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The Subprime Crisis: Causal Distortions and Regulatory Reform

by

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I Introduction

- **Financial bubbles associated with leverage and the crises to which they give rise are always a consequence of distortions somewhere in the world economy.** To be sure, there is usually more than one factor at work in the timing, location and size of a crisis. But the reform process will need to consider causality, if sensible principles are to be developed.

- The economic consequences of the bursting of the subprime bubble are only in their early stages. The banking system is short of capital—both in the USA and in Europe (where people seem, perhaps wrongly, to be very sanguine about the likely fallout).

- The crisis took policy makers by surprise. In the spring of 2007, there was only mild concern about the risk of a storm.[1] The IMF Financial Stability Report, a good touchstone for official consensus at the time, ranked credit risk as the lowest in their Global Financial Stability Map, and wrote:

  "This weakness has been contained to certain portions of the subprime market (and to a lesser extent, the Alt-A market), and is thus not likely to pose a serious systemic threat. Stress tests conducted by investment banks show that, even under scenarios of nationwide house price declines that are historically unprecedented, most investors with exposure to subprime mortgages through securitized structures will not face losses."[2]

  The UK Financial Stability Authority (FSA) signed off on Northern Rock becoming an early Basel II 'internal ratings-based' obligor, knowing full well that this would dramatically reduce their capital, only shortly before the crisis began.

- There was also a general tone amongst policy makers of a greater willingness to rely on the private sectors' own assessments of risk and capital requirements, consistent with the push towards Basel II in its sophisticated version.

- Notwithstanding the surprise factor in the crisis, views are divided concerning the broad paradigm in which financial policy making is carried out. The Financial Stability Forum (2008) looks to iron out various anomalies and oversights. The move to Basel II, the blueprint for which was published in June 2004, is endorsed (with some yet-to-be announced modifications). "*There is a strong consensus that the implementation of Basel II will put capital regulation on a sounder footing*"[3]. Mr Paulson of the US Treasury is focused on the US, and is advocating major consolidation of the overlapping regulatory structure there.

[1] Certain 'Mavericks' in the official family voiced concerns, but they had been doing so for a long time in some cases, apparently 'wrongly', and did not affect the policy process in any preemptive way.
[2] See IMF (2007), page 7.
[3] See Wellink, N. (2008). Nout Wellink is chairman of the Basel Committee on Banking Supervision, and President of the Netherlands Bank.

- Academic research is more critical, and points to possible major flaws in the capital regulation paradigm, not just the ineffectual Basel I system, but the evolution towards Basel II which will be both pro-cyclical in its current proposed form and will not systematically penalise concentration and regional risk factors, except insofar that supervisors under Pillar II choose to focus upon such concerns.[4] Banks, credit rating agencies, and monoline insurers are ducking for cover on their past 'mistakes', but are finding a voice to argue against regulatory over-reaction.

- The main risk is, with all of these cross currents, that the US and other economies 'muddle through' again this time, and necessary reform is not put in place. Indeed, if current policy responses increase moral hazard in the banking system, then future crises may not only be likely, but possibly larger than the current one.

- Understanding causality is a pre-condition for correct policy making. Causality in economics usually carries the connotation of 'exogeneity': a policy distortion, a change or a shock not caused by events, but setting them in motion. Endogenous variables respond to the shock subject to certain parameters or conditioning factors that may restrain or exacerbate outcomes—themselves often drifting and stretching over time. The reform process needs to think about the conditioning factors, and improve them. But bubbles and crises will still occur if the causal distortions are not addressed directly. Think of the analogy of a flood of running water from a badly-made and bursting dam: the gullies, rocks and branches in its way are conditioning factors that influence the speed and direction of the flow—but the excess water will always find its way around these obstacles. They only influence precisely where the inevitable damage to the landscape and will follow. A bad dam is causal, the obstacles, levies etc. may moderate or exacerbate the situation—but most fundamentally we need to understand what good and bad infrastructure is. So it is with liquidity, financial bubbles and leverage crises and regulation.

- This paper examines the process of disintermediation that led to the crisis, the extent to which it was an unintended consequence of capital regulation, and what the turmoil means for prospects for the financial system and how it should be regulated. The plan of the paper is as follows:

  Section II looks at the global macro causes of the crisis. Section III explores the securitisation process: the main players, trends, the nature and size of the crisis and the case for serious regulatory reform. The Financial Stability Forum summary of key weaknesses and recommendations is summarised in Section IV and causal versus conditioning factors are discussed. Key elements of the Basel capital regulation framework are set out in section V, and Basel I is compared with the revised Basel II framework. Problems with capital regulation under Pillar 1 are set out in section VI, and the extent to which Pillars 2 and 3 might be expected to help is discussed in section VII. The problem of 'anticipation' affecting what banks did in respect to mortgage concentration in the run up to Basel II is discussed in this section. Section VIII looks at

[4] See Goodhart (2007), for example.

the problem of regulatory competition and illustrates it with the controls placed on Fannie Mae and Freddie Mac, which in the view of this paper played a role in causing the crisis. Econometric techniques are used to illustrate the likely magnitude of the contribution of regulation to the subprime crisis in section IX. To support the views in all the preceding analysis from the micro perspective of what firms actually did, the cases of Citigroup (section X) and UBS (section XI) are looked at in some detail. Capital regulation in the USA is compared to the situation in Europe in section XII. Europe is shown to be very under-capitalised compared to the US and less able to absorb financial turmoil. A summary of the key findings of the paper is set out in section XIII and finally some observations on the key required elements of reform are set out in section XIV.

II. The Global Liquidity Bubble

- Liquidity-driven bubbles have their roots in distortions somewhere in the world economy. To think about causality it helps to look at the exogenous drivers. The starting point for subprime in this broad context focuses on 3 (interrelated) distortions:

  1. 1% US interest rates: following the tech bust (causing a weaker $ from 2002).

  2. Chinese industrialization, foreign reserves accumulation and Sovereign Wealth Fund (SWF) growth: high saving and current account surpluses; a strongly managed exchange rate in the face of FDI inflows resulting in huge foreign exchange intervention; the low administered energy prices that do not permit the rising oil price to have a demand-slowing effect, and result in even higher global oil prices and unprecedented revenue to oil producing countries and their SWF's; and the recycling of Asian and OPEC surpluses and reserves back into western financial markets, affecting interest rates and the cost of capital (while at the same time disguising inflation pressure as a current account deficit, with cheap manufactures causing import competition, etc).

  3. Japan's near zero interest rate and (low) exchange rate policy: as it tries to adjust to new competitive challenges from Chinese and other industrializing countries. This reinforces the low global cost of capital in financial markets via carry trades.

- The ex-ante excess of saving over investment and nominal flows to which these trends gave rise resulted in financial price responses to equate ex-post savings and investment. The search for yield contributed to financial bubbles and excess leverage.[5]

- Liquidity driven bubbles and a too-low global cost of capital lead to excess risk taking, and asset prices get driven out of line with fundamentals based on realistic future cash flows. Excess leverage results from the reduction of nominal constraints on borrowers (cash flow impact of the servicing burden) and because collateral values, as measured at a point in time, are directly linked to loan size.

- Sensible reform of the global financial system must go hand in hand with wider regulatory reform if periods of financial turbulence are to be avoided (exchange rate

[5] See Blundell-Wignall, A (2007a) and (2007b).

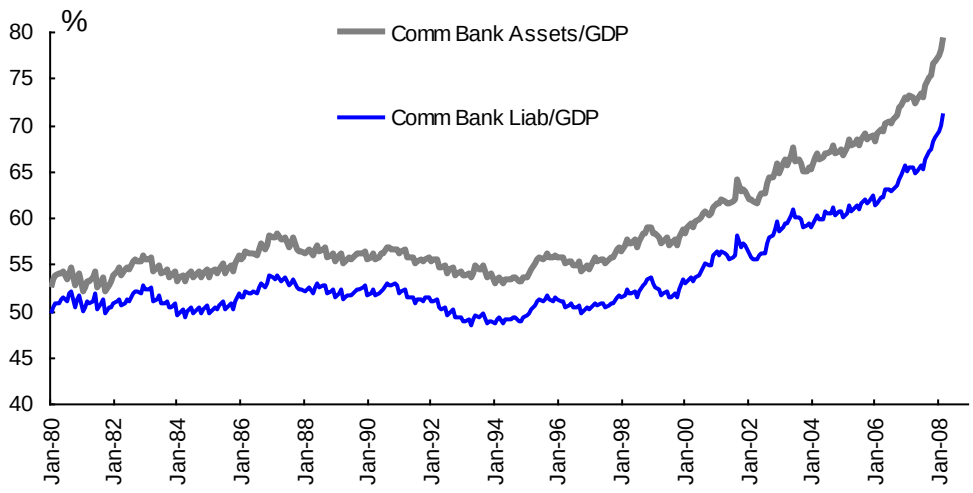
arrangements, energy price controls, and low interest rate beggar-my-neighbor policies). Regulation cannot and should not have to compensate for serious macro distortions that drive rolling liquidity bubbles.

- **At the more micro level of financial markets, it has to be asked: why did this flood of liquidity, like the water analogy above, find its way into the sub-prime sector in such an extreme and damaging way, in spite of the financial regulations in place to stop it? Even more puzzling, why was it so extreme in private-label residential mortgage-backed securities (RMBS) after 2004?**

III. Intermediation and Securitisation

- Banking is a highly-leveraged activity—it consists in borrowing from the public through deposits or via commercial paper in the wholesale markets (liabilities) and lending to households and businesses (assets). Between these 2 large sides of the balance sheet sits a thin sliver of capital or equity (on the liabilities side) which can disappear quickly. The gap between assets and borrowed liabilities of US commercial banks is shown in **Figure 1.** In the decade from January 1994 (the end of a previous major banking crisis) to January 2004, US bank assets rose from 53% of GDP to 65.4%, some 12.4 percentage points of GDP. From January 2004 to March 2008, in just over 4 years, assets rose again by 12.4 percentage points to a record 79.3% of GDP.

Figure 1: US Commercial Banks, Assets & Liabilities (%GDP)

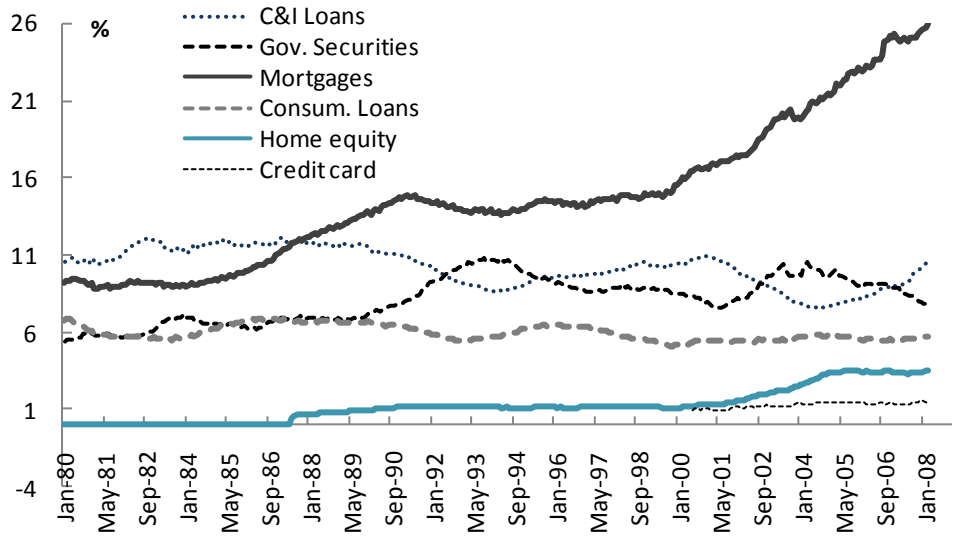


Source: Datastream, US Federal Reserve

The parabolic 'take off' in mortgages and securitisation of mortgages

- The surge in assets post 2004 was driven almost exclusively by (residential and commercial) mortgages, as can be seen from **Figure 2.**

Figure 2: Commercial Bank Asset Composition (%GDP)



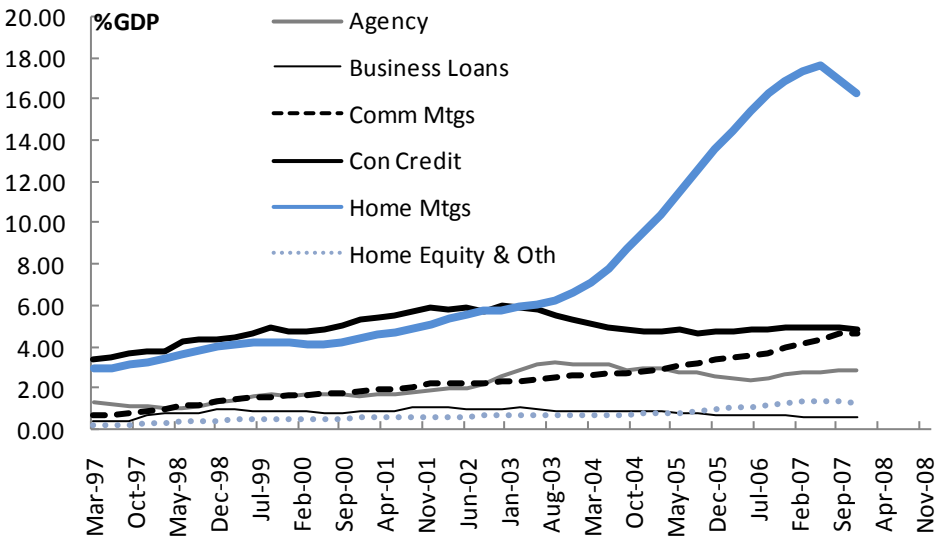
Source: Datastream, Federal Reserve

- From the end of 2004, the process of securitisation of mortgages from private-label ABS issuers also took off, but in a more extreme and almost parabolic fashion—notwithstanding that securitisation had been around for about 2 decades, and the conduits used to create leveraged-demand for RMBS (for example, collateralised debt obligations (CDO's)) have existed for at least a decade. **Figure 3** shows RMBS alongside other securitised loans.

- On-balance-sheet bank mortgages rose 6.2 percentage points of GDP from 19.7% in January 2004 to 25.9% in March 2008—but RMBS from ABS issuers rose much more dramatically. RMBS and home equity loans rose from 7.2% of GDP in 2004Q1 to a peak of 17.7% in 2007Q2, some 10.5 percentage points, before dropping back to 16.3% by year end as the crisis in these instruments began to emerge. This is quite extraordinary: from the end of 2004 RMBS accelerated more in 3 years than it had in the prior 20 years. This sudden and extreme move in private-label RMBS was to become the vortex of the subprime crisis.

- Any causal understanding of the subprime crisis has not only to describe general contributing factors to securitization and off-balance sheet activity; it must also explain the magnitude of change in such a compressed period of time (post 2004). What were the causal catalysts?

Figure 3: RMBS versus Other Securitised Assets



Source: Datasteam, Federal Reserve

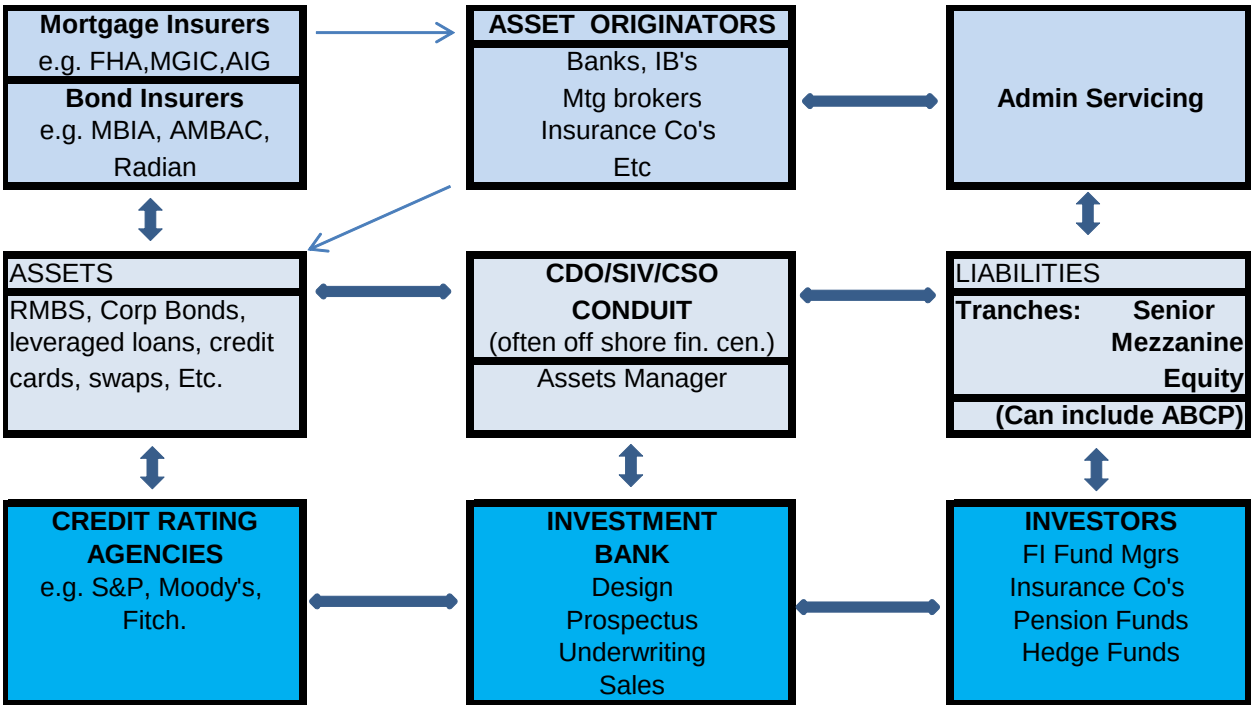
The securitisation players

- The main players in the securitisation and structured products process are shown schematically in **Figure 4.** Loans are originated then securitised by an Asset-Backed Security (ABS) issuers—often the originator if it owns an Investment Bank (IB). Mortgages are also bought from third party issuers for this purpose. The pooled loans securitised in this way are sold to investors for a fee, thereby transferring the assets off the balance sheet. Pipelines of loans and ABS would be warehoused by the IB until securitised and sold. To ensure investor demand would keep up with the fee-driven securitisation process from 2004, the use of off-balance sheet special purpose vehicles (SPV's) like CDO's, Asset-Backed Commercial Paper conduits (ABCP's), and Structured Investment Vehicles (SIV's) accelerated sharply. The conduits are not actual institutions in most cases, but are entities created for bookkeeping purposes—their assets and liabilities are shown schematically in the central row of **Figure 4.**

- Other key players include the Credit Rating Agencies (CRA's) (shown bottom left) and 'monoline' bond insurers (top left). Both were critical to the securitisation process to ensure comfort levels for investors buying CDO tranches: because super senior tranches would have AAA ratings attached, and interest payments would be insured (see the discussion below). The whole edifice also requires servicing (usually a fee channel kept by the originator to continue to look after the loan servicing, see the top

Right-hand side of **Figure 4**) and investment banks to do the underwriting (middle of the bottom row).

Figure 4: RMBS, CDO/SIV Process

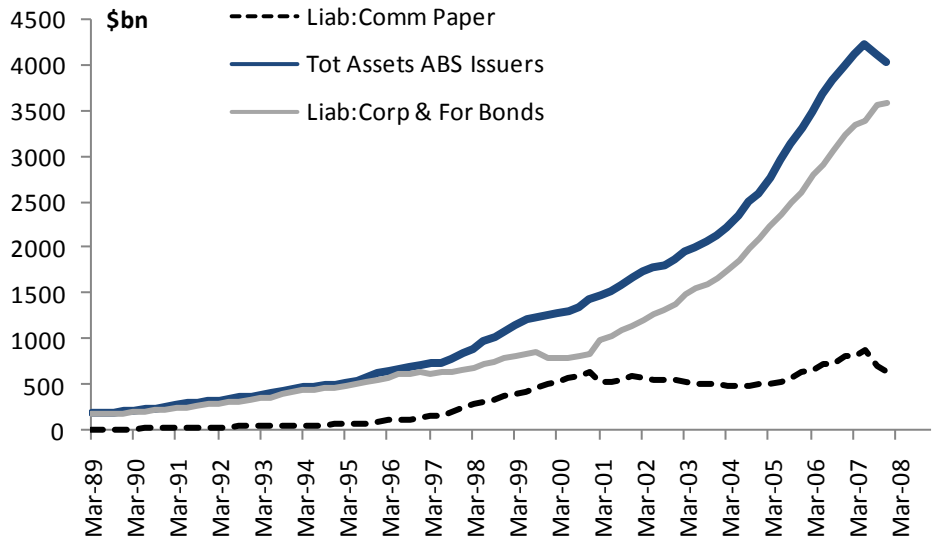


Source: OECD

- Total assets of ABS issuers in the US are shown in **Figure 5**, alongside the commercial paper and bond funding liabilities. Fortunately the lion's share of the funding is longer duration, but there was $890bn in short-term commercial paper funding at its peak in June 2007 just prior to the crisis. Short-term notes are rolled at the discretion of the holder and, as the crisis unfolded, such funding dried up. This meant that banks had to bring conduit assets back onto the balance sheet of the originator or extend credit (via pre-arranged credit lines). Reputational considerations sometimes came into play when arms length relationships were supposed to be in effect between the bank and the conduit.

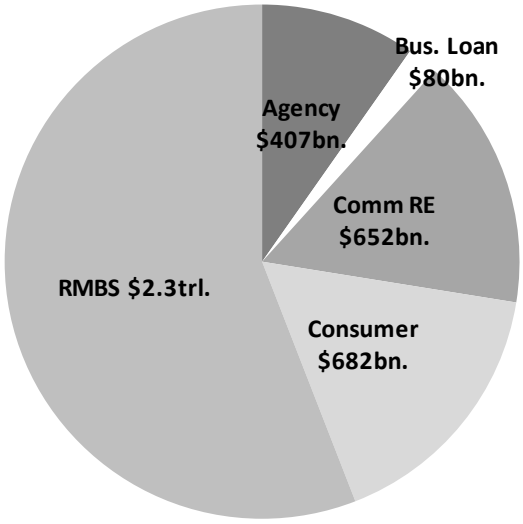
- The breakdown of the assets of private ABS issuers is shown in **Figure 6**. Of the $4.05 trillion, more than half is accounted for by mortgages and home equity loans ($2.3 trillion), followed by consumer and commercial real estate mortgages at $682 billion and $652 billion, respectively.

Figure 5: ABS Issuers, Assets and Liabilities



Source: Datastream, Federal Reserve

Figure 6: ABS Issuers Asset Composition, $4.05 trillion in Q4 2007



Source: Datastream, US Federal Reserve

Securitisation and the capital market: subprime and the 'lemons' issue

- The central idea of financial intermediation is that banks produce information about borrowers that is not known to outsiders in the wider capital market, they allocate credit and then monitor borrowers. If problems arise in the course of this monitoring, banks can restructure loans to try to control borrower behaviour prior to delinquency, default and foreclosure action. If they do this well, with appropriate diversification then, with lender-of-last-resort central banking and the presence of deposit insurance in most jurisdictions (and certainly in the USA), they produce securities that should be almost riskless on the liabilities (depositor or buyer of notes) side. Bank loans should not be saleable to capital markets because of the information asymmetry implicit in this form of intermediation—'if a bank wants to sell me this loan, then there must be something wrong with it'.[6] Yet this is exactly what happened in the genesis of the subprime crisis—indeed it happened on a scale that proved that it was quite easy to sell lemons into the capital markets.

- This transformation was made possible by the role of bond insurance and CRA's. **The CRA's worked with the issuer to provide a credit default rating** on the bond (an assessment of its underlying assets), essentially taking over the role the bank would provide in assessing credits. As the CRA would receive a fee for this task, so that its own corporate revenue would benefit, a natural moral hazard existed: top-rated securities give comfort to investors, and the more generous the rating the more sales volume would go through.

- The average rating of a CDO's underlying bond pool is BBB—this is needed to make the spread profitable (as returns have to be paid to investors) the bulk of which is typically AAA, in the super senior tranche. This seemed sensible on the basis of past mortgage history because: the non-investment grade and equity tranches of the CDO should absorb 'normal' losses, and because the interest payments could be insured by the bond insurers (often referred to as '*monolines*', such as MBIA, AMBAC etc.). The AAA ratings obviously helped to sell the super senior tranches to investors. Risks, being based on past price history, were massively mispriced in the new edifice. **A 10-standard-deviation price event before the subprime crisis is very different to what it would be measured at today**—a sobering point that bears on the likely effectiveness of the revised Basel II approach (discussed below). The ultimate losses are likely to be large, and bank capital is small in comparison.

The Crisis

- Delinquencies in subprime mortgages underlying these RMBS and leveraged off-balance sheet conduits began to rise in early 2007, causing their prices to fall and generating losses on securities. With mark-to-market accounting rules in place these losses had to be recognized under corporate reporting requirements. This was followed by downgrades to the securities by the CRA's, and there was a general loss of confidence. Money market investors in ABCP refused to roll their investments in bank

[6] See Akerlof, (1970).

conduits and SIV's. By August, sponsoring banks with liquidity commitments to their off-balance sheet vehicles sought to raise cash and refused to provide loans to others in the interbank markets. As these markets dried up, central banks became the major providers of 'crisis liquidity', and price discovery in illiquid markets became a major problem. No one was sure what assets were worth, and hence how large losses and potential bankruptcies might be, so the liquidity crisis extended.

- The underlying crisis should be thought of as a **solvency crisis**: of underlying mortgages and of banks without sufficient capital to absorb the losses. Where banks had been warehousing mortgages and bonds in the securitization process, this was a direct hit on their assets. Where they were forced to bring conduit assets back onto their balance sheets, at mark-to-market prices, there was a further hit. These hits led to write-offs and the destruction of bank capital. As the sliver of capital is so thin, some institutions failed, while others became desperately short of equity—if not falling below regulatory minima, certainly impacting their 'well capitalized' status and credit ratings, which led to problems of banks dealing with each other. Loss of bank capital is precisely the situation that leads to 'deleveraging' (a 'credit crunch') by banks, and capital markets too dry up as a source of funds. These are the key channels that generate recessionary pressures. **Mark-to-market accounting and the liquidity crisis should be thought of as exacerbating factors.**

- **Financial institutions across the globe, most notably Europe**, were drawn into the crisis for the simple reasons that: **(i)** their global banks operate in the US, **(ii)** about 1/3 of the securitisation subprime-related products were to sold to offshore investors, **(iii)** the business model used all over the globe that saw longer-run assets financed out of the commercial paper market came under extreme pressure as the liquidity crisis unfolded, and **(iv)** because asset price beta effects across the globe affected the value of assets under mark-to market accounting rules (extreme volatility correlation).

- The worst moment of the crisis so far was the collapse and rescue of **Bear Stearns**, with significant amounts of public money at risk. The likely de-leveraging process that will accompany the subprime and related mortgage losses will cause major headwinds to the economy and will take time to work through—the risk to inflation if liquidity policies go too far for too long also raises the **spectre of stagflation.**

Size of losses, deleveraging and the economy

- When a bank loses that thin sliver of capital, or goes below the regulatory minimum, it has **3 basic choices:**

  1. To raise capital, by diluting the shareholders with new equity or subordinated debt issuance. These are often taken up in a crisis situation by risk takers such as SWF's and hedge funds.

  2. To retain earnings and cut the dividend, so that capital is built internally—but this takes more time. OR

3. Cut back on lending and reduce its balance sheet, so that the smaller capital base is consistent with asset size and capital requirements. This latter route gives rise to the *credit crunch*. If banks don't lend and call in loans, you will have a recession—which is exactly what happened in the 1991 crisis.

- In 2007 the OECD was the first to put out a big estimate of the likely ultimate losses--$300bn based on ABX pricing.[7] International organisations and private firms have since used these techniques to come up with some truly alarmist numbers, such as $1 trillion.[8] There is a massive problem of distortion and exaggeration when ABX prices are used to estimate losses, precisely because of the illiquidity problems discussed above. For this reason in 2008 the OECD built a **credit default model,** independent of market prices.[9] This requires modelling delinquency and default rates, and pushing these back onto scenarios about the economy (GDP, employment and, most importantly, house prices). It also requires assumptions to be made about recovery rates as property collateral is repossessed and sold. The latest number for ultimate losses calculated this way is $370-$440bn, or around $400billion near the mid point, a bit up on last year, but not too far.

- **A $400 billion loss** is very bad because those 'thin slivers of capital' are so 'thin'. Of this, about $90 billion is estimated to accrue as ultimate losses to the US banks and IB's (about $130 billion is in Europe, and $180bn is split between non-bank US investors (insurance, hedge funds and fund managers).[10] This $90bn of losses will be difficult to raise as new capital—about half this amount was raised on a recent count—but initial SWF investors were so burned they won't be back for a while. More importantly, $90bn is not enough—covering the ultimate losses only allows banks to maintain a flat balance sheet—which is exactly what happened in 1991.[11] This would still give rise to a credit crunch, as the economy needs rising intermediation in order to grow. To grow by the average balance sheet growth of 7% pa would need more than double this amount of capital to be raised over a full year. If banks attempt to adjust by earnings alone, with no lending, Blundell-Wignall (2008) estimates that it will take 5 quarters to adjust fully—and certainly through all of 2008.

- These numbers are 'first round' estimates, and there is a risk that the credit crunch could lead to a worse economic scenario than assumed.[12] If this proves to be so, not only will the subprime losses be larger, but the risk of flow-on effects to other sectors and assets (like corporate defaults—affecting corporate bonds—equities, and their investors) rises.

[7] The prices of credit default swaps used to insure the risk of default in the underlying subprime mortgages.
[8] IMF (2008).
[9] See A. Blundell-Wignall (2008). See Greenlaw et.al. (2008) for a detailed look at alternative approaches.
[10] Ultimate losses are what bond markets should price, i.e. after foreclosure and sale of collateral. It is highly unlikely that this is happening. So ultimate losses are likely to be smaller that initial write-downs.
[11] Assuming some regulatory forbearance if mark-to market write-downs are greater than ultimate losses.
[12] A small recession like the 2001 period and house price falls of no more than 4% using the OFHEO measure.

Moral hazard and the urgent need for better regulation

- This is the 3rd major banking system crisis since the early 1990s, and maybe the biggest. The risk of a credit crunch is large. Europe is lagging behind the US, but similar forces are in play. In the case of Bear Stearns, taxpayer's money has been used to guarantee the Bear Stearns portfolio beyond a certain amount of loss—and it can by no means be assumed that this is the end of it for Bear Stearns' or any other firm's toxic assets. Few people realise that had the FED-JPM weekend rescue not happened, then during the following week at least 2 more investment banks were at grave risk: and the world would have been on the verge of an even less manageable crisis situation. At that point there was no choice. Similarly the rescue of IKB bank in Germany has large implications for the German taxpayers, as does the nationalisation of Northern Rock (following the first bank run in the UK in 150 years). In principle taxpayers' money should not be used in this way.

- **After such a crisis, with public money on the line, it is reasonable to ask: can the effectiveness of markets as an allocator of capital amongst competing ends be relied upon in the future, when the trade-off between risk and return is now so asymmetric, and banks know they are too big to fail. As the memory of this current crisis fades, we will be straight back into a process that leads to the next one.**

- It is like the space traveller about to pass into a black hole, asking a Martian the way back to Earth—he replies: '*if you want to get to Earth, you shouldn't be starting from here'*. But the regulatory debate is starting from here. There needs to be some new thinking about reform of the regulatory and policy making paradigm for the longer run.

- It is important to ask: what went wrong? Is the problem one where a combination of better short-term liquidity management and some improvements to the existing rules and regulations will be sufficient to right the situation and put the global economy on an even keel for the next few decades? Or is there something more fundamentally wrong with the structure of the market and the current paradigm of thinking about how to regulate it?

IV. The Financial Stability Forum Analysis of the Crisis and the Causality Issue

- At the global level the body charged with analysing the crisis and recommending reform is the Financial Stability Forum (FSF). It brings together top-level central bankers and supervisors as well as representatives of international organisations (IOSCO, IMF, World Bank, OECD, etc). This group can draw on all of the resources of institutions around the world to do some thorough analysis. The FSF published their findings in April 2008. A summary of the findings is presented in **Figure 7.**[13] There are 9 key underlying weaknesses on the left-hand side (LHS), and 5 sets of key recommendations shown on

[13] See FSF (2008).

the RHS of the table. The weaknesses taken together presumably should explain the sudden explosion of RMBS after 2004—in other words, there should be causal factors amongst them. Effective reform, as argued earlier, should attach more weight to causal as opposed to conditioning factors.

- Taking the **9 weaknesses** as hypotheses about causality in turn.

  (i) Poor underwriting standards. Their presence is un-contestable. But does this factor cause the explosion in RMBS and levered conduits? It is equally arguable that it is a facilitating aspect of the process and not a cause. Loan officers did not decide exogenously to become lax after 2004-05. Rather, the pressure to securitise may have forced them in that direction.

  (ii) Poor risk management. Again, this is tautologically correct for the institutions that made bad loans. But did risk management models switch to inferior types in 2004-05? Did management deliberately or inadvertently decide to downgrade/ignore the role of risk management after 2004? It is argued below (in the discussion of UBS) that cultural factors embedded in bank strategy—and driven by revenue pressures from other causes—caused some boards to give a lower weight to risk before the crisis.

  (iii) Poor investor due diligence: Again a tautology. Investors are always likely on average to take excessive risks in a loose liquidity boom. This is a part of the pro-cyclicality debate. No one is going to disagree with a recommendation that they should try to do better. But will human nature, given the evidence of all past cycles, really be likely to change in an effective way in future decades? This is highly unlikely.

  (iv) Credit rating agencies. It is indisputable that they did a poor job, as has been evidenced by the extent of recent downgrades. What is less clear is that they independently decided to deteriorate their analysis after 2004? As with risk control, ratings become subject to the laws of pro-cyclicality that will always be a feature of the financial landscape. Of course improvements in practices are desirable, and this will at minimum avoid future exacerbating behaviour. But it is not going to remove pro-cyclicality.

  What is very important, and not a focus of the FSF report, is **market competitive structure**. The monopoly of the *issuer-pays* model with only a few ratings firms is likely a causal factor in the fee incentives and moral hazard issues that arose. If institutional investors in securities on the 'buy side' were required to obtain an independent appraisal, for example, then a competitive market would develop. Groups like Morningstar with the right in-house expertise could move into debt rating for the buy-side, putting pressure on fees, reducing moral hazards and improving the process of rating itself.

  (v) Incentive distortions via Basel I regulatory arbitrage and financial market compensation schemes—the former had been in play since 1992, and the latter for much longer. Basel weights are exogenous, and more causal in the sense of this paper.

The more interesting question is what caused these mechanisms to be taken advantage of from 2004 onwards.

(vi) Disclosure (valuation, fair value accounting, audit, etc)—did it deteriorate in 2004, or did pre-existing weaknesses come to light as other causal driving factors accelerated the securitisation process? The FSF focuses on strengthening models and procedures. This suggestion has to be supported as an important 'conditioning factor'.

A more structural concern is the audit market itself. **There are only 4 audit firms (post Arthur Anderson) who work closely with complex financial institutions**, for substantial fees. This closeness is a concern and risks reduced independence. These firms are protected by a legal restriction in key jurisdictions: that only audit partners can own shares in audit firms. This precludes a Warren Buffet setting up competitor firms by raising funds on the stock exchange. This issue is surely worthy of further consideration in the reform process.

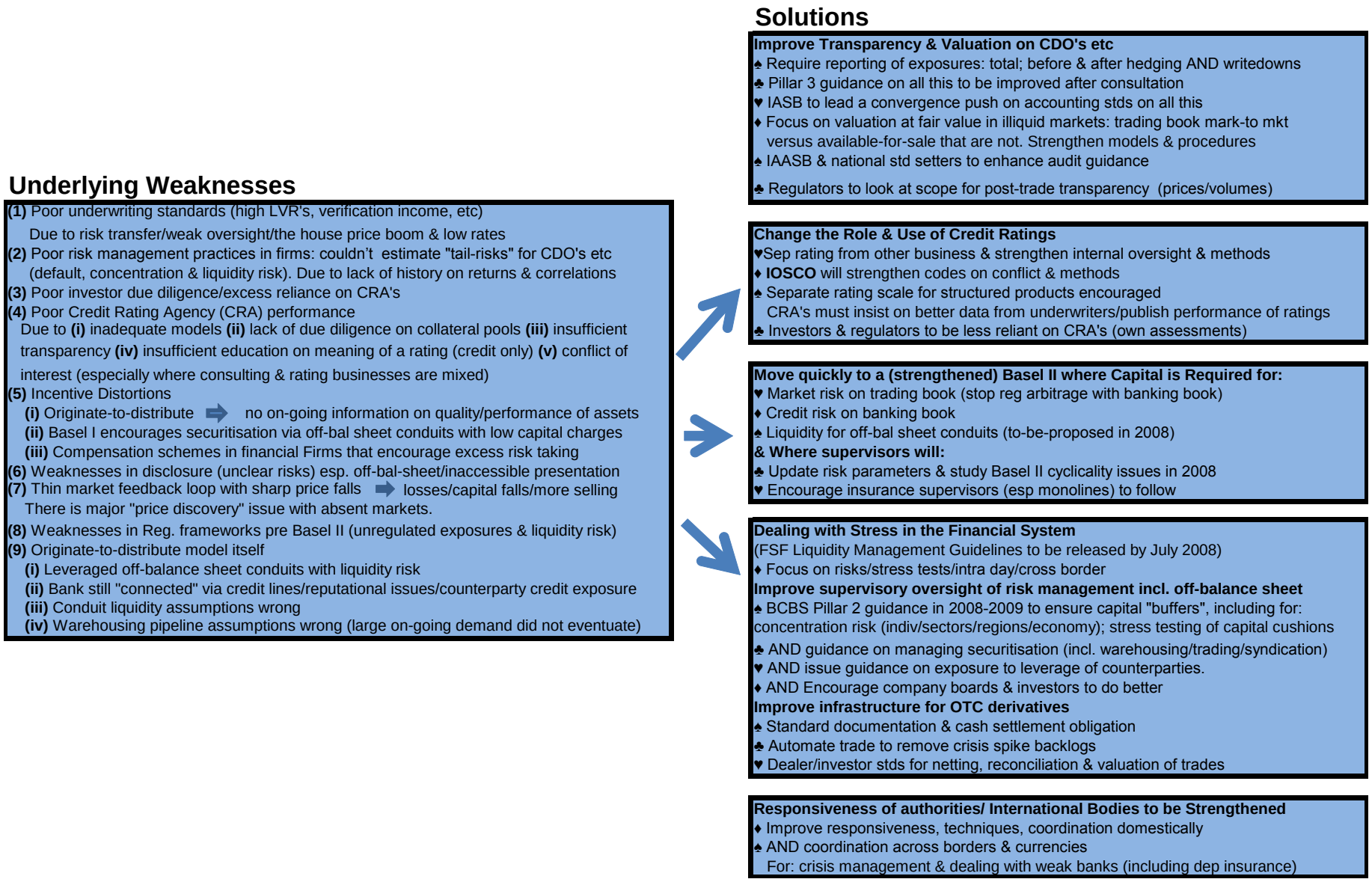
(vii) Thin markets and price discovery—this liquidity issue was exposed by the solvency crisis in mortgages and under-capitalised banks. It is unlikely to have been a cause of the crisis, but clearly exacerbated it. The FSF intends to issue guidance on dealing with leveraged counterparties (like hedge funds), warehousing and the like. What remains unclear, at least to the authors of this paper, is a set of clear definitions of what sort of institutions should fall with the regulatory framework for '*safe-and-sound banking*' and those that do not.

(viii) Weaknesses in the regulatory structure pre-Basel II—this area is a key focus of this paper because regulatory changes were signalled and some changes did occur at the critical time that needs explanation. The 'mid-year' Basel II text for the revised framework for capital standards was released in June 2004, and QIS 4 Basel II simulations also revealed the extremely favourable likely weighting for mortgages and the freeing up of capital that would arise for banks. At the same time The Office of Federal Housing Enterprise Oversight (OFHEO), the Fannie Mae and Freddie Mac regulator, began a series of strong measures that constrained the balance sheets of these monoliths. These events fit with the timing of the RMBS surge and are exogenous events. They have to be considered as potentially causal factors.

(ix) The originate-to-distribute model—was this a causal factor? Or was its' increased use quite logical flowing from the incentives set up by other distortions after 2004?

- As noted in the introduction, causality carries with it some notion of exogeneity in economics and econometrics, while other factors condition the outcome of the causal influences and may even restrain them. Regulatory factors are causal in this sense and deserve special attention. Private sector practices need to be improved, to be sure, but if regulators set distortions, then problems will follow just as surely as do the consequences of a bursting and poorly-made dam.

Figure 7: Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience



V. Capital Regulation & the Basel System[14]

- Sudden changes in asset quality/value can quickly wipe out bank capital. Where short-term wholesale liabilities fund longer-term assets, failure to roll notes, or a 'run' on deposits, can force de-leveraging and asset sales. Banking crises associated with such changes are often systemic in nature, arising from the interconnectedness of finance: banks between themselves, with derivative counterparties and with direct links to consumption and investment spending decisions. In history, banking crises have been associated with major economic disruption and recessions. It is for this reason that policy makers regulate the amount of capital that banks are required to hold, and require high standards of corporate governance, accounting, audit and lending practices.

- **Capital regulations under Basel 1** came into effect in December 1992 (after development and consultations since 1988). The aims were: (i) to require banks to maintain enough capital to absorb losses without causing systemic problems, and (ii) to level the playing field internationally (avoidance of competitiveness conflicts). A minimum ratio of 4% for Tier 1 (essentially equity less goodwill) to Risk Weighted Assets (RWA) and 8% for Tier 1 and Tier 2 (certain subordinated debt etc).[15] The Basel I risk weights for different loans are shown on the left side of **Figure 8**.

- **A 'revised framework' known as Basel II** was released in June 2004 (see Basel Committee (2004)) after many issues with Basel I, most notably that regulatory arbitrage was rampant.[16] Basel I gave banks the ability to control the amount of capital they required by shifting between on-balance sheet assets with different weights, and by securitising assets and shifting them off balance sheet—a form of disintermediation. Banks quickly accumulated capital well in excess of the regulatory minimum and capital requirements in effect had no constraining impact on bank risk taking. The evolution of US commercial bank capital (goodwill included) versus a calculation of the regulatory minimum under Basel I is shown in **Figure 10.**[17]

The 'revised framework' is based on "Three Pillars"

- **Pillar 1**, defines minimum capital to buffer unexpected losses. Total RWA are based on a complex system of risk weighting that applies to 'credit', 'market' (MR) and 'operational' risk (OR), which are calculated separately and then added:

  $$RWA=\{12.5(OR+MR) + 1.06SUM[w(i)A(i)]\}$$

  Where w(i) is the risk weight for asset I, and A(i) is asset i.

[14] Both Basel I and II are only frameworks for capital regulation. Actual regulations reflect national modifications to Basel in different countries
[15] A 3rd tier of capital is defined in the Market Risk Amendment to the original accord.
[16] See Jackson (1999).
[17] This is calculated by weighting all of the assets of the banking system by their corresponding weight shown in Figure 8.

OR and MR are directly measured and grossed up by 12.5 for 8% equivalence; Credit Risk is the sum of the various asset classes each weighted by its appropriate risk weight. A scaling factor applied to this latter term, estimated to be 1.06 on the basis of QIS 3 data (but subject to change), was envisaged for the transition period, which was supposed to start for most countries in January 2008. Banks were to be able to choose between: (i) a simplified approach (for smaller institutions without the capacity to model their business in risk terms) by using the fixed weights shown in the second column of **Figure 8**; (ii) managing according to external ratings (shown in the 3rd column); and (iii) for sophisticated banks their own internal rating model could be used (see the right side of Figure 8).

Figure 8: Basel I and Basel II Risk Weights and Commentary

Selected Risk Weights Under Basel I and Basel II (Pillar I), %

SECURITY	BASEL I	BASEL II Simplified Standardised	BASEL II Standardised based on External Ratings		BASEL II Advanced: Internal Ratings Based (IRB) 2004-05 QIS 4 Av % Chg in Portf. MRC	2004-05 QIS 4 Median % Chg in Portf. MRC	Basel II Advanced IRB
Most Government/central bank	0	0			0	0	Comes close to letting banks set their own
AAA to AA-			0				**Pillar 1** capital, with supervisory oversight.
A+ to A-			20				Risk weights depend on internal estimates
BBB+ to BBB-			50				of a loan's probability of default; loss-given-
BB+ to B- (& unrated)			100				default; exposure to loss. These are based
Below B-			150				on the banks' own complex risk models,
Other public (supervisors discretion)	0-50	0			0	0	relying on subjective inputs and often on
Claims on MDBs	20	0			-21.9	-29.7	unobservable (e.g. OTC illiquid securities)
Most OECD Banks & Securities firms	20	20	<90days	Other	-21.9	-29.7	prices.
AAA to AA-			20	20			**Pillar 2** provides for supervisory oversight.
A+ to A-			20	50			With stress testing, and guidance from
BBB+ to BBB- (&unrated)			20	50			supervisors, banks can be made to hold
BB+ to B-			50	100			capital for risks not adequately captured
Below B-			150	150			under Pillar 1.
Residential Mortgages-fully secured	50	35	35		-61.4	-72.7	**Pillar 3** is disclosure and market discipline
Retail Lending (consumer)	100	75	75		(-6.5 to -74.3)	(-35.2 to -78.6)	which relies on some notion of market
Corporate & Commercial RE	100	100			(-21.9 to-41.4)	(-29.7 to -52.5)	efficiency. Rational markets punish poor
AAA to AA-			20				risk managers.
A+ to A-			50				
BBB+ to BB- (&unrated)			100				
Below BB-			150				

Source: BIS (1988) and BIS (final version June 2006). FDIC (2005). Author commentary.

- The simplified approach is more 'granular' than Basel I, but retains its basic features. It is striking in light of the subprime crisis that the simplified approach shows the Basel Committee cutting the risk weight to mortgages by some 30% (from 50% to 35%).
- The 'Internal Ratings-Based' (IRB) approach requires banks to specify the probability of default for each individual credit, its loss-given-default, and the expected exposure at default. This requires highly-complex modeling and aggregation, and offers banks with the necessary expertise the possibility of deriving more risk-sensitive weights. This approach requires the approval of the bank's supervisor.

VI. Problems with Basel Capital Regulation and Pillar 1

Portfolio invariance and linear weights

- The risk weighting formulas are based on a specific mathematical model developed by the Basel Committee[18] which is subject to the restriction that it be '*portfolio invariant'*; i.e. that the capital required as backing for the loan should depend only on the risk of that loan, and must not depend on the portfolio it is added to. This is convenient for additivity and application across countries. But it has an important disadvantage: it does not reflect the importance of diversification as an influence on portfolio risk. Thus the minimum capital requirements associated with any type of loan due to credit risk simply rise linearly with the holding of that asset type regardless of the size of the exposure (appropriate diversification is simply assumed). This means, in simple terms, that it does not do the most basic risk management function of penalizing portfolio concentration (as might occur for example under a quadratic rule).

- Furthermore, the problems of regulatory arbitrage under Basel I are not solved within the 1st pillar of Basel II, and may even introduce new issues. For example, the problem of moral hazard is stronger with the IRB approach, as risk inputs are subjective. Some prices are of the OTC variety and are not observable, and nor do they have appropriate histories for modeling purposes. Banks can manipulate inputs to reduce capital required. Sheila Bair, chairman of the FDIC puts it this way:

  "..the key risk inputs that drive the advanced approaches are subjective, unreliable and unproven…..Regulators have taken appropriate care not to micro manage internal rating systems. But the resulting wide latitude in capital requirements could lead to inconsistency across banks. And it could lead regulators to accept capital requirements that are too low"[19]

- For these sorts of reasons, the Basel Committee envisaged that Pillar 2 would deal with risks not appropriately covered in Pillar 1.[20]

Regional and sector risk factors

- For the mathematical model underlying the Basel approach (I or II), each exposure's contribution to value at risk (VAR) is portfolio invariant only if: (a) dependence across exposures is driven by a single systemic risk factor—a global risk factor, since it is supposed to apply to global banks operating across countries; and (b) each exposure is

[18] See Gordy (2003).
[19] Bair, S. (2007), page 2.
[20] Kane (2006) points out that the whole process of negotiating Basel II in the US has been hugely problematic between complex financial institutions and the various regulatory groups in the US. In this process the banks are always going to contract for the least burdensome system where any choice is involved.

small.[21] What we know of the subprime crisis is that it originated out of the US housing market (regional sector risk), and exposures became quite large.

- Of the two conditions for invariance, by far the most important is the requirement of a single risk factor that applies to all participants. Almost prophetically, Gordy (2003) says[22]:

  "A single factor model cannot capture any clustering of firm defaults due to common sensitivity to these smaller scale components of the global business cycle. Holding fixed the state of the global economy, local events in, for example, France are permitted to contribute nothing to the default rate of French obligors. If there are indeed pockets of risk, then calibrating a single factor model to a broadly diversified international credit index may significantly understate the capital needed to support a regional or specialized lender."

  If the word 'France' was replaced by 'the USA', and 'subprime' was mentioned as the pocket of risk, the story of the current turmoil was pretty much told in a mathematics paper 5 years before the crisis.

- The Chair of the FDIC comments on US mortgages versus global banking risk after the US Quantitative Impact Study 4 (QIS 4) that showed banks reducing their weights to mortgages by up to 90%, in the following way:

  "To me, one of the most troubling aspects of Basel II is that a purely historical look at mortgage data might have justified such numbers. …. These kinds of results are simply unacceptable. Redefining capital requirements sharply downward in this way under the advanced approaches, risks increasing the fragility of the global banking system".[23]

Basel pro-cyclicality

- The Basel system is known to be pro-cyclical. There are many reasons for this. But the most basic reason is that judgments tend to underestimate risks in good times and overestimate them in bad times. More specific factors include:[24]

  (i) Leverage ratios that depend on current market values (high in good times and vice versa). If asset values do not accurately reflect future cash flow, pro-cyclicality results. This is of course would be amplified by the distortions of excess liquidity and low interest rates discussed above.

  (ii) Banks' risk measurements tend to be point-in-time and not holistic measures over the long cycle (see UBS discussion below).

  (iii) Counterparty credit policies are easy in good times and tough in bad.

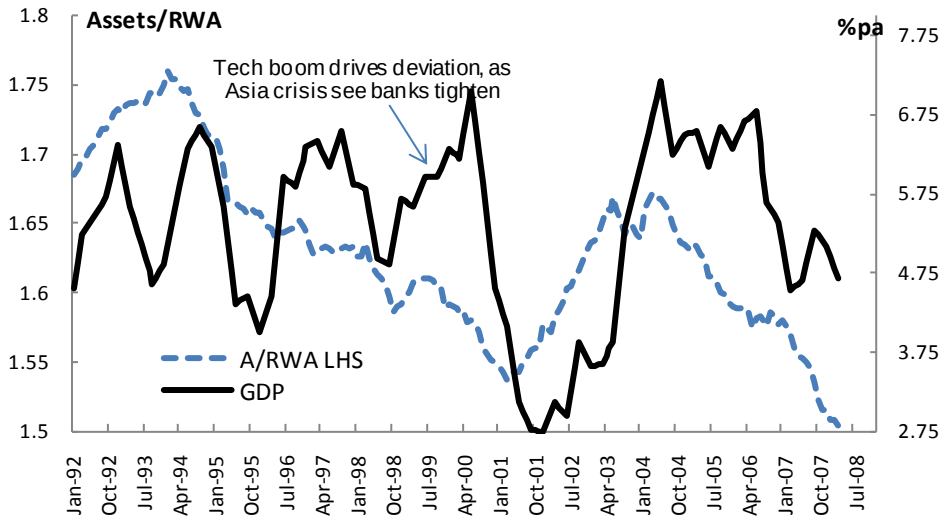
[21] See Gordy (2002).
[22] See Gordy (2003), page 222.
[23] Bair, Sheila (2007), page 2.
[24] See Bernanke, Gertler and Gilchrist (1999) for a literature summary.

(iv) Profit recognition and compensation schemes encourage short-term risk taking, but do not adjust them for risk over the business cycle.

- Capital regulation under Basel does nothing to counter this pro-cyclicality. Banks can control their RWA's via regulatory arbitrage (as soon as risk weights differ—the more complex the greater the scope) and by varying bank capital more directly via dividend and share buyback policies (high dividends and buybacks in the good times and vice versa).

- **Figure 9** shows US GDP growth and a constructed series of aggregate total assets as a ratio to RWA, over the Basel era. This simple variable leads the broad trend in the nominal business cycle.

Figure 9: US GDP and Total Assets/RWA



Source: Datastream, OECD.

- The IRB approach of the revised framework actually institutionalizes this pro-cyclicality by making banks themselves responsible for estimating probability of default, loss given default and exposure at default, which are all a function of the cycle, and are led by the stock market, asset values and other financial variables. **Private bankers cannot predict future asset prices and future volatility events.** The simplified system would change nothing versus Basel I, and the external ratings based approach uses credit ratings, which are notoriously pro-cyclical.

VI. Pillars II and III

- **Pillar 2 relates to the supervisory review process**. With stress testing and guidance from supervisors, banks can be made to hold capital for risks not appropriately captured under Pillar 1. Building buffers in this way requires supervisors to be forward looking, i.e. to keep up with market structural change, practices and complexity. This is inherently

difficult. Supervisors are even less likely to be able to predict future asset prices and volatility than private bankers. Furthermore, supervisors have smaller staff (per regulated entity) and are less well paid. If supervisory practices lag (as in the subprime crisis) the effectiveness of letting banks influence their own required capital levels is potentially weakened.[25] Pillar 2 is not likely to be effective in a forward-looking way.

- The Chair of the FDIC is highly skeptical about the ability of supervisors to play the role asked of them in compensating for all the deficiencies in the basic capital rules:

  "*In response to such criticisms, many argue that supervisory diligence under Pillar 2 will somehow protect against inadequate capital under Pillar I. More specifically, they say required stress testing by banks will take care of any shortages under Pillar I….Despite the best of intentions…banks and supervisors may be ill-equipped to mitigate deficiencies in the advanced approaches. If the basic capital standards are unreliable, how can we have confidence that supervisory add-ons will be sufficient or consistent?*"[26]

- In this respect it is worth noting (see below) that the UK FSA, which is one of the best staffed and most sophisticated of supervisors, signed off on Northern Rock to be one of the first banks to go to the Basel II IRB approach, understanding fully that this would reduce their capital massively, immediately prior to the subprime crisis.

- **Pillar 3 relies on disclosure and market discipline** to help enforce sound risk management practices—bad firms would be punished. Underlying this is an efficient markets notion that markets will act in a fully rational way.

- At the level of markets, the bubble that has been the subprime crisis, and those before it, suggest the systematic absence of informational efficiency. The whole pro-cyclicality debate concerning the Basel system is premised on the idea that asset prices do not reflect accurately future cash flows.

- At the reporting level there is room for even greater skepticism. In March 2008 **KPMG** conducted research amongst 1080 audit committee members of public companies (150 from the UK and the rest globally). 46% were satisfied that that their company has an effective process to identify the potentially significant business risks facing the company; and only 38% are very satisfied with the risk reports they receive from management.[27]

- The reality is that even insiders have difficulty in measuring and reporting risk to themselves. For banking, in a mark-to-market reporting world, particularly in a universal bank that incorporates an IB alongside a consumer bank, risk management and reporting systems are extremely complex and require enormous resources. The ability of supervisors to follow any of this in anything other than a superficial way and to act preemptively is a daunting task.

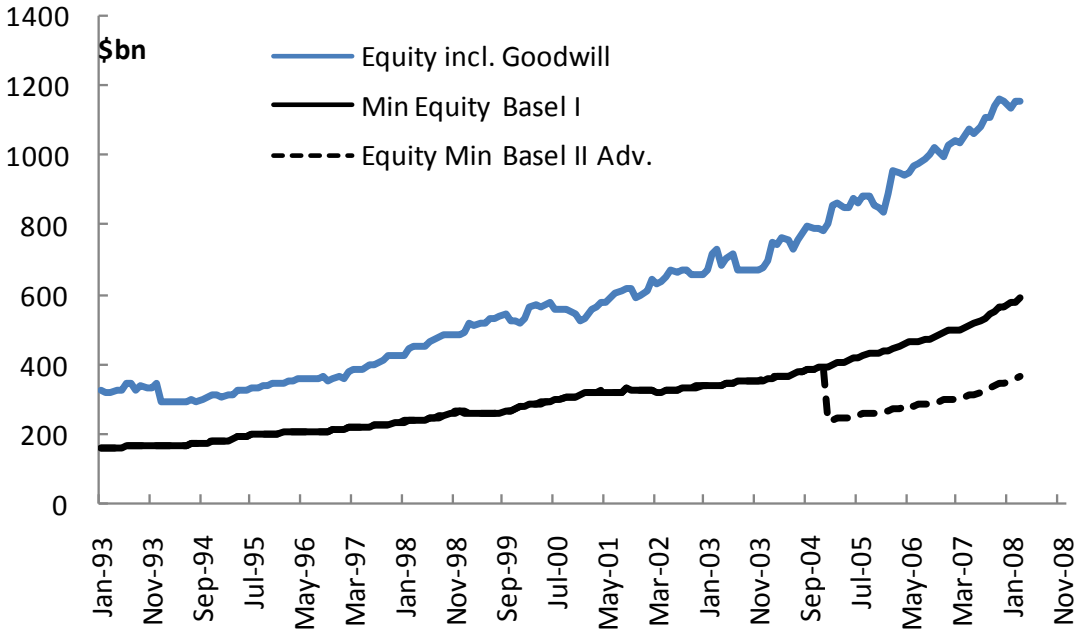
[25] A previous very senior member of the Basel Committee mentioned several times in discussions that banks are very effective at driving their agenda and influencing outcomes
[26] Bair, S. (2007), pages 2 and 3.
[27] KPMG (2008).

VII. The Subprime Crisis and the Role Played by Regulation

- The revised framework was published in June 2004 after years of consultations and negotiations with financial institutions. In 2004 the QIS 4 was conducted in a number of countries to see how risk weights would change in practice. These studies were completed by the start of 2005. The results were surprising, and some of the average and median changes in minimum regulatory capital are shown in the final 2 columns of **Figure 8** for the USA. Of telling importance for the purposes of this paper is that the average minimum risk weight for fully-secured mortgages would fall by 61.5% and the median weight by 72.7% (for some individual institutions the fall was closer to 90%).

- As a simple illustration, the dotted line in **Figure 10** shows the implied changes to the minimum regulatory capital where the 'average' % changes from the QIS 4 results are applied to the Basel I weights (using the more granular categories of Basel II) in the US commercial banking system. By the end of 2007, just prior to the supposed introduction of the revised framework, this would amount to a reduction in minimum regulatory capital of around $220bn. Of course supervisors in many jurisdictions recognized this effect and provided for various transition arrangements to avoid such an immediate large drop—the argument here, however, is that banks nevertheless would anticipate the freeing up of capital and take advantage of changing weights to optimise their future position.

Figure 10: US Commercial Bank Equity, Basel I Min. Capital, Basel II Adv. Estimate



Source: US Federal Reserve, OECD

- From 2005 to 2007 a frequent theme in broking research notes was the question of what banks would do with the excess capital to which the revised framework would give rise. Banks could either expand their portfolios and take more risk; or return the money to

shareholders via dividends and buybacks. Banks could not assume with certainty what the final risk weights would be, or what overall fall in total capital might be permitted by supervisory sign off, particularly during the first few years of transition. The US, for example, flagged in September 2005 that there would be a 3 year transition period with: no cuts in minimum capital in 2008, a 95% floor in 2009, 90% in 2010, 85% in 2011 and full removal possible thereafter. Nevertheless, **bank strategy would inevitably have to take into account the changes that had been clarified, and the extremely favourable cut in the risk weights that would in any case apply to mortgages.**[28]

Off-balance sheet treatment

- Under Basel II off-balance sheet exposures are converted to balance sheet equivalents by "credit conversion factors" (CCF's) which vary depending on the type of exposure (as with Pillar1 weights). Exposures unconditionally cancellable by the bank without prior notice carry a CCF of 0%. Other CCF's range up to 100%. Risk weights are applied to the converted amounts.

- Under the standardized approach, structured products are treated like corporate exposures as long as they carry an investment grade rating of BBB- or above. The better end of the junk ratings carry a 350% risk weight and exposures at rate B+ or below and unrated securitisations must be fully deducted from capital. Where banks use the IRB approach, the risk weights depend on external ratings, with weights ranging from as low as 7% to very high weights and in the limit full deductibility from capital. Originating banks can exclude certain securitized product exposures where risk is fully transferred—but otherwise they generally require a CCF (usually 100%). This is undoubtedly the most positive and important aspect of the revised framework.

- Given that Basel II would deal explicitly with off-balance sheet exposures in this way, and that the time line for its introduction was clear, a rational financial organisation would not take advantage of the anomalies under Basel 1 by rapidly growing its off balance sheet exposures, only to find that it had massively to deleverage or to raise capital as Basel II came into force—**unless of course Basel II was to free up capital anyway, and off-balance sheet exposure could be concentrated in products with much lower than Basel I weights.** This of course is exactly the situation that banks became aware of by 2005, and fits with the explosion of private label RMBS at that time.

  (i) Mortgages risk weights would be cut to 35% under the simplified system, and much less than 35% under the IRB approach, encouraging the expansion of on-balance sheet mortgages from 2004 onwards (see **Figure 2**).

  (ii) The Basel II scope for banks originating securitisations to reduce their exposures or to exclude them altogether, as well as the low risk weights (7% to 35% under IRB) for senior tranches rated BBB+ or above.

[28] See Joint Press Release, Board of Governors of the Federal Reserve, Federal Deposit Insurance Corporation, Office of the Comptroller of the Currency, office of Thrift Supervision: Banking Agencies Announce Revised Plan for Implementation of Basel II Framework (30 September, 2005).

(iii) The additive nature of required capital without penalty for concentration (other than Pillar 2 requirements being imposed after the fact) meant that banks were fully encouraged to arbitrage differences in risk weights by shifting to real estate and securitised assets (see in **Figure 3** the RMBS acceleration after 2004).[29]

- It would be very naïve to believe that banks did not begin to incorporate these changes into their growth strategies. The following quote from a senior investment banker not wishing to be named sums up the situation:

  "We started looking at the implications of Basel II from the day it was published back in 2004. Changes like these have huge implications for our business, so you can't just leave it to one side until the system is up and running. Internal seminars and meetings began even before the 2004 publication. We have been looking at this and adopting anticipatory strategies for at least 4 or 5 years. What you have to understand about complex regulations that affect our business is that we work intensively to minimise the impact they have on our bottom line. It is exactly the same as with taxation. The more complex the structure the more scope there is for finding ways around it! It amazes me that regulators asked us to set our capital regulation weights, given the way the incentives are. Of course our managers want to participate in the process, for all the obvious reasons. But good luck to any supervisors who want to find out what is going on inside businesses—that is difficult for insiders to know fully and impossible for outsiders. In our country the supervisors are thought of as excellent on a global comparison, and we think they are very smart. It is just that the scope to choose how you report and measure things is so huge. Our internal processes and resources are enormous, and we work only on our own bank. The supervisors can never match this with the best will in the world".

Northern Rock and the 'anticipating Basel II' factor

- Northern Rock is another good on-the-record example of the anticipation of Basel II affecting the structure of the portfolio. They were one of the 1st banks to get up and running under the Basel II IRB approach. The collapse was preceded by a few years of aggressive expansion (over 25% p.a.) funded by borrowing heavily in the wholesale market (requiring rollovers and refinancing) and they concentrated their assets in mortgage products (75% of assets) reducing their capital requirement as they progressed.

- Here is the response of the CEO in the UK Treasury Committee Evidence:[30]

  Mr Fallon: *"Mr Applegarth, why was it decided a month after the first profit warning, as late as the end of July, to increase the dividend at the expense of the balance sheet?"*

[29] Under Basel 1 credit lines to off-balance sheet identities required capital to be held for credits of longer than 1 year duration. In effect this required no capital at all as credit lines could simply be structured to be 364 day loans or contingent credit lines.
[30] Treasury Committee (2007); Ev 47.

Mr Applegarth: *"Because we had just completed our Basel II two and a half year process and under that, and in consultation with the FSA, it meant that we had surplus capital and therefore that could be repatriated to shareholders through increasing the dividend."*

In this 2-1/2 year preparation period Northern Rock grew its balance sheet rapidly (in the year to June 2007 by a very fast 28.3%) and funded it in the wholesale market. It is implicit here that the well-resourced FSA became critical of Northern Rock only after the crisis; they had to approve the Basel II IRB approach for Northern Rock in June 2007, knowing full well that it would reduce their required capital.

- By June 2007, just as the crisis was to break and liquidity was to dry up, Northern Rock had total assets of GBP113.4bn and shareholders equity of GBP2.2bn. Their RWA under Basel II was a mere GBP18.9bn (16.7% of total assets), compared to GBP33.9bn under Basel I (30% of assets). Under Basel II they had Tier 1 capital a healthy 11.3% of RWA, but only 2% of total assets. When the crisis started and liquidity dried up they suffered the 1st run on a British bank since 1866, and their regulatory capital was less than 10% of the GBP23bn that the authorities used to support it.

- These mechanisms of preparing for Basel II and concentrating in mortgages played a key role in some of the banks that suffered huge losses. Basel II transition was a necessary if not sufficient condition to explain the sudden nature of the acceleration of RMBS post 2004.

- In the US a second factor, or catalyst, also played a role and curiously enough was also a result of actions within the complex US regulatory structure.

VIII. The Regulation of Fannie and Freddie (the Dominant RMBS Firms)

- The main regulatory players in US banking are: the Board of Governors of the Federal Reserve (for federally-chartered banks), Federal Deposit Insurance Corporation (FDIC, deposit insurance banks and thrifts), Office of the Comptroller of the Currency (national and foreign bank branch regulation and supervision), and Office of Thrift Supervision. Another important regulator which deals with the largest mortgage players, Fannie Mae (Federal National Mortgage Association) and Freddie Mac (Federal Home Loan Mortgage Corporation) is the Office of Federal Housing Enterprise Oversight (OFHEO).

- **The complex and overlapping regulatory structure in the US is another key part of the puzzle for the behaviour of RMBS post 2004.**

  (i) From early 2004 OFHEO imposed an ongoing requirement on each enterprise to maintain a capital level at least 30 percent above the statutory minimum requirement. This was implemented because of the financial and operational uncertainties associated with Fannie and Freddie's past problems associated with operational control and audited financial statements. When capital has to be raised like this de-leveraging mechanisms lead to balance sheet contraction and constraint.

(ii) Balance sheet caps were subsequently imposed (post the capital-induced deleveraging effect). For Fannie Mae the cap was the end of 2005 balance sheet level, with any increase to be approved by OFHEO. For Freddie Mac, the cap was set at ½% per quarter growth above the mid 2006 level. These were to remain in place until the GAAP audit issues were solved. Removal occurred on 1 March 2008 (partly to help alleviate pressures from the subprime crisis).

- Fannie Mae and Freddie Mac were dominant in the mortgage securitisation business in large measure because they benefited from an implicit government guarantee and insurance. After the S&L crisis, Fannie and Freddie expanded their balance sheets rapidly filling the gap left by shut-down S&L's. Private label securitisation also proceeded but at a much slower pace. Banks and mortgage lenders, however, sell mortgages to Fannie and Freddie, and this was a significant revenue generator. When the constraints were imposed, this did 2 things:

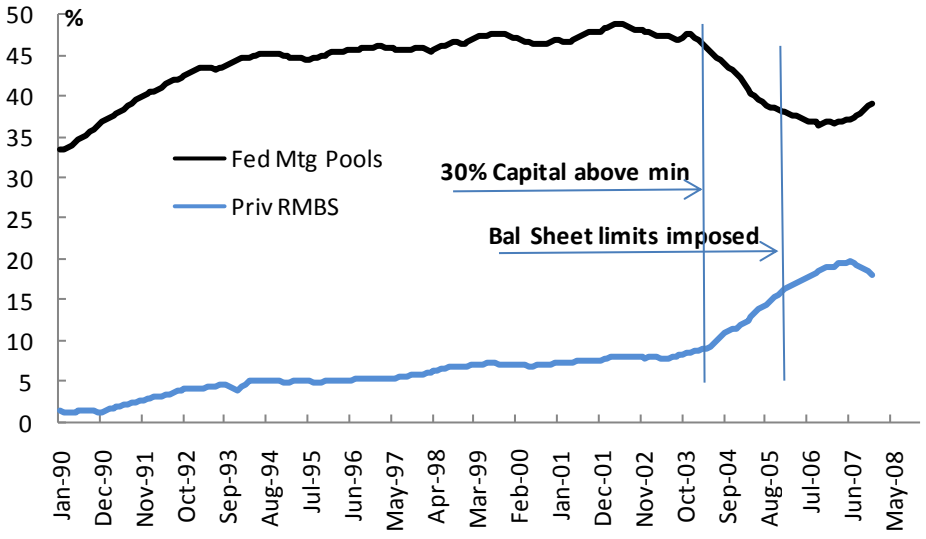
  1. The potential for a large *revenue gap* opened up, with no sales to Fannie and Freddie, hurting bank share prices if it was not filled.

  2. It caused the contraction and subsequent 'hobbling' of the major players in securitised mortgages, which had previously had the unfair advantage of competing with perceived government guarantees. This had the effect of opening a new market for banks, helping them to move more quickly in to the RMBS business, which they had always thought should have been theirs in the first place.

- Think of a **patchwork balloon**. If you impose inflexible strips into it, then the hot air just forces its way into the flexible parts. At the micro level, bonus remuneration and the profit motive set in train incentives to hit the new growth areas hard. As there were no government guaranteed competitors, and the flexible conditioning factors like credit ratings, bond insurance, lending standards, corporate governance, risk control, etc. could adjust, RMBS (encouraged by the prospect of even more favourable weights for mortgages under Basel II) exploded.

- **Figure 11** shows Federal mortgage pools as a share of GDP, with the periods of regulatory activity shown in the vertical lines, alongside the private label RMBS as a share of GDP. The inverse pattern is clear.

Figure 11: Fed Mortgage Pools versus Private RMBS, % GDP



Source: OECD, US Federal Reserve, Datastream.

IX. An Illustrative Econometric Analysis of RMBS Structural Change: Basel and OFHEO

- **Figure 12** sets out the econometric model of the various influences on private-label RMBS in a simple co-integration analysis, where major structural change is expected as a consequence of changes in Basel I rules and the OFHEO constraints imposed on Fannie and Freddie.

- In its simplest form the mortgage securitisation model is related to GDP, the spread between the mortgage rate and money market rates (Fed Funds), i.e. a proxy for the profit margin to be split between the various players, the level of the mortgage rate as a nominal demand constraint on the mortgage borrower, excess capital over the Basel 1 minimum, and the rate of growth of house prices as a speculative demand variable. A dummy variable is included for the massive disruption caused by the S&L crisis of the early 1990's (calculated as the $ value of write offs of the assets of S&L's that were formally closed down between January 1989 and December 1993, scaled by total assets of the banking system, and zero elsewhere).

- The monthly model is estimated for 2 periods (1990-2002, and to 2003) prior to the structural change. Both models have the expected signs, are fairly stable, and both appear to be co-integrated (see the 2 bottom rows of Figure 12). Over the full sample, through the period of structural change, the model breaks down (with wrong-signed coefficients on house prices and implausible jump in the Basel I excess capital variable). The Durban-Watson of 0.06 and the wrong sign and insignificance for the restricted error correction coefficient, both indicate that the old model is not co-integrated over the full

sample period. Including a simple Dummy variable for the Fannie and Freddie balance sheet constraints period (4th column), has the expected positive sign and is highly significant. All the correct signs are restored, and the model again becomes consistent with weak co-integration. If structural change is allowed to shift the Basel 1 coefficients in the direction of the QIS 4 changes (greatly favouring mortgages and reducing expected required capital) from the beginning of 2005 (refer to Figures 8 and 10), then most of the old pre-structural change coefficients are restored to be similar to their old values. The Fannie/Freddie dummy variables and the redefined excess capital (Basel I prior to 2005 and QIS 4 adjusted after) are both highly significant. The model is again consistent with strong co-integration.

Figure 12: RMBS (Monthly) Model & Major Regulatory Structural Change

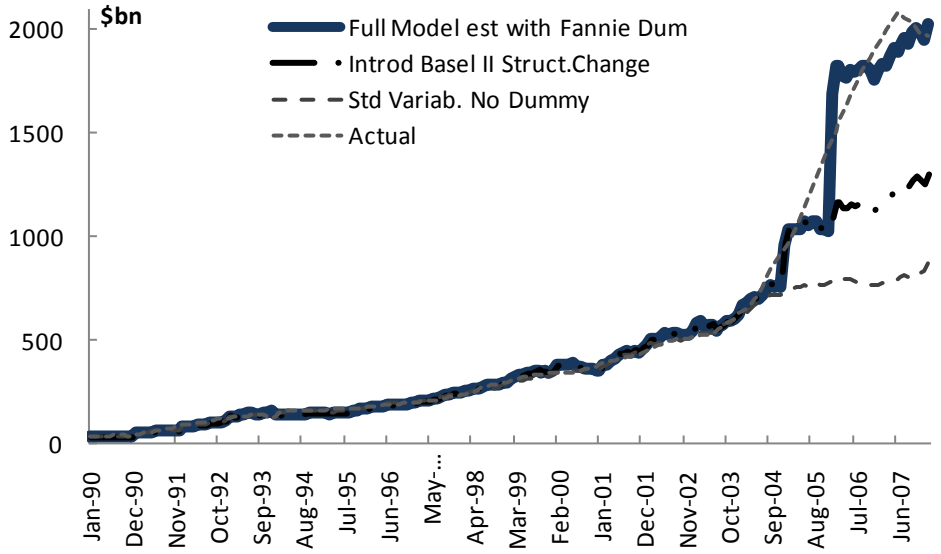
	1990-2002		1990-2003		1990-2007					
Dep Variable log(RMBS)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Const c	-17.04	-24.36	-16.94	-27.62	-25.32	-25.34	-18.47	-23.24	-18.26	-27.82
Log GDP	2.48	30.54	2.46	35.92	3.39	31.87	2.65	31.18	2.58	37.16
Fixed Mtg Rate	-0.027	-2.35	-0.024	-2.55	-0.027	-1.21	-0.044	-2.94	-0.021	-1.75
Spread to Fed Funds	0.047	8.95	0.046	9.91	-0.014	-1.38	0.032	4.44	0.029	5.07
12m House Price Inflation	1.72	2.66	1.81	3.09	-2.45	-3.92	2.21	4.32	1.24	2.87
S&L Crisis Dummy 89-93	-0.236	-19.31	-0.24	-22.81	-0.079	-3.89	-0.184	-12.41	-0.18	-15.11
Basel I Excess Capital/Total Assets	2.66	2.09	2.65	2.32	14.01	5.37	4.58	2.48	na	na
Basel 2 Adj Excess Cap/Tot. Assets	na	na	na	na	na	na	na	na	10.91	10.24
Fannie/Freddie B-Sh Constraint Dummy	na	na	na	na	na	na	0.675	16.02	0.444	10.63
Durban-Watson [ ]		[0.365]		[0.37]		[0.06]		[0.27]		[0.36]
Restricted error corr. test for cointegration	-0.097	-3.77	-0.096	-3.87	0.011	0.99	-0.022	-1.77	-0.038	-2.58

Source: OECD

- **Figure 13** sets out the results of econometric dissection of the various influences in a simple econometric model of private label RMBS.

- In February 2008 the total off-balance sheet RMBS is around $2trillion. Of this about $802billion is due to the standard variables from the old model prior to 2004 (GDP, the interest rate terms, house price inflation and Excess Basel I capital). Allowing for the Basel I coefficients to change following QIS 4, and assuming this leads to anticipatory behaviour as discussed earlier (e.g. Northern Rock etc.), adds $452billion or a total of $1.25 trillion. The rest, some $750billion, was due to the regulations placed on the balance sheets of Fannie and Freddie.

Figure 13: Model-based Contributions to the RMBS Explosion



Source: OECD

X. Citigroup: Illustrations of Capital Regulation & Off Balance Sheet Activity

- Too often macro policy makers focus on broad aggregates and analyses including econometrics that may or may not be consistent with *firm-specific* developments. Two institutions with the highest profile write-offs in the sub-prime crisis are Citigroup and UBS. Both combine investment and consumer banking. This section looks at developments in Citi in light of the above aggregate analysis. **Figure 14** shows Citigroup's balance sheet and capital management and **Figure 15** summarizes its use of securitization vehicles, most of whose assets are off-balance sheet. These are used to answer some of the key questions.

- **Is there evidence of capital arbitrage and absence of constraints on the Citi balance sheet?** From December 2002 to June 2007 (just before the crisis) gross additions to equity in the form of retained earnings and new stock issues amounted to $53.8billion (bottom of Figure 14). At the same time, $38.6 billion was distributed as cash dividends, while Citi returned $23.3 billion to shareholders with share buybacks, for a net addition to equity from these sources of $30.5billion. This is approximately equal to the increase in Tier 1 capital, which rose by 57%. Notwithstanding the large return of cash to shareholders, total assets on balance sheet more than doubled (Figure 14, row 1), implying only 2.7% equity backing for the total asset increase of $1.1trillion, as excess regulatory capital was absorbed. This understates the degree of evident comfort in terms of capital adequacy, because the analysis to this point ignores off-balance sheet transactions.

- **Was the off-balance sheet activity substantial?** Yes. Citigroup's securitization activities are largely carried out using two main types of Special Purpose Entities (SPE's), most of whose assets are **not consolidated** onto Citi's balance sheet. Variable Interest Entities (VIE's, see **Figure 15** for a definition) amounted to $478bn at the end of 2007, $356.3billion of which was not consolidated. This figure, which represents a tripling from end-2003, is nevertheless a decline from the previous year, due to the large consolidation of previously off-balance sheet assets due to the sub-prime crisis. In the second block of the table, assets of Qualifying Special Purpose Entities (QSPE's, see **Figure 15** for a definition), predominantly mortgages, add a further $766billion, only $32billion of which reflects 'retained interests'. A continuous series for QSPEs is not available, but expansion of these assets seems to have proceeded in line with those in VIEs. Altogether, assets in unconsolidated SPE's are equivalent to an additional 52% of the balance sheet. In principle the risk associated with these assets has been largely transferred, justifying non-consolidation, even though exposure to losses in the unconsolidated VIEs could be as high as 43%, or $152billion (see 7th row of **Figure 15**). Some commentators continue to argue that Pillar 2 of the revised framework can be relied upon to save the flaws in Pillar 1. This episode suggests that pre-emptive supervisory intervention is at best very difficult.

- **Is the Citi evidence consistent with pro-cyclicality of the Basel capital regulation process?** During the 4 ½ years from the end of 2002 to mid-2007, essentially the upswing that followed the tech bust, Tier 1 capital rose by 57%. At the same time, risk weight adjustments, i.e. assets not requiring capital backing, rose from 35% to 46.5 % of total assets, allowing an overall balance sheet expansion of more than 100%. And securitized assets off-balance sheet, substantially real estate related, rose even faster. During this period OFHEO house prices rose by 41%. As the crisis emerged, Tier 1 capital and the risk-weight adjustments both declined, resulting in a small balance sheet contraction during the second half of 2007 even as off-balance sheet assets were repatriated to the balance sheet, reinforcing the cyclical slowdown under way.

- **How long will it take Citi to recapitalise via earnings?** So far Citi has announced $41bn of write-offs related to sub-prime and off-balance sheet exposures. The tax man will absorb a significant part of this, but retained earnings and external capital will be required to restore Citi's capital base, and resumption of normal operations involving balance sheet expansion will require further capital backing. On the basis of analysis similar to the aggregate work on the size of losses and time required to rebuild in Blundell-Wignall (2008), summarised earlier, it would take until mid-2010 for Citi to rebuild the equity backing for its balance sheet to 2003 levels while supporting balance sheet expansion of 6%, i.e. in line with nominal GDP. This assumes an underlying earnings rate 'norm' somewhat over 1% of assets, elimination of the dividend and no external capital injections. In fact Citi has already raised $7.5bn from ADIA and $6.88 from GIC, so recovery could come somewhat earlier.

- **Is there evidence that accounting is an 'art' not a 'science': firms have scope to recognize and model potential losses and risks in different ways that can lead to**

massive revisions? The maximum loss exposure for Citi's unconsolidated VIE's was reported as $109bn for 2006, in the 2006 filings. In the 2007 filings Citi revised its definition of "significant" involvement in VIE's and restated its 2006 disclosure data to be consistent with this. The number was raised to $147.9bn for the 2006 accounts, a 35% increase (see **Figure 15**, 3rd block of data, 2006 column). In 2007 the maximum loss exposure rises only modestly to $152bn. Similarly, the assets in QSPE's reported in 2006 covered "all" involvement and amounted to $1.51trillion. In 2007 coverage as regards mortgage securitizations was more restricted and the number reported was cut to $541bn for the 2006 year (see 4th block of data in **Figure 15**). The ability of internal audit committees, external auditors and bank supervisors to keep track of consistency with accounting standards and to avoid such arbitrary outcomes—presumably at least one of the many key requirements for the success Basel II—seems questionable.

Figure 14: Citigroup Balance Sheet Management and Capital

Capital Resource Management, Citigroup ($ billion, except where indicated)										
	2002	2003	2004	2005	2006	Quarterly: 2007				2008
						31-Mar	30-Jun	30-Sep	31-Dec	
Balance sheet (end of period)										
Total assets*	1070	1236	1452	1461	1851	1987	2182	2318	2146	
Risk-wtd. assets (BIS)	696	750	852	885	1058	1107	1168	1262	1253	
Risk-weight adj.%	-35.0	-39.3	-41.3	-39.4	-42.8	-44.3	-46.5	-45.6	-41.6	
Equity*	60	70	77	79	86	88	89	87	72	
Tier 1 capital (BIS)	59	66.9	74.4	77.8	90.9	91.4	92.4	92.4	89.2	
Memo: Mortgages	152.2	161.0	205.5	237.0	275.9				313.5	
Memo: Total Loans	447.8	478.0	548.8	583.5	679.2				778.0	
Capital ratios (end of period)										
Equity ratio (%)	5.61%	5.66%	5.30%	5.41%	4.65%	4.43%	4.08%	3.75%	3.36%	
Leverage ratio (%)	5.67%	5.56%	5.20%	5.35%	5.16%	4.84%	4.37%	4.13%	4.03%	
BIS Tier 1 ratio (%)	8.47%	8.91%	8.74%	8.79%	8.59%	8.26%	7.91%	7.32%	7.12%	
Cash impact on capital (flow)										
Dividends	3.7	5.8	8.4	9.2	9.8	2.7	2.7	2.7	2.7	
Stock repurchases	5.5	2.4	0.8	12.8	7	0.3	0	0	0	
Cash returned to owners	9.2	8.2	9.2	22	16.8	3	2.7	2.7	2.7	
Retained earnings	9.7	12.1	8.6	10.6	11.4	2.3	3.5	-0.5	-12.5	
Stock issues	0	0.7	0.9	1.4	1.8	0	0.5	0.1	0	
Gross additions to equity	9.7	12.8	9.5	12	13.2	2.3	4	-0.4	-12.5	
SWF convertible stock purch.									7.5	6.88
Write Offs cum. to Q1_08										41.9
Memo:										
Cash returned to owners 2003-2007(Q2) $61.9bn: o/w Dividends $38.6bn, Return of Capital $23.3bn.										
Gross additions to equity 2003-2007(Q2): $53.8bn: additions net of return of capital $30.5bn.										
* Net of goodwill.										

Source: Citigroup, 10K filings with SEC.

- **Is the Citi off-balance sheet activity consistent with the view that an unintended consequence of the Basel II expected reduced weightings to mortgages, AND the Fannie and Freddie caps, was to stimulate private-label securitisation?** The first line of the fifth block of **Figure 15** shows proceeds from new mortgage securitisations. 2004 was the year of publication of the Basel II framework and QIS 4 testing, and it was in 2004 that Fannie and Freddie had to raise 30% more capital and stopped buying mortgages. In 2003 Citi's proceeds from mortgage securitisations was $70.9bn. In 2004 it actually fell. Subsequently these proceeds accelerated sharply. From $66bn in 2004, it

rose 122% to $147bn by 2007. A revenue gap opened up in 2004 and was subsequently closed via off-balance sheet VIE and QSPE securitisations (or private-label RMBS as these activities have been referred to throughout this paper). While these numbers are not operating revenues, they incorporate fees and contribute importantly to the commissions and fees reported in **Figure15.**

Figure 15: Citigroup Off-Balance Sheet Activity

Citigroup: Securitisation and Special Purpose Entities						
Balance sheet, end Dec. $bn	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Assets in consolidated VIEs *		36.9	35.6	50.4	42.1	121.8
Assets in unconsolid. VIEs (*signif.* Involve.)		116.6	135.8	191.4	388.3	356.3
Sub-prime in Securities and Banking						37.3
o/w ABS-CDOs						29.3
Direct exposure						8
Max.loss exposure to unconsolid. VIEs		50	78	91	109	
As reported & revised in 2007 financials					147.9	152.2
o/w funded						38.5
o/w unfunded						113.7
Assets in QSPEs: all involvement *		653.9	971.9	1203.5	1505.7	
QSPE (Citi acting as 'principal')					541.2	766
o/w retained interests in mortgages					8.8	18.4
o/w transferred mortgage exposures					394.4	582.5
o/w other retained interests					10.4	13.9
o/w other transferred interests					127.6	151.2
Cash flows during the year $bn						
Proceeds from new mortgage securitiz.	40.1	70.9	66.4	85.2	99.4	147.3
o/w US Consumer				58.9	67.5	107.2
o/w Markets and Banking				26.3	31.9	40.1
Commissions and fees		15.7	16	16.9	19.2	21.1
o/w Investment banking		3.5	3.5	3.5	4.1	5.2
o/w Credit cards and bankcards		4.2	4.5	4.5	5.2	5.1
o/w Smith Barney (GWM)		2.1	2.2	2.3	3	3.3
o/w Markets and Banking trade-related		1.6	2	2.3	2.5	2.7
Principal transactions	4.5	4.9	3.7	6.7	8	-12.1
o/w Markets and Banking				5.6	6.9	-15
o/w Fixed income	2.3	2.4	1.8	3.9	5.6	4.1
o/w Credit products**	0	-0.1	0.1	0	-0.8	-21.8
o/w Equities	0.2	0.2	-0.3	0.3	0.9	0.8
o/w Foreign exchange	1.9	2.2	1.8	0.6	0.7	1.2
o/w Commodities	0.1	0.1	0.4	0.8	0.5	0.7

* Securitization vehicles used by Citigroup are generally accounted for as "Qualifying Special Purprose Entities"(QSPE's), or "Variable Interest Entities"(VIE's). QSPE's are passive entities generally exempt from consolidation by the transferor, here Citigroup. VIE's are vehicles that either must supplement their equity with additional subordinated finacial support, or whose equity investors lack the characteristics of a controlling financial interest. Under FIN 46-R the primary beneficiary of a VIE is obliged to consolidate it. Maximum exposure to loss where a "significant involvement" in an unconsolidated VIE exists must also be disclosed.
** Includes structured products, incl. sub-prime related

Source: Citigroup 10K Filings with SEC.

- As with Northern Rock, increasing concentration of mortgages was also a feature. Citi's on-balance sheet mortgages were 34% of total loans in 2003, and rose to 41% by the

end of 2006 (see **Figure 14**). The share of mortgage-backed assets in unconsolidated VIEs is not available, but the far larger and rapidly increasing QSPE assets are dominated by mortgages.

XI. UBS Report to Shareholders

- It is difficult to understand the complexity, the incentives for revenue generation, the influence of personalities, and the culture for growth and beating the competition that this breeds in an IB. Containing those forces is difficult for management, and their willingness to do so is also cyclical. The history of UBS in the run up to the crisis (a write-up forced on them by the Swiss regulator) gives a rare insight into some of this.

Corporate governance, risk control and funding

- On paper UBS looks to be '*state of the art'* in corporate governance and risk control. Overarching principles include: managerial responsibility; independent checks and controls; the requirement for transparent risk disclosure internally; earnings protection for shareholders; and the protection of UBS's reputation. There is a specialist risk sub-committee of the board, an audit committee and internal and external audit reviews.

- Risk control included explicit frameworks for '*market*' and '*credit*' risk, and all new business initiatives and significant transactions required prior approval by management. '*The market risk framework'* explicitly favours VAR and stress loss analysis (as favoured by the Basel Committee). These cover concentration issues, exposure to related parties and operational limits. **Credit risk** covers limits and monitoring (country, sector and products). In 2006 and 2007 UBS chose to allocate the bulk of their VAR limit and Group Stress Loss Limit to the IB, around which the growth strategy was centred.

- There is an **internal funding process** run by a centralised Group Treasury, with group-level governance oversight.

- Group Senior Management (GSM) identified the subprime issue as a major risk in September 2006, but the IB management did not act until July 2007, when it was too late. What is striking about the UBS story is that complexity and the very nature of IB culture makes it difficult to manage capital and risk even for highly-sophisticated organisations. No internal rules appear to have been broken, but the losses piled up quickly to around 50% of stockholders equity.

The damage

- At the time of writing, UBS has taken $19.2bn in write-downs. In December 2007 total balance sheet assets were CH2273bn, or around $1828bn (versus Citi's $41bn write-down with assets of a similar size at $2187bn). These losses were heavily linked to the IB and Dillon Read Capital Management (DRCM). At December 2007 UBS had $37.7bn capital compared to Citi's $113.6bn in stockholder's equity.

- These losses came from businesses within the IB (84% of write-downs, or about $16.1bn), or from DRCM (16% of the losses; about $3.1bn).

- The main contributor to UBS write downs within the IB was the CDO desk in the Securitized Products Group (66% of write-downs, or $12.7bn). This business grew rapidly through 2006.

- The rest of the losses in the IB came from foreign currency and cash collateral trading (10%, $1.92bn) and Proprietary Trading and the Credit Fixed Income businesses (8%, $1.5bn).

- With good governance, new business and transaction approval rules in place, Basel capital requirements being met, and oversight from supervisors all over the world, it interesting to see just what went wrong.

Primary causation: the revenue gap/growth catch-up factor

- As discussed earlier, by June 2005 the financial boom and liquidity bubble characterised by global carry trades was in full swing, and it was argued that US mortgage originator/IB's were developing new strategies for private label RMBS and leveraged conduits for structured products to facilitate demand. UBS is not a major US subprime loan originator, and could not have been impacted much by the new regulations on Fannie and Freddie. UBS saw the rapid growth of these new businesses, and perceived that it was falling behind. At this time UBS management launched Dillon Read Capital Management (DRCM), with the precise aim of establishing a new alternative investment business.

- An external consultant (Mercer Oliver Wyman) was also appointed to recommend strategy. This consultant pointed out that of all the businesses, Fixed Income was the area where the IB lagged the 3 leading competitors the most. The IB had its biggest gaps in the Credit, Securitized Products and Commodities businesses—product gaps in Credit, Rates, mortgage-backed securities (MBS), subprime and adjustable rate mortgages (ARMs) were singled out. In March 2006, the IB presented its conclusions and key initiatives to close revenue gaps. These included expanding: its securitised products via a new Securitised Products Group; its Global Structured Finance and High Yield Loan Business; Structured Credit; and the development of trading strategies for these products.

- The 3 biggest players in fixed income revenue in 2005 and 2006 were Goldman Sachs (about $8-3/4bn & rising to $10.4bn in 2006), Citigroup (about $9-1/4bn & rising to $10.5bn in 2006); and Deutsche Bank (about $9bn & rising to $11.5bn in 2006). These numbers were presented by the UBS head of Fixed Income in March 2007 as the 'gap' that had to be closed—UBS was a mere 9th at around $6bn in 2005 and about $6.2bn in

2006.[31] UBS developed a '*me too*' revenue gaps strategy—a growth at any cost mentality—at exactly the wrong time from a macro prudential risk perspective. This is classic investment banking (from the Latin American Debt crisis to subprime, the modern bankers continue a long tradition). Market share, revenue gaps and beating the key competition is the topic of every morning meeting at all levels in the bank, and for senior management it can be a question of holding your job.

- The corporate governance and risk control functions in many firms will adjust; this is as much a cultural issue within the organisation. It is very hard for these functions to stand in the way of growth—the idea of a 'crisis' is not on the sell team's mind before a crisis breaks, and all the incentives work to make money for the company and for the key personalities seen to be driving this. This certainly appears to have been the case in UBS, where departing top managers were replaced by people from a sales background (consistent with growth) not a risk management background. Key internal risk controllers do NOT hold sway at this point, and they simply have to adjust, or risk their own jobs—this is how it works. Only once a crisis hits does the relative power begin to shift in favour of the risk controllers.

Funding, hard limits and staff remuneration incentives

- UBS has a centralised treasury able to raise funds efficiently in the open market, and it chose to distribute funds internally within the normal external spread:

  "…*i.e. internal bid price bids were always higher than the relevant LIBID and the internal offer prices were always lower than LIBOR*".[32]

  The businesses were able to fund themselves at prices better than in the market. No attempt was made to take account of liquidity in this process (to match term funding to liquidity). A stricter funding model was seen as a '*constraint on the growth strategy'*.

- There was strong resistance from the IB management to hard limits on the balance sheet and RWA's. Such limits were quickly installed in Q3 and Q4 2007, only once the crisis was under way.

- Staff compensation incentives did not differentiate between the creation of genuine 'alpha' versus the creation of returns based on low cost funding, nor the quality (risk attributes) of staff earnings for the company. The relatively high yield from subprime made this an attractive candidate for long position carry trades, (even with thin margins) via leverage (and using derivatives). This encouraged concentration in the higher carry mezzanine tranches of CDO's. It also encouraged minimal hedging of super senior positions (in order to be more profitable).

[31] Simon Bruce, UBS Fixed Income Investor Day, March 2007. He identifies a $4.3bn revenue gap to the top 3 competitors as the most significant revenue opportunity.
[32] UBS (2008) p25.

Corporate governance stretching

- Notwithstanding the fact that GSM identified the subprime issue as a major risk in September 2006, the IB management did not adjust until July 2007. The way this works internally is that GSM and the Board would not have felt strongly enough about a crisis. Growth and revenue are in the interests of the shareholders and the Board would not have been able to act forcefully: in complete contrast to their actions once the crisis became clear and the weight to a negative view rose. IB management held sway and GSM and the Board went along with it. The report states that GSM took comfort from the main exposures being AAA CDO's, and that they were prepared to rely on IB assurances that the risk was well managed. Revenue growth and catching up to competitors was the dominant culture. All management focus within the IB on 'processes' for new business initiatives and prior approval of transactions were:

  "…*on speeding up approvals as opposed to ensuring that the process achieved the goal of delivering substantive and holistic risk assessment of the proposals presented".*[33]

- The report also states that internal reporting of risk positions was complex, even across the 'silos' within a business line. A holistic picture of the risk situation within IB business lines was not presented to management or the board, and there was no serious internal challenge to the overall strategy.

How the losses occurred in DRCM

- DRCM (16% of losses) implemented their strategy late, just as the market turmoil was beginning. This 'bad luck' led to reviews of the reporting line and control issues; but the shareholder report states quite clearly that no internal rules were broken. The Report suggests that problems arose because of: **(i)** staff changes—leadership and technical 'key person' risk played a role and is not captured in regulations; **(ii)** the relative autonomy of the team, with cross reporting lines.[34] This contributed to a doubling up of fixed income strategies in the IB and DRCM—when DRCM was closed in 2007 the exposures still existed in the IB; and **(iii)** the inability of management internally to focus on all aspects of the complex growth in their business.

The Investment Bank

- The IB was anointed as the key driver of the growth strategy. This strategy together with the cheap funding and lack of hard limits on RWA ensured that the IB would play a key

[33] UBS (2008), p41.

[34] DRCM reported to Global Asset Management, but the IB was exposed to the risk and returns of DRCM managing its proprietary capital via UBS finance companies.

role in the losses. The IB was not incentivised to assess and prioritise between businesses from a resource allocation perspective when setting strategy.

- The CDO desk within the IB was responsible for 66% of write-downs. UBS-sourced RMBS were held in a CDO warehouse (on UBS's books, thus exposing the IB to market risk). Once securitised the RMBS were transferred to a CDO Special Purpose Vehicle (SPV) and structured into tranches. Higher fees caused the desk to focus on mezzanine tranches (the structuring fee was 125 to 150 basis points on the notional value of the deal, whereas super senior was only 30 to 40 bp). The report also states clearly that the growth in the structuring business was hugely accelerated by the development of the Credit Default Swap (CDS) market, because this avoided cash ABS being sourced for inclusion (the cash plus synthetic 'hybrid' CDO's became 75% of the total CDO exposure). The warehouse was responsible for one quarter of the CDO desk losses.

- In 2006 and 2007 there were no notional limits on the warehouse pipeline and retained pipeline positions, but they were subject to VAR limits and stress testing and were identified by Market Risk Control (MRC) as early as Q42005 as the main source of market risk in the IB. That there were no notional limits and all deals were approved is very consistent with growth culture dominating the risk control culture until mid 2007. **This relative cultural sway within an organisation is the most basic source of 'pro-cyclicality', and is almost impossible to regulate against.**

- UBS at first sold the super senior AAA CDO tranches to 3rd party investors, but then began to retain them for their own book (and buy them from 3rd parties). This (with cheap funding) was seen as an easy source of profit. Some of these were fully hedged (via CDS) with monoline insurers as counterparties. There was no break-down in risk controls or the setting and monitoring of counterparty limits. The losses here simply came from the widening of margins in anticipation of expected severe downgrades. They simply 'got it wrong'.

- The Amplified Mortgage Portfolio (AMP) also became a part of this business. Here the super seniors were only partially hedged to improve their expected profitability: a few per cent only of the notional value was believed to be sufficient to hedge even a major negative event; i.e. based on historical statistical analysis. There were no notional limits on the size of these positions. The partial hedges were quickly exhausted as the crisis unfolded leaving UBS fully exposed, because the volatility was well outside of historical experience. When decisions were taken to exit positions from mid 2007, it was too late as liquidity had disappeared.

- Of the $50bn super seniors held by UBS at December 2007, $20.8bn was bought from 3rd parties, $15bn was fully hedged and the remaining $5.8bn was only partially hedged. Super seniors contribute three quarters of the CDO desk losses and 50% of the total write-downs.

- Because of illiquidity, the crisis dramatically changed what a 10 standard deviation event was to look like—2-4% hedging looked adequate before the crisis, but for some AAA

tranches we now know that 50% losses or worse is quite possible. This of course highlights one of the great weaknesses of the Basel II IRB approach which relies on internal bank modelling.

- The VAR methodologies also rely on the AAA ratings of the super senior tranches. There was no attempt to look through these to analyse the underlying collateral; there was a belief that subprime would not impact AAA assets. (Once again this calls attention to the role of CRA's.)

XII. The Situation in the EU versus the US and the Leverage Ratio

- **US banks are much better capitalised than their European counterparts.** It has been argued above that the US subprime crisis is a regional/sector crisis that the Basel RWA approach is ill-suited to deal with. It was also argued that the problems in the US were compounded by proposed changes to the Basel weights. The crisis was centred in the US and not elsewhere, because: **(i)** at the macro level the US growth cycle was not synchronised with other countries; the Fed had 1% interest rates (following the tech bubble and bust), and international reserves from Asia were pouring mainly into the US flattening the yield curve, both of which helped generate a housing boom; and **(ii)** a regulatory catalyst stimulated the private mortgage securitisation and sale process, where the crisis was to become focused. Were US banks not as well capitalised as they are, the impact of the crisis would be much worse than it currently is.

- **Figure 16** shows the leverage ratios for a selection of European and US major banks—measured here as Tier 1 capital divided by the bank's total assets. The average leverage ratio for the European banks shown is 2.68%, while that for the USA banks is 5.15%, and 5.88% if IB's are excluded. European banks, in other words, typically have around half the capital of US banks as a share of assets.

- The reasons for this are due to the explicit use of the leverage ratio required by the Fed, (a minimum of Tier 1 to adjusted total assets of 4% for most banks) regardless of RWA, and the 1991 passing of the FDIC Act, enshrining 'prompt corrective action' in law. The aim of the latter is to minimise loss exposure of the deposit insurance fund. Five categories are established:

  (1) "Well-capitalised", means 'significantly exceeds' the Fed's minimum, and more precisely, by 25% or more, (i.e. a 5% or greater leverage ratio). **(2)** "Adequately capitalised" means meeting the minimum; **(3)** Undercapitalised means failing to meet the minimum; **(4)** "Significantly undercapitalised" means failing by a significant amount in view of FDIC; and **(5)** "Critically undercapitalised" means failing to meet any of the capital requirements, and this is specified as no less than 2%. At "significantly undercapitalised" levels, banks are forced by law to raise capital or resolve the issue in other ways (e.g. merge, etc), whereas the worst category makes it mandatory for the relevant regulator to appoint a receiver.

Figure 16: Bank & Investment Bank Capitalisation, US versus Europe

EUROPE	currency	Assets (A)	Tier 1 Cap. (B)	Leverage ratio (B/A)
Deutsche Bank	EUR	2,020,349	28,320	1.40%
Credit Agricole	EUR	1,414,223	28,000	1.98%
Commerz bank	EUR	616,474	16,333	2.65%
Barclays	GBP	1,227,361	27,408	2.23%
BNP Paribas	EUR	1,694,454	37,601	2.22%
UBS	CHF	2,272,579	32,811	1.44%
Societe Generale	EUR	1,071,762	21,616	2.02%
Credit Suisse	CHF	1,360,680	34,737	2.55%
HBOS	GBP	666,947	24,388	3.66%
Lloyds	GBP	353,346	13,952	3.95%
BBVA	EUR	502,204	20,659	4.11%
Santander	EUR	912,915	39,725	4.35%
RBS	GBP	1,900,519	44,364	2.33%
European total	Euro	15,673,605	351,950	2.68%
UNITED STATES				
Citigroup	USD	2,187,631	89,226	4.08%
US Bancorp	USD	237,615	17,539	7.38%
Wells Fargo	USD	575,442	36,674	6.37%
Bank of America	USD	1,715,746	83,372	4.86%
JPMorgan Chase & Co	USD	1,562,147	88,746	5.68%
Suntrust	USD	179,574	11,425	6.36%
Washington Mutual	USD	327,913	22,406	6.83%
BB&T	USD	132,618	9,085	6.85%
National City Corp.	USD	150,374	9,367	6.23%
Countrywide Financial Corp.	USD	211,730	8,754	4.13%
Goldman Sachs	USD	1,119,796	42,728	3.82%
Lehman Brothers	USD	691,063	23,103	3.34%
Merrill Lynch	USD	1,020,050	31,566	3.09%
Morgan Stanley	USD	1,045,409	32,074	3.07%
US total		11,157,108	506,065	5.15%
US Banks		7,280,790	376,594	5.88%
US Investment Banks		3,876,318	129,471	3.33%

Source: Bank Annual Reports.

- On this basis none of the European banks shown in the table would be “well capitalised”, 2 would be adequately capitalised, 8 would have to adjust and 3 would be closed down. In the US case, only the IB’s (Goldman’s, Morgan Stanley, Lehman’s and Merrill Lynch) would not meet the minimum requirement. This is because investment banks were not supervised as banks, but fell under the supervision, on a voluntary basis, of the SEC. It is interesting in this regard that Bear Stearns, an IB, has been the main casualty of the subprime crisis thus far.

- The FDIC has analysed the implications of the US QIS 4 results (some of which are reported in **Figure 8**) for prompt corrective action. All 26 institutions in the study experienced a drop in capital based on RWA, and 9 became significantly under-capitalised, and 3 critically so, if capital were determined under the revised IRB

approach. In effect, the leverage ratio would become the binding constraint in capital regulation.[35]

- Because of these issues the debate is shifting. Countries that rely relatively more heavily on RWA and the Basel system, as in Europe, have relatively weak capital positions. A financial crisis in the EU along the lines of the US crisis would have much more devastating economic consequences through the deleveraging mechanisms referred to earlier. If banks were asked to double their capital in Europe pre-emptively this too would be disruptive (extremely so for rapid adjustment). This argues in favour of changes and reform.

- Given compliance costs, abandoning the RWA would be the natural outcome if a leverage ratio was always to be the binding constraint (more capital than the RWA approach requires), particularly if the IRB approach were not altered to address concentration issues.[36]

- If some reformulated RWA was thought necessary—one that avoided all of the above criticisms—then combining it with a leverage ratio would have the advantages of: **(i)** supervisors and banks focusing on broader metrics which reduces the scope for regulatory arbitrage. Banks could no longer arbitrage to maximise profits against a single metric; and **(ii)** Increasing the scope for dealing with regional/sectoral risk factors, as opposed to the global risk factor upon which the RWA approach is based.

XII. Summary and Overview of Some of the Key Issues

1. Causal versus conditioning factors

- Mixing these 2 things risks coming up with an impressive list of reforms without weighting them, i.e. risks giving insufficient attention to causal structural factors. To continue the earlier water analogy, better levies, building location restrictions and warning signs should be encouraged, but are not a substitute for sound dam infrastructure.

- Key **causal** (more exogenous) factors identified in this report include:

  (i)Global interest and exchange rate distortions: leading to rolling excess liquidity-driven bubbles.

  (ii) A sub-optimal Basel II (Pillar I) capital regulation framework: that can lead to under capitalisation of banks via regulatory arbitrage and by handing the setting of capital standards to the modelling and assumptions of private banks. Sophistication and complexity increases the scope for reducing capital requirements. This distorts asset allocation decisions; leads to pro-cyclicality; and fails to address regional/sector risks.

[35] See Powell, D. (2005), former chair of the FDIC.
[36] There is no point in imposing compliance costs, which can be very high, if they have no binding influence,

Anticipatory behaviour has already influenced mortgage concentration and wholesale financing in some institutions and contributed to subprime issues. Sheila Bair puts it very well:

*"**Risk number one**: The advanced approaches come uncomfortably close to letting banks set their own capital requirements. That would be like a football match where each player has his own set of rules. There are strong reasons to believe that banks left to their own devices would maintain less capital—not more—than would be prudent."*[37]

(iii) Problems with multiple independent regulation authorities for interdependent financial firms: with changes by one regulator leading to problems for others. The Fannie and Freddie controls, for example, caused revenue gaps and created incentives for a rapid expansion of the private-label RMBS.

(iv) Regulating investment banks differently to banks and bank holding companies that include IB subsidiaries. In the US case this has left IB's with half the capital of banks, yet many of the subprime problems (and need for capital) has involved the activities of IB's. Nor are 'consolidated' capital rules likely to resolve this issue. The 'revised framework' of Basel II states that capital requirements should be '*applied on a consolidated basis to internationally active banks….to ensure it captures the risk of the whole banking group*'.[38] However, wide scope exists for parent groups to meet capital requirements simply by shifting funds within the group. Balance sheets can expand without requiring subsidiaries to add capital for the group as a whole.[39]

(v) Pro-cyclical incentive structures

The 'revenue gap' and 'market share' focus of bank strategy leads to copy-cat behaviour with respect to new innovations in competitor banks (see the UBS discussion above).

Compensation incentives that are geared to short-term return recognition and are not risk-adjusted (see the UBS discussion above) are inherently pro-cyclical.

Risk tools that measure risk at a point in time, rather than through-the-cycle cause pro-cyclicality.

Counterparty credit policies that vary with the cycle are pro-cyclical.

Reliance on credit ratings: which in practice tend to be cyclical variables.

Leverage linked to asset values which vary with the investment cycle and do necessarily reflect future cash flows accurately are a key cause of pro-cyclicality.

[37] Sheila Bair, chairman of FDIC, speech at 2007 Risk Management and Allocation Conference, Paris, France, June 2007, page 2.
[38] Basel Committee, (2006), paragraphs 20-21.
[39] See Atkinson (2008), forthcoming, for an exposition of this and examples from Citi, Merrill Lynch, E-Trade, and Northern Rock.

(vi) The competitive structure of rating agency and audit markets: Both of these markets have oligopolistic structures, at least as it applies to dealings with complex financial institutions leading to high fees and the potential for reduced independence. (See the discussion of the FSF conclusions above).

(vii) Bailouts that create moral hazard asymmetries: associated with 'too big to fail' risk-taking by lenders and borrowers (see the Bear Stearns, Northern Rock and IKB discussions above).

- **NB. If these problems are not addressed, they will push the job of supervisors to the limits of difficulty and occasionally beyond it.**

2. Conditioning Factors that little or no improvement can be hoped for

- It is impossible for **financial firms and supervisors to predict the future level and volatility of asset prices** nor their correlations at different points in time. This means that business strategy for the future, and the ability to control risk in the face of unexpected shocks, are always going to pose major challenges. Risk models fail not because firms aren't sophisticated enough; they fail because the inputs can't be predicted, and the past is a guide only for situations where gap events, panic and liquidity problems are absent. Internal systems can be improved, but it is a case of "garbage-in-garbage-out'. If you do not anticipate a crisis in risk analysis, the best model in the world will not help much in the presence of an '*a-historic'* risk event that is not normally distributed.[40] The US has the deepest and most active financial markets, and it still experiences major risk events. There is no *'magic pudding'*. At the board level corporate governance, because directors are no better at predicting the future than anyone else, will always have a pro-cyclical element to it.

- It is **impossible to change human nature as it operates in a broker-dealer or investment bank**. Job tenure is limited and remuneration depends on how well you do while you are in the position. It is possible to change remuneration formulae (as discussed above) to encourage longer-run thinking and risk-adjusted rewards. But this is likely only to have limited results. Job tenure can't be guaranteed in the face of adverse outcomes. Key employees understand this, and will still seek and achieve rewards for successful rapid moves up the risk curve in apparent good times, and vice versa in bad times. Employers adjust because key people will go to other employers or (even more likely these days) leave to set up their own boutique or hedge fund (note the discussion of key person risk in the case of DRCM).

[40] All of the mathematics of VAR models depends on asymptotic normal distributions of volatility and error terms.

XII. Ten Elements for a Sound Global Regulatory System

The observations and analysis in this paper suggest at least 10 elements that need to be thought about in the context of regulatory reform:

(1) Recognition that regulatory policy needs to proceed hand in hand with reform to the international monetary system. Systems of fixed/managed exchange rates (especially in the presence of price controls on energy) across the BRICS, Asia and the Middle East have contributed to excess demand and worked to destabilise the global financial system. Without progress on this front, the task of financial regulation in individual countries is made more difficult, and regulatory policies themselves will always be subject to more lobbying from domestic financial firms with respect to their competitiveness.

(2) Equally, recognition that monetary policy in advanced countries should take more account of the international global financial implications of their policies. Extreme low interest rate policies pursued with domestic activity objectives in mind cause carry trades and asset price effects that influence leverage.

(3) Complexity of rules and unrealistic models need to be downplayed. A single global risk factor is not a sound basis on which to base any binding model for capital requirements in each jurisdiction. Allowing banks to set their own capital standard via complex internal modelling of risk outcomes is likely to generate too little capital and concentration distortions. Complex weighting rules that discriminate between assets in terms of capital penalties create an industry of avoidance which is both costly in terms of productivity and likely to distort asset mixes. A simplified and more transparent system of *ex-ante* requirements, like the leverage ratio with prompt corrective action triggers, allows greater scope to take local and global factors into account and gives supervisors ***ex-ante* tools that do not rely on judgement** and predicting the future.

(4) Recognition of the need for a framework more sensitive to concentration of risk and duration mismatch. Penalising or limiting deviations from a 'benchmark' is common in pension fund oversight. It should also have a role in capital regulation with respect to the assets and liabilities of banks. At the consolidated portfolio level penalties for concentration need built-in *ex-ante* capital rules (not reliant on supervisory oversight in Pillar 2). A quadratic (as opposed to linear) capital rule penalising increasing portfolio concentration in Pillar 1 is worth considering. **Asset and liability duration mismatch is linked to concentration risk**. Northern Rock, for example, used wholesale funding to build rapid concentration in mortgages. It also contributed to the liquidity crisis.

(5) Consolidation of on- and off-balance sheet bank exposure. This is an important advance under Basel II. But it will require very clear and uniform definitions for what constitutes an 'arms-length' relationship or entity. This is critical for the effective operation of internal and external auditors. In this context, it is probably unwise to allow consolidation of IB and commercial bank capital requirements within a holding company context.

(6) Recognition competitive structures increase efficiency and independence in the role of rating and audit firms. There needs to be some thought about requiring the '*buy side'* to obtain independent ratings assessment (to improve quality, increase the independence and quality of ratings, and reduce the monopoly element of the issuer-pays model). A removal of the legal restrictions that enhance audit firm monopoly is also worth consideration as a means to encourage the entry of new (and listed) capital.

(7) A clear definition of what the bank/financial regulated sector is, rather than endless debates about how much hedge funds should or should not be regulated or self-regulated. There is interconnectedness between banks and hedge funds, as there is between banks and corporate borrowers, and banks' dealings with corporate Treasuries. The line between banking and certain other financial activities that warrant regulation for safety and soundness needs to be made clear. For example, if a hedge fund begins to issue notes in its own name to raise capital; begins to employ market-making traders in derivative markets; or begins to take on reinsurance activities, then it may have to come inside the regulatory net for banks, IB's and/or insurance companies. This is quite different from a hedge fund that borrows from a bank or deals in derivatives with a bank, as most large corporate treasuries also do. On this view the line for prudential supervision turns on what the firm actually does. Of course all firms fall within the market integrity and consumer protection regulations.

(8) A single overarching regulator for prudential standards across all financial institutions; and a single overarching regulator for market integrity and consumer protection (the so-called 'twin peaks' model used in Australia is a good starting point). This should not be the central bank, where monetary policy should focus on inflation objectives and not risk conflicts in policy objectives in a solvency crisis.

(9) **A lender-of last resort facility and comprehensive market liquidity provisions** for maintaining the stability of the financial system in the event of periods of turmoil (which can only be run out of the central bank).

(10) Recognition of the moral hazard causing effects of bail outs and government guarantees on assets. This creates asymmetry in risk taking. The threat of bankruptcy and loss of shareholders' and at least some non-deposit funds needs to be made more 'credible'. A resolution regime including protection for depositors (to avoid Northern Rock situations), and clear receivership processes for the closing down of banks (in jurisdictions where these elements are absent) would help in this respect.

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