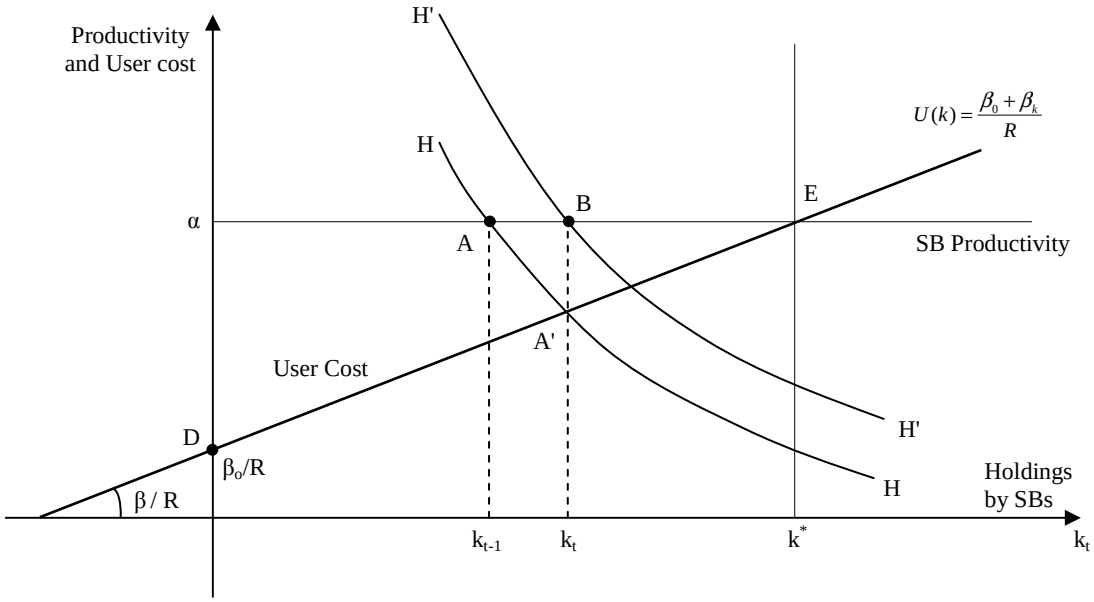

Figure 1 Asset accumulation by productive Small Businesses

The flow of profits accruing to the small businesses on initial land holdings, αk_{t-1}, are used to expand production. As land prices reflect the lower productivity of wealth owners - and not the relatively higher productivity of small businesses - current profits (used as a down payment on borrowing to acquire more land) permit an expansion of holdings, shown by the hyperbola through A which intersects the opportunity cost – or ´user cost´ – schedule at B. On the same principle, land holding

[9] See, for example, Gai *et al*.(2008)

in periods $t+1$ can be found by shifting the hyperbola to the right as shown. The fact that SB net worth, αk, increases as k approaches k^* from below reflects the fact that, with credit rationing, the relatively high productivity of assets held in this sector is only realised with delay.

The logic behind this process is indicated next, before looking at how quantities and prices interact to temporary shocks. Small businesses are borrowed up to the hilt and happily postpone consumption of traded goods to some later date[10]: so their flow of funds accounts show land holdings, denoted k_t, evolving as:

$$\text{Land Accumulation} = \text{Income} + \text{Net Borrowing}$$

or, in symbols,

$$q_t(k_t - k_{t-1}) = \alpha k_{t-1} + b_t - Rb_{t-1} \qquad (1)$$

where b_t is the amount of one-period borrowing, to be repaid as Rb_t (R is one plus one-period interest rate), q_t is price of land, and α measures the productivity of land in this sector.

Non-contractibility imposes limits on borrowing: KM assume, specifically, that each agent in this sector uses an 'idiosyncratic technology'[11] (and retains the right to withdraw labour) so they may credibly threaten creditors with repudiation. This puts a strict upper limit on the amount of external finance that can be raised: debt contracts secured on land are the only financial instruments that creditors can rely on. The rate of expansion of the highly-leveraged, credit-constrained agents is thus determined not by their inherent earning power but by their ability to acquire collateral.

The credit constraint, assumed to bind at all times, is that borrowing gross of interest matches the expected value of land, i.e.

$$b_t = E_t q_{t+1} k_t / R \qquad (2)$$

Note that the degree of leverage is keyed to expectations of future prices, with more

[10] KM also include the production and current consumption of non-traded goods by credit-constrained agents: this is omitted for present purposes, however.

[11] Idiosyncratic in the sense that once production has started at date t, only s/he has the skill necessary to produce output at $t+1$, i.e., if s/he were to withdraw labour between t and $t+1$, there will be no output at $t+1$, only the land k_t

lending when capital gains are in prospect, as in Gorton's account of sub-prime lending cited above. With perfect foresight of future land values (in the absence of shocks), substitution into (1) yields an 'accumulation' equation for small businesses who use all their net worth to make down payments on land, namely:

ACC $$(q_t - q_{t+1}/R)k_t = \alpha k_{t-1} \qquad (3)$$

where the expression in parentheses on the left is the down-payment required to purchase a unit of land and the term on the right measures both the productivity of those in this sector and their net worth[12].

Turning next to the behaviour of deep-pocket investors, it is assumed that they equalise expected returns of using land as a productive asset themselves and that from lending (on a secured basis) at the rate of interest R:

ARB $$f'(k_t) + E_t q_{t+1} - q_t = (R-1)q_t \qquad (4)$$

where $f'(k_t)$ is the marginal productivity of land in the *unconstrained* sector (expressed as a function of k_t the amount of land in the constrained sector as in Figure 1 above, assuming the total amount of land is fixed[13]).

This arbitrage condition can be rewritten to show how the 'down payment' by the borrower has to match the 'user cost' of land in the other sector:

$$q_t - q_{t+1}/R = f'(k_t)/R = u(k_t) \qquad (5)$$

where $u(k_t)$ is the discounted marginal productivity of land for deep-pocketed investors (where there is also a one period lag in production).

The simple dynamics of asset accumulation by small businesses indicated in Figure 1

[12] By definition, the net worth of property companies at the beginning of date t is the value of tradable output and land held from the previous period, net of debt repayment, i.e. $(\alpha + q_t)k_{t-1} - Rb_{t-1} = \alpha k_{t-1}$.

[13] Note that, with diminishing returns in production in the unconstrained sector, where output is $g(\bar{k} - k_t)$, defining $f'(k_t) = g'(\bar{k} - k_t)$ implies that $f'' = -g'' > 0$ i.e. small businesses face a rising cost of acquiring land.

comes from substituting (5) into (3) to give:

$$u(k_t)k_t = \alpha k_{t-1} \qquad (6)$$

where the absence of asset prices in (6) reflects the assumption of perfect foresight.

For analytical simplicity, assume (as in Figure 1) that the opportunity cost (or 'user cost') of land for small businesses is linearly related to their collective holdings $k_{t,}$ so:

$$u(k_t) = (\beta_0 + \beta k_t)/R \qquad (7)$$

where β corresponds to the second derivative of the production function in the unconstrained sector, i.e. measures the rate of decline in the marginal productivity of land used by deep pocket investors and the discount factor 1/R reflects one-period lag in production. As for the price of land, this is determined by deep pocket investors present as the discounted value of their own 'user cost', i.e.

$$q_t = \sum_{s=0}^{\infty} u(k_{t+s})/R^s \qquad (10)$$

where this is measured along the path towards equilibrium.

With current profits used to pay the user cost, the dynamics of asset allocation and prices in the absence of shocks are:

ACC $$(\beta_0 + \beta k_{t+1})k_{t+1}/R = \alpha k_t \qquad (8)$$

ARB $$q_{t+1} = Rq_t - (\beta_0 + \beta k_t)\,. \qquad (9)$$

The recursive structure – so it seems that land prices do not affect the process of acquisition – depends crucially on the assumption of perfect foresight, however. Without it, accumulation will be affected by 'errors of forecast', as we see below.

Note that the accumulation process has two points of stationarity. There is a stable

equilibrium, $k^* = (R\alpha - \beta_0)/\beta$, $q^* = (\beta_0 + \beta k^*)/(R-1)$, where land is - subject to credit constraints - allocated efficiently in terms of its productivity. There is another - inefficient and unstable – equilibrium, $k^* = 0$, $q^* = \beta_0/(R-1)$, where credit-constrained small businesses lose all their property. A key issue is whether there are forces which might throw the system into the inefficient equilibrium, at least for a while.

To study prices and quantities together, the system may be linearised around equilibrium to obtain:

$$\begin{bmatrix} k^0_{t+1} \\ q^0_{t+1} \end{bmatrix} = \begin{bmatrix} \lambda .....0 \\ -\beta ...R \end{bmatrix} \begin{bmatrix} k^0_t \\ q^0_t \end{bmatrix} \qquad (11)$$

where $\lambda = \dfrac{R\alpha}{\beta_0 + 2\beta k^*}$ is the stable root on the path to equilibrium, shown as SS in Figure 2, and the variables are measured from equilibrium (so $k^0_t = k_t - k^*$).

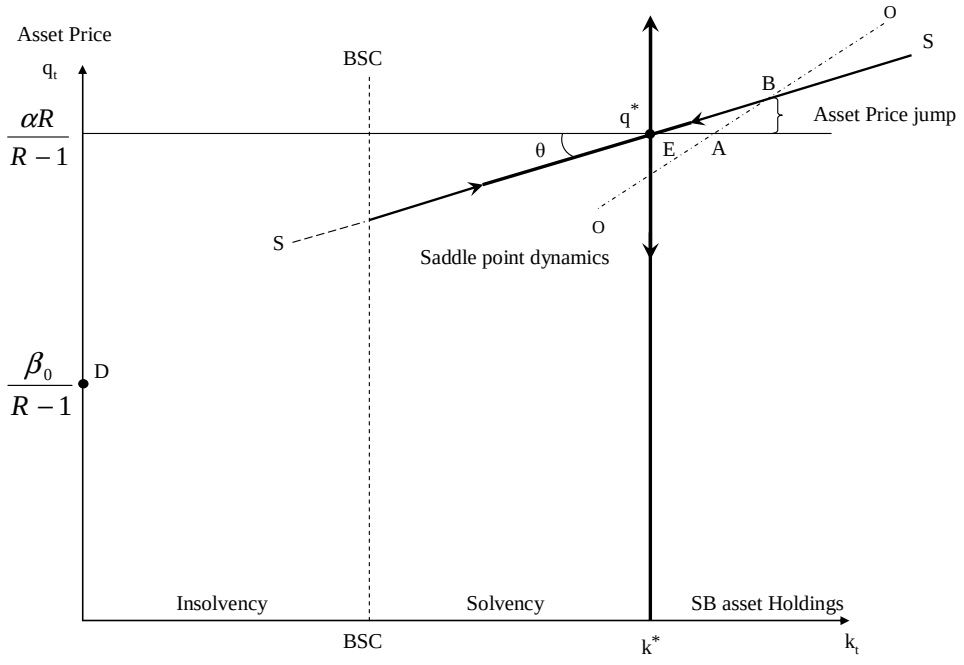

Figure 2 Price - quantity convergence - and the effect of an unanticipated positive technology shock $\Delta\alpha$ (see initial condition given as OO)

The sensitivity of land prices to land sales depends on the slope of the stable path denoted

$$\theta = \frac{\beta}{R - \lambda} > 0 \qquad (12)$$

which is effectively a weighted average of productivity in the two sectors.

Expectations have so far been taken to be correct: but what if there is a shock? The immediate effect of the temporary, surprise increase in productivity across all small businesses discussed by KM is shown in the Figure by the intersection of the 'initial condition' OO[14] with the stable path SS. The distance EA, from the equilibrium to the initial condition OO, indicates how far Small Businesses could expand using the temporary rise in profits as down-payment on fresh borrowing at a constant land price. This expansion will increase the price of land and borrower net worth, however; so it sets off a 'financial accelerator' that takes short- run equilibrium to point B on SS.

What about negative productivity shocks – a flood perhaps? While an isolated negative shock can be handled by asset sales and deleveraging, the same may not apply for a correlated negative shock as the financial multiplier now works to weaken balance sheets - and may trigger industry-wide insolvency.

2(b) A Bursting Bubble, De-leveraging and Disaster

The Real Business Cycle literature to which Kiyotaki and Moore were contributing typically deals with technology shocks: we focus on financial shocks - a negative asset price correction in particular, as when small businesses who have borrowed heavily against overvalued collateral[15] face a sudden fall in its value. So long as the shock (the ending of overvalued land prices) comes after they have put in their labour and committed their net worth, small businesses cannot unilaterally bargain a debt write-down: with lower net worth they will – like US farmers in the 1930s - have to sell assets to 'pay down' their debts. So there will be 'fire sales' of

[14] Analysed algebraically in the next section.
[15] i.e. collateral valued higher than indicated by the path that converges to the 'good 'equilibrium, see (11).

land.

Is such a large, collective error of forecast conceivable? To help understand the bubble in US house prices that peaked in 2006, Shiller (2008, p 62) appeals to a behavioural theory, where people 'try to think of speculative events as rational responses to information… [and] accept as simple fact the stories that accompany the bubble.' Without appealing to this theory of 'contagious exuberance', one can nevertheless tell a plausible story of anticipated fundamentals that leads to a similar result[16]. What if, for example, there is news of a potential technological improvement for Small Businesses which promises to raise α substantially - and so to lead to a greater share of land for that sector. With the expectation of widespread implementation at a later time T, the asset price should jump on the news, increasing steadily thereafter towards the higher value stable path S'S' associated with the $\alpha' > \alpha$ as shown in Figure 3. But what if, when the asset price has reached B at time T-1 and all Small Businesses are set for expansion next period, the promised implemention fails to occur?

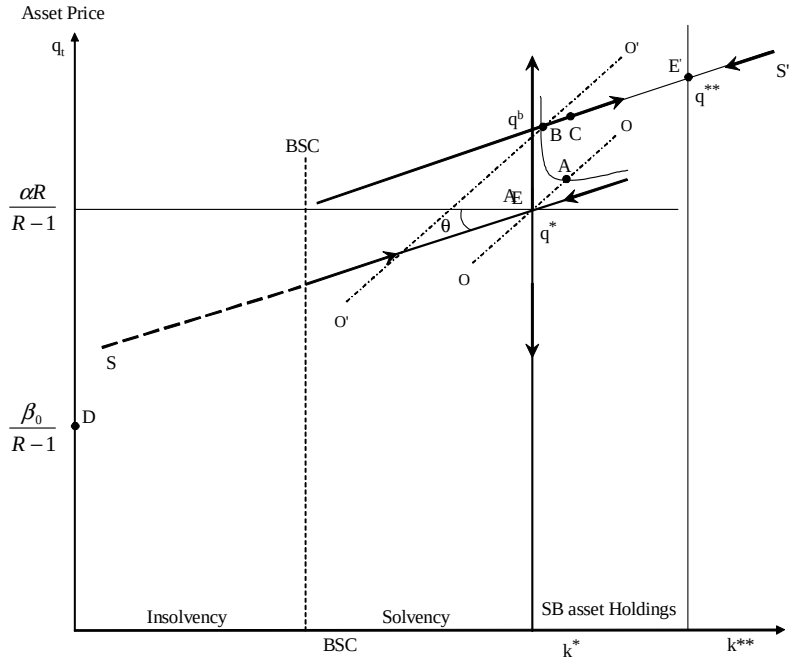

Figure 3 False dawn: a promised productivity boom that doesn't materialise

[16] Though not treated here, the microeconomic reasons for asset price distortions and how to prevent recurrence is a key issue. Allen and Gale (2008) indicate how asset bubbles may reflect agency problems, as when 'risk-shifting' leads to over-pricing of risky assets: if agency problems were at the root of the asset price overvaluation, institutional change and /or enhanced regulation would be essential to prevent prompt recurrence.

All Small Businesses will be faced with a correlated shock as asset prices fall and their balance sheets are marked-to-market. As they consistently borrow the discounted value of land one period ahead, Small Businesses will be loaded with debt without the anticipated flow of income to service it: so deleveraging will be called for – adding to the downward pressure on land prices via the financial accelerator. Will the out-turn be as shown by the schedule O'O' in the Figure where prices overshoot before returning to equilibrium; or will the credit squeeze prove counter-productive - driving all borrowers bankrupt and leading to equilibrium at D ?

For analytical convenience, we study the initial condition after a shock assuming that there is perfect foresight thereafter, as in KM: we also assume that the asset price overvaluation takes when land holdings are at k* (so the initial equilibrium lies on the unstable eigenvector). Allowing for an adverse price shock involves correcting the net worth in equation (8) for the error of forecast. So k_t and q_t are implicitly defined by

$$(\beta_0 + \beta k_t)k_t / R = [\alpha - (q^b - q_t)]k^* = [\alpha - (q^b - q^*) - (q^* - q_t)]k^* \qquad (13)$$

together with pricing equation (11) above. On the left is the user cost of holding land k_t : on the right the 'corrected' net worth of the small businesses.

Given the linearization, the initial condition can be rewritten as

$$(\beta_0 + 2\beta k^*)k_t^0 = [-(q^b - q^*) - q_t^0]k^* = [-\Delta - \theta k_t^0]k^* \qquad (14)$$

where $(q^b - q^*)k = \Delta$ is the required price correction for 'excess borrowing' and $q_t^0 k^* = \theta k_t^0 k^*$ is the 'financial accelerator' due to fire-sales that this induces.

To see whether the system will survive without a crash, we plot the two sides of equation (14) separately in Fig. 4, using the version linearised around equilibrium, where the user cost of land is shown as UU (with equilibrium at point E where it crosses the line αk_t).

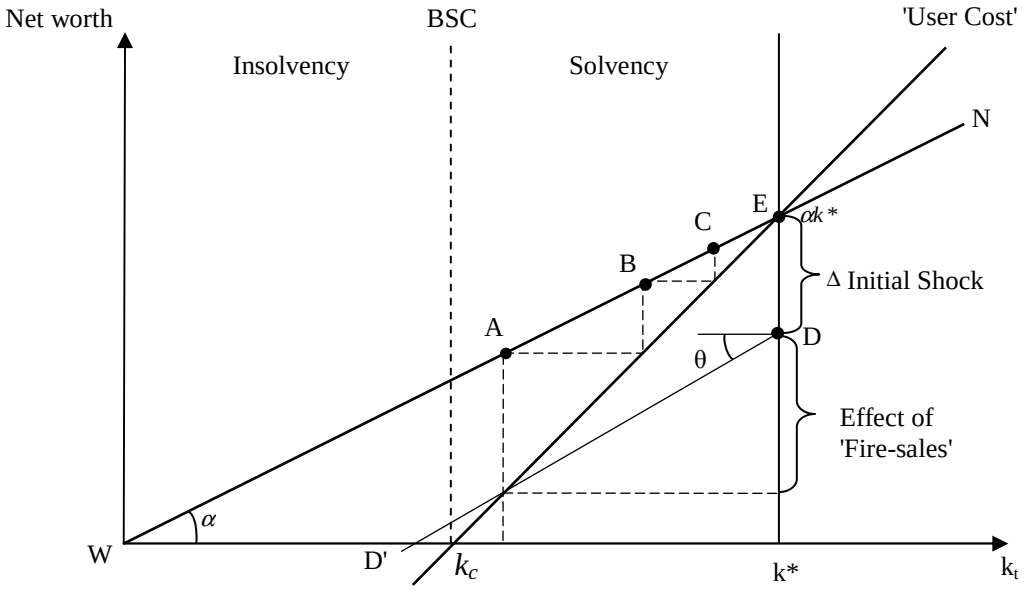

Figure 4 Aggregate net worth of 'credit-constrained' Small Businesses

In the absence of shocks, the aggregate net worth of credit-constrained businesses will lie on the line NW passing through the origin with slope α, so at E net worth is αk^*. But where land holdings of k* have become overvalued, an asset price correction will reduce SB net worth for two reasons: first because debts contracted before the correction will now exceed the value of the collateral assets as shown by Δ (the distance ED in the figure); second because asset prices will fall below equilibrium as collateral is sold in the deleveraging process – the financial accelerator. The net worth schedule incorporating these effects is shown as DD' with slope θ, where the 'overshooting' term $q_t - q^*$ has been replaced by the approximation $\theta(k_t - k^*)$. (It is because the latter depends on the volume of disposals, that the net worth function DD' slopes downward to the left in the figure.)

There will only be a return to the 'good equilibrium' if these two curves intersect *without triggering insolvency*, as illustrated by the intersection at D' where the productivity of land remaining in the hands of credit constrained businesses will generate profits at the point labelled A in the next period, allowing for gradual recovery to E thereafter. A smaller shock – corresponding to a more favourable 'initial condition' - will lead to less land sales and faster recovery. But a larger shock that rules out any intersection where borrowers remain solvent leads to collapse as credit-

constrained businesses lose their land holdings. The distance measured algebraically as $(\alpha - \lambda\theta)k*$ is the size of the largest financial hit consistent with survival of small business enterprise without intervention[17] and the location of k_C identifies the Balance Sheet Constraint, BSC.

This Balance Sheet Constraint also appears in Figure 5 showing the value of land and its allocation, along with the 'initial conditions' corresponding to two different price corrections. If asset prices are overvalued by BE when a correction takes place, this is consistent with overshooting and recovery: but if the overvaluation is larger, then correction threatens mass insolvency, as shown by the schedule O'O'.

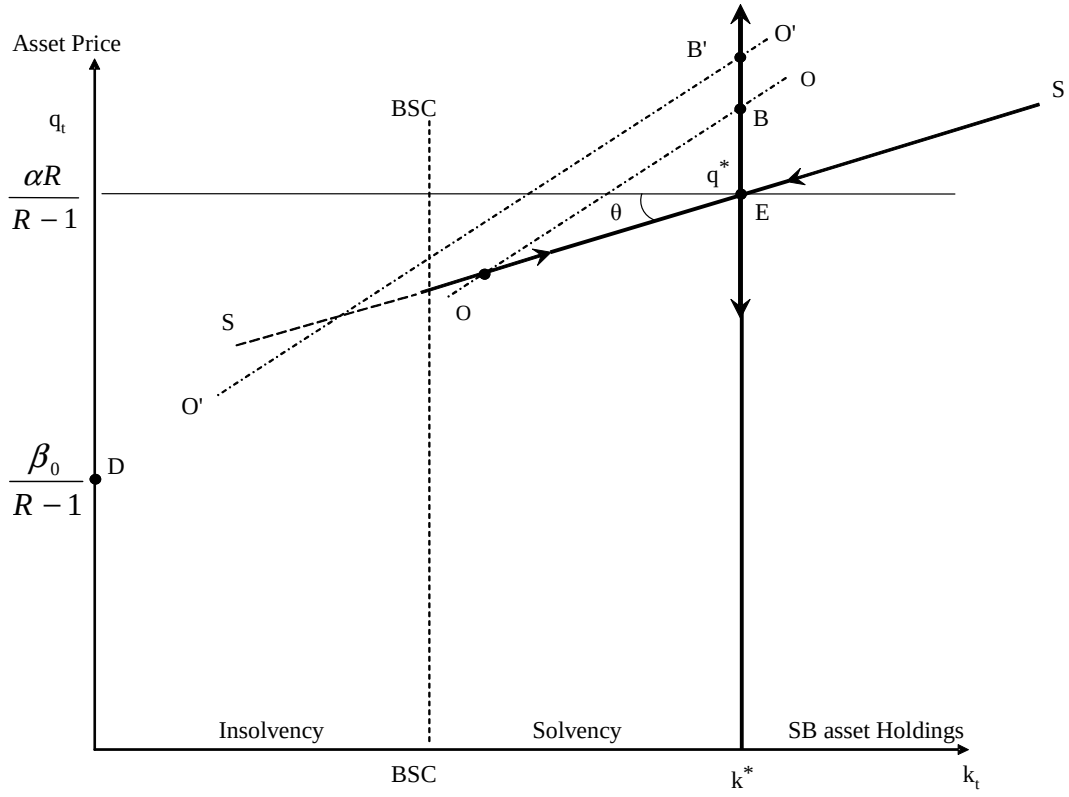

Figure 5 The ending of an asset bubble and the risk of mass insolvency (see initial condition given as O'O')

Highly leveraged borrowers with very little net worth can easily become insolvent. If their net worth were only 5% of assets held as collateral for loans, a

[17]The peculiar feature that net worth falls to zero in this special case is an artefact of the linearization. In fact the user cost function specified takes a quadratic form from the origin to E, with the maximum shock determined as a point of tangency, as in Edison et al.(2000)

correction of asset prices in excess of this would be enough to wipe out their net worth - even before fire-sales begin. The system becomes a good deal more robust if borrowers are subject to a prudential margin requirement which provides an *ex ante* buffer against such losses, Edison et al (2000), Gai *et al*. (2008). Assuming that margin requirements are relaxed when asset prices fall, the shock to net worth will be cushioned by this buffer[18]. (The recent recapitalisation of banks in the UK and the US is surely designed to create such a buffer, as discussed below.)

(3) Averting Melt-down

(a) Capital restructuring

Wholesale reallocation of assets to relatively unproductive, 'deep pocket' lenders is obviously socially inefficient; and, as the 'going concern' value of small businesses after restructuring exceeds the alternative 'user cost' , the principles of bankruptcy law confirm that they should be kept going. Chapter 11 of the US bankruptcy code, for example, aims at restructuring credits so as to avoid premature liquidation. The customary legal procedures are, however, designed to handle small, idiosyncratic shocks - not macro shocks hitting the whole economy. Judges can hardly be expected to take account of externalities imposed by fire-sales of the assets involved in individual cases, making liquidation much more likely.

Restructuring to internalise the price effects of asset 'fire-sales' due to margin calls in the midst of a crisis requires an override of normal procedures – what we refer to as "super" Chapter 11, where the principles of bankruptcy are applied at a macro level. Three kinds of restructuring are considered in broad outline: a debt-equity swap, a temporary capital injection, and a debt write-down. How these might work in practice - at least for banks - has been vividly demonstrated in the recent restructuring of bank balance sheets in the UK and USA.

(A) Debt-Equity Swap

[18] If, for example, prudential margin requirements are suspended after the shock - leaving only the down-payments as described above - the initial equilibrium for k_t may be found as before, except that the shock Δ will be net of the prudential margin held beforehand.

Capital restructuring under Chapter 11 frequently involves an exchange of debt for an equity share, so lenders become owners, relieving the borrower of collateral requirements and interest payment obligations, Zingales (2008). In Figure 4, for example, the excess debt ED owed to the wealth owner could be swapped for equity of the same value. [But note that, to avoid the moral hazard problem of equity ownership in the Kiyotaki and Moore (1997) framework, it would be necessary for ownership rights to be taken an agency which has ways of enforcing payment beyond those available to private creditors.]

(B) Capital injection

A key feature of the UK rescue plan has been the provision of capital injections in preference shares or unsecured debt. How can this avoid a meltdown if it is designed to be temporary? The answer, broadly speaking, is by checking the de-leveraging process that follows a shock to net worth, and so limiting the negative externality of asset sales.

To see how this works, assume that the initial financial shock would lead to collapse but deep-pocket lenders provide unsecured financing C when the shock occurs, to be repaid as CR one period later, where R is the gross market rate of interest. To avoid the moral hazard problem of unsecured lending, assume that (as in the current crisis) the capital injection is arranged through the agency of the government, which has ways of enforcing payment beyond those available to private creditors.

If the amount provided is sufficient to avert collapse, then, as shown in Fig. 6, this extra capital will shift the financing constraint up from DD to ensure a first-period equilibrium as at A'. The figure illustrates a case where borrowers are able to repay the temporary finance with interest in the very next period: this repayment lowers the net worth constraint (by RC) but the borrowers are, nevertheless, able to reverse some of their fire-sales of land and there is convergence back to equilibrium at E as shown.

[Algebraically, the amount of temporary financing required in the linearized case must be greater than M , defined by the condition that

$$(\beta_0 + 2\beta k^*)k_t^0 = [-(q^b - q^*) - q_t^0]k^* = [-\Delta - \theta k_t^0]k^* + M \qquad (15)$$

where k_c is the point of zero net worth shown in Fig. 5.]

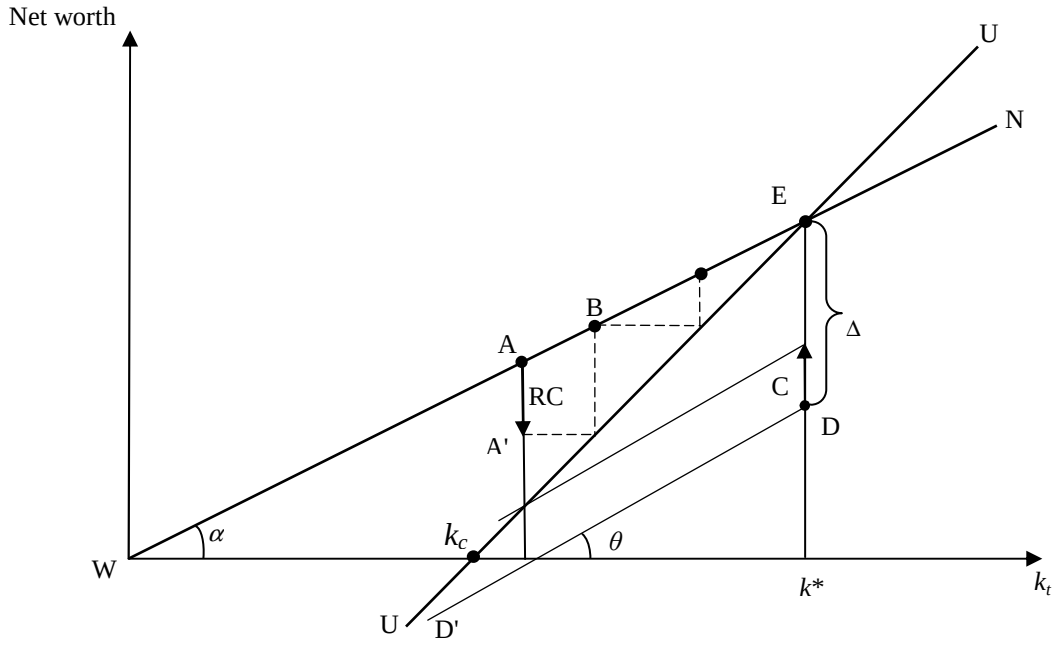

Figure 6. Temporary capital injection (C) to avert insolvency

The effect of providing temporary finance to limit fire-sales of collateral assets is to shift the initial condition shown as O'O' in Figure 5 so that it no longer violates the Balance Sheet Constraint. [19]

(C) Loan Write-Downs

What about debt forgiveness? A loan write-down is another way of avoiding the negative externalities caused by loan enforcement programmes.

> We need bankruptcy reform allowing for homeowners to write down the value of their homes and stay in their houses, in addition to the help that the current legislation proposes. [Furthermore], the government could assume part of the mortgage, taking advantage of the lower interest rate at which it has access to funds and its greater

[19] In the case of the banks in the UK, however, more than one injection has been required.

> ability to demand repayment. In return for the lower interest rate – which would make housing more affordable – it could demand from the homeowner the conversion of the loan into a recourse loan (reducing the likelihood of default), and from the original holders of the mortgage, a write down of the value of the mortgage to say 90% of the current market price. (Stiglitz (2008))

(b) Monetary policy: emergency rate cuts

It is not only legal restructuring that can ameliorate the conditions of those who have borrowed heavily against overvalued assets whose prices are being 'corrected': timely adjustment of interest rates can in principle also help. The idea is simple enough – to cut rates so as to stabilise the prices of those assets whose collapsing values are threatening the system. A reduction in real interest rates at the time the bubble bursts - and for a while thereafter[20] - will generate a transfer from lenders to borrowers, and help to limit the fire-sales at the root of the crisis.

The jump in price which takes account of the size and duration of the interest rate cut and the endogeneity of land holdings is shown in Figure 7, where the schedules labelled SS and $S(R_L)$ $S(R_L)$ show the price paths leading to equilibrium for rates that are *permanently* high or low.

[20] Possibly a long time, if Japanese experience is any guide.

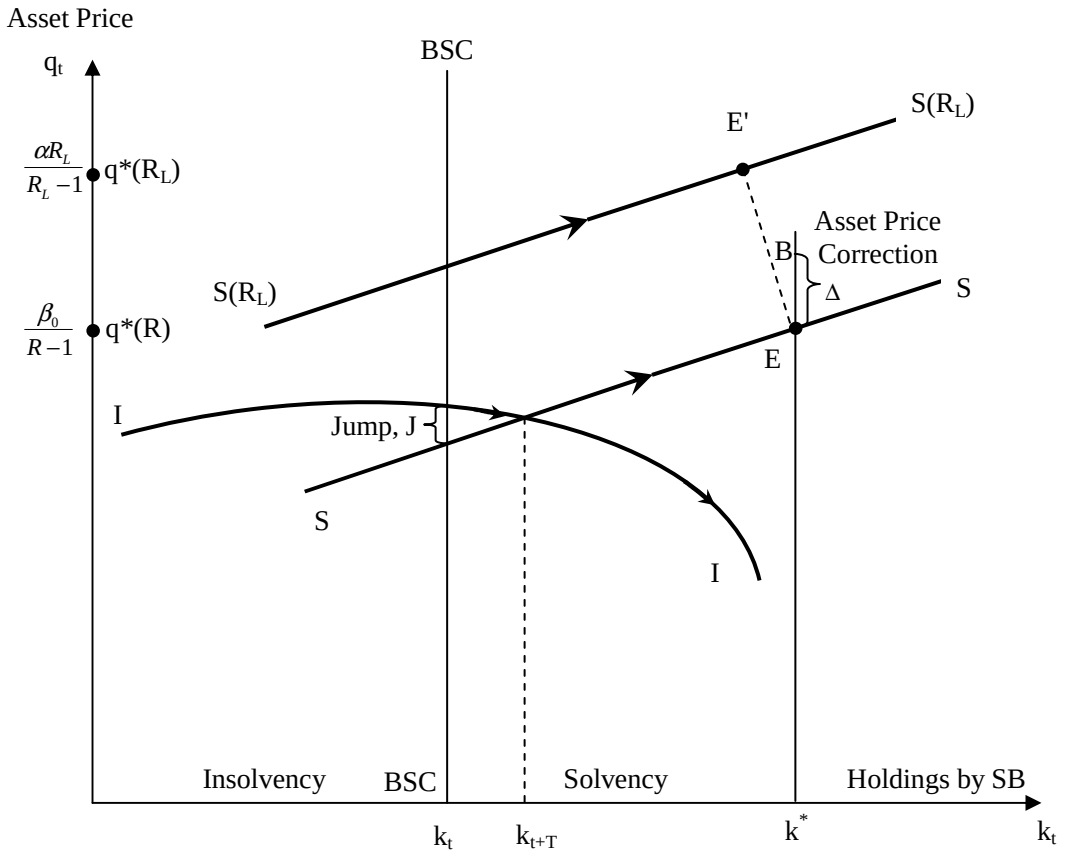

Figure 6. Checking 'fire-sales' by temporary interest rate cut

The impact on asset prices due to a *temporary* cut in rates expected to last for T periods is shown by the integral curve II, along which it will take T periods to travel from k(t) to k(t+T). The height of this curve above SS, shown by J, is the capital gain in question.

When this term is inserted into the initial condition:

$$(\beta_0 + 2\beta k^*)k_t^0 = [J - (q^b - q^*) - q_t^0]k^* = [J - \Delta - \theta k_t^0]k^* \qquad (17)$$

fire-sales will be reduced which should help avoid mass insolvency. A rate cut is no panacea: but it goes hand-in-hand with a programme of capital restructuring.

4) Conclusion

The framework used here is very much an iconic 'reduced form': it would clearly be more satisfactory to model the process of intermediation explicitly, particularly because insolvency in the non-financial sector (of those who have taken

on mortgage commitments they cannot afford, for example) has manifested itself as insolvency in banks as they write down the value of their toxic assets. Interest rate cuts have, as a consequence, become less effective: instead of passing on rate reductions to borrowers banks have sought to widen spreads so as to rebuild their own capital. The response by the authorities in both the US and UK - issuing government debt to buy private debt in what is called 'quantitative easing' – means , however, that they are effectively overstepping the broken banks by supplying finance directly to those who need it.

The situation may be complicated, but the message seems clear enough - credit conditions matter a lot and emergency steps to restructure balance sheets are crucial for fixing problems of excessive leverage. This stands in sharp contrast to the view from conventional DSGE models - that 'the effects of a worsening of financial intermediation are likely to be limited' and can be handled by interest rate cuts alone; and it seems to correspond broadly-speaking to what has actually been done in the banking sector!

Paul de Grauwe's warning - that conventional models fail to connect with the issues at hand - carries another message: that the micro-foundations of macroeconomics needs similar treatment. Issues of heterogeneous agents and asymmetric information, of externalities and coordination games, are too important to be left out of the picture. What is needed - as John Muellbauer (2007) puts it - is for orthodox macroeconomics to catch up with modern microeconomics.

In the meantime, economic history may help in designing preventive measures. It may well be necessary, for example, to reintroduce the Glass-Steagall Act to reduce risk-taking in the banking sector which provides credit for households and small business - and a means of payment for everyone. The traumatic experience of Sudden Stops in Emerging Markets may also provide useful lessons[21]: critics of the pro-cyclicality of finance to emerging markets, such as Griffith-Jones and Ocampo (2007), may find their analyses have a wider application. A measure proposed by Goodhart and Persaud (2008), in the same spirit, is to vary bank capital requirements

[21] Furman and Stiglitz (1998)

- making them high in boom times and lower in slumps[22]. The Bank of England's Deputy Governor for Monetary Stability has indeed acknowledged that:

the central bank is trying to achieve two objectives – price stability and the avoidance of unsustainable financial imbalances – with just one instrument, the official policy rate. So ideally one wants to call on another instrument, preferably one targeted at the market failure driving the excessive credit boom. …The obvious way to address this problem is by requiring banks to raise extra buffers of capital or to put aside additional reserves during the boom phase of the credit cycle, which can then be called upon if the credit cycle turns. Bean (2008)

If Zingales (2009) is right about the widespread absence of accountability in the finance industry in general, this will need to be part of a more profound overhaul of corporate governance before the financial system is fit for purpose.

The international spread of the financial crisis means that preventive measures must function in a global context - as the Basel Rules for prudential banking were supposed to do. But events have shown that that Basel II is misconceived: as was pointed out *ex ante* by Keating et al (2001) in a prescient critique from the LSE, it offered no guarantee of systemic financial stability[23]. It too needs to be replaced.

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[22] The effect of varying the loan to value ratio over the cycle in the KM model is explored in Silonov (2008).

[23] See also Alexander et al. (2006 pp. 40,41 et seq.) for another warning of the inadequacy of Basel II in respect of systemic risk.

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