Macro-prudential policy: what can it achieve?¹

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Abstract

This paper examines both the objectives and the available instruments for new macroprudential policy making bodies. It argues that the objective – financial stability – is best understood as avoiding widespread disruption of financial flows. Achieving this objective requires that policy makers carry out two different but related tasks. First they must ensure the resilience of the financial system to external shocks. Second they must respond in a timely fashion to future unsustainable expansions of credit and growth of asset prices. These are old policy challenges. What has changed is the emergence of new vulnerabilities in our innovative and relatively lightly controlled financial system, exposed by the recent global financial crisis. Macroprudential policy can be effective in addressing these vulnerabilities but will not remove the major political and institutional obstacles to the effective control of unsustainable credit expansions. [136 words]

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1. Introduction

The global financial crisis has generated considerable negative comment on the actions of both monetary policy makers and financial regulators. The chairman of the UK Financial Services Authority

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Authority concedes that financial and regulatory authorities have made mistakes, arguing that their major failing in the years 2004-2007 was not recognizing and responding to growing system wide financial risks; and that it was this, much more than any flaws in the arrangements for supervising the activities of individual institutions, that allowed the global financial crisis of the past two years to take place (Turner (2009)).

The accusation against monetary policy makers is that they allowed an unsustainable growth of bank credit and asset prices to continue unchecked for far too long. Some conclude from this that the objectives of monetary policy should be altered to include financial as well as price stability. According to this view, rather than being focused purely on control of inflation, interest rates should also be used to dampen unsustainable credit expansion and asset price growth. As William White puts this argument in a recent paper (White (2009)), monetary policy should be used proactively to ‘lean’ against the credit cycle, instead of just being used to ‘clean’, i.e. to deal with a collapse of credit and asset prices after the event.

But this implies that central banks step back from their current focus on price stability, relaxing the inflation targeting regimes adopted by the ECB, the Bank of England and other central banks or adding new objectives for the US Federal Reserve. The Governor of the Bank of England argues to the contrary, that monetary policy arrangements need not be changed. In King (2009), page 5, he states that: “Inflation targeting is a necessary but not sufficient condition for stability in the economy as a whole. When a policy is necessary but not sufficient, the answer is not to abandon, but to augment it. Indeed, the overarching lesson of this crisis is that the authorities lacked sufficient policy instruments to take effective actions.”

Policy makers worldwide are now seeking to develop a new ‘macroprudential’ approach to policy making to help prevent a repeat the mistakes of the recent past. The authorities in the US, the UK and continental Europe are creating new bodies with responsibility for containing systemic financial risks (Section 4 below reviews these developments). But creating new committees and institutions is only the starting point. If this new approach is to be successful we need a better understanding, both of the objectives of these new institutions and of the instruments that they will use to achieve them.

This paper argues that achieving the objective of financial stability (a goal which is itself often not clearly defined) requires two things. First that policy makers respond in a timely manner to unsustainable growth of credit and asset prices. Second that they take steps to ensure the resilience of the financial sector to external shocks.

Neither of these are new concerns. In the course of the past few hundred years there have been many examples of credit and asset price booms leading, eventually, to financial crisis.³ The

³ See Reinhart and Rogoff (2009). The main conclusion from their quantitative analysis of financial crises in 66 countries over a period of nearly eight centuries, is that excessive debt accumulation plays a role in all virtually all crises and that the systemic risks this creates are much greater than appreciated at the time.
historical record suggests that policy makers are typically either unable or unwilling to restrain these unstable expansions. Financial sector vulnerabilities are not new either. Deposit banking has since at least the 18th century been subject to episodes of banking panic where withdrawal of short term deposits has resulted in large scale bank failures. Here the record of policy makers is better. Central banks have learnt how to supply liquidity as ‘lender of last resort’ and prevent such systemic bank runs. The withdrawal from US money market mutuals and other weak financial institutions, following the failure of Lehman Brothers in September 2008, was the first such systemic run since the US banking panic of 1907. 

What is different today is that in a lightly regulated, and continually innovating financial system, financial sector instabilities can emerge in many new and unsuspected ways. If we wish to encourage financial innovation and the free availability of credit, and there are good reasons for doing so, then we need also to recognise that this can lead to new systemic vulnerabilities. Macroprudential policymakers will have the responsibility for identifying these vulnerabilities, when they emerge, and taking steps to remove them before they trigger systemic problems.

This assignment of new macroprudential responsibilities is welcome but this will not entirely remove the threat of financial instability. Financial sector vulnerabilities are easy to identify after a crisis, but much more difficult to spot before hand, especially during periods of strong growth of expenditure and incomes. Moreover macroprudential policy does not offset the strong political and institutional forces that encourage and support cumulative and unsustainable expansions of credit.

The paper is organized as follows. Section 2 considers what is meant by financial stability, the ultimate objective of macroprudential policy. It adopts a relatively narrow definition of financial stability, as avoiding widespread disruptions to financial flows. It then considers the underlying sources of such disruption suggesting that this can come both from within the financial sector (vulnerabilities that amplify external shocks) and from outside the financial sector (unsustainable build up of debt and asset prices ending in a sudden reversal of credit and real spending). In practice it is typical for both of these to contribute to the disruption of financial flows that then occurs in a financial crisis. It is extremely hard, if not impossible, to quantitatively model the probability of such a crisis taking place.

Section 3 provides a brief review of the crisis of 2007-2008, focusing on the vulnerabilities within the financial sector (complementing the paper of Collyns. et. al. in this volume, which focuses on the buildup of macroeconomic imbalances and the subsequent reversal of private sector expenditure). Section 4 briefly reviews the current initiatives to create a new institutional architecture of macroprudential policy.

Section 5 and 6 then consider how regulatory instruments, such as capital and liquidity requirements, might be used to promote financial stability. These sections draw on a useful

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*See Gorton (2009).*
distinction, drawn by Borio (2009), between the cross-sectional and time-series components of systemic financial risk. Section 5 considers their use to ensure the resilience of the financial system i.e. addressing the cross-sectional component. For countries with limited access to international capital flows and extensive state involvement in the financial sector, such as the major industrial countries in the period 1945-1970 and most emerging markets even today, the principal vulnerability to disturbance of financial flows arose in foreign exchange markets. Such disruption could be avoided by using the conventional macroeconomic instruments. There was then no need for the active use of regulatory instruments to protect the financial system. In today’s sophisticated international capital markets it is no longer possible to identify a single source of potential disruption of financial flows. There are instead several possible sources of systemic financial risk, not just foreign exchange markets, and we need to use a number of additional instruments to address them all.

Section 6 then considers whether these new tools can also be used to prevent unsustainable rises of indebtedness and asset prices, i.e. the time-series component of systemic financial risk. There may be some benefits to using countercyclical variation of bank capital requirements, to restrain credit booms, but this must be thought through properly; such arrangements could easily conflict with the operation of monetary policy. But even if these new regulatory tools prove helpful, they will do little to deal with the underlying political and institutional impediments to taking appropriate policy action. Section 7 provides a brief conclusion.

2. What is financial instability? How does it arise?

Macroprudential policy is the use of regulatory instruments to reduce the risk of financial instability. Analysing how this might be done in a coherent way requires us to go back to fundamentals. We need to make clear what we mean by financial instability and identify its causes. We need to identify underlying market failures – for example externalities (eg actions by individual firms such as extending credit can impose risks on other firms that are not internalised by themselves) of coordination failures (eg the instability caused when investors or depositors all try to reduce their exposure at the same time) – and once these are identified consider how using macroprudential or other policy instruments might then improve on market outcomes.

The phrases financial stability and financial instability and their close cousin ‘systemic financial risk’ are typically used far too loosely. This paper interprets financial instability as the widespread disruption of financial flows. This can be contrasted with the much broader definition adopted by Ferguson (2003) “…as a situation characterized by these three basic criteria: (1) some important set of financial asset prices has diverged sharply from fundamentals; and/or (2) market functioning and credit availability, domestically and perhaps internationally, have been significantly distorted; with the result that (3) aggregate spending deviates (or is likely to deviate) significantly, either
above or below, from the economy’s ability to produce.” Ferguson’s definition is unsatisfactory because it confuses cause (divergence of prices from fundamentals) with effect (the resulting distortion of financial markets, credit availability and aggregate spending).

The term ‘widespread’ is not precise. But a definition of this kind is helpful because it emphasizes that for a financial event to be systemic it must have a major impact on household and corporate expenditure and also because it reminds us of the possibility that systemic financial problems can affect many forms of financial intermediation not just bank lending. They can also arise in foreign exchange markets and in the markets for government bonds, corporate bonds, equities, and derivatives.

The definition used here is based on the definition of a systemic event (financial or non-financial) provided by Besar et. al. (2009). They propose that a systemic event can be defined as one involving “… damage or degradation of the networks of interconnections that link households, firms and financial intermediaries”. Systemic events need not just be financial (Besar et. al. refer to the possibility of systemic disruption of electricity supplies) but financial markets and credit extension are two of the most important economic networks linking firms, households, and financial institutions. Any widespread disruption to financial flows would count as a systemic event according to their definition.

The definition used here can be related to the concept of ‘CoVar’, proposed by Adrian and Brunnermeier (2009) as a measure of an individual institutions contribution to systemic risk. CoVar is defined as the covariance of the returns on an institution’s portfolios with the returns on other institutions, conditional on a systemic financial event having taken place. Adrian and Brunnermeier stress the role of ‘endogenous risk’, i.e. the possibility that a major shock, will lead to large scale forced asset sales, and this in turn results in an amplification of the initial disturbance. As a result the correlation of asset returns increases sharply in a crisis. This can be measured using CoVar. But it is not easy to make the concept of CoVar operational, since we need both to identify both the magnitude of the external shock that will create endogenous risk and then quantify the resulting increase of correlation. Section 5 considers whether CoVaR can be a useful practical macroprudential policy tool.

With this relatively narrow definition, how then do we model and understand financial instability? Just as we need to add frictions to standard models in order to create a role for, monetary policy, we also have to introduce the possibility of contractual incompleteness and contractual failure, in order to create the possibility of financial instability. If inter-temporal financial contracts are always available and always fulfilled then there is no need for financial intermediaries or financial

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5 Other related models of endogenous risk include Brunnermeier and Pedersen (2009) in their model of ‘margin spirals’ and earlier work by Persaud (), by Adrian and Shin () and by De Fries et. al. ()
intermediation and no possibility of widespread disruption of financial flows. There can be no bank runs and no failure of borrowers to repay. Individual borrowers might make mistakes about prospective incomes and the inter-temporal allocation of their expenditures. But such outcomes would not create any disruption to financial flows and not be of any macroeconomic concern.

This indicates that we can think of a sequence of models, of increasing complexity, successively allowing for nominal rigidities and financial frictions:

(a) The first and most basic model is the pure flex-price equilibrium, the standard setting for thinking about general equilibrium and an appropriate model for thinking about real issues, such as long-run productivity growth and the trend of potential output. This is the standard Arrow-Debreu general equilibrium set-up, although it can be extended to incorporate a role for public policy, for example through the introduction of public goods or of investment externalities.

(b) The standard model can be generalized by introducing wage and price frictions (and possibly also financial market frictions), resulting in a model in which nominal variables matter, one with more realistic macrodynamics and a role for expectations, and one in which inflation needs to be kept under control. It is in this setting – that of dynamic stochastic general equilibrium – that monetary policy is no longer neutral and a policy regime such as inflation-targeting can be analysed. But in this setting financial flows and financial intermediary balance sheets do not have any independent macroeconomic impact. It is possible to extend such models to incorporate financial flows and financial institution balance sheets, but there is no possibility of disruption of financial flows.

(c) The third set of models not only have wage and price frictions, but also a more explicit modeling of financial intermediation with the possibility of financial instability: of widespread disruptions of financial flows, and of systemic liquidity crises and solvency crises. This is the setting where the possibility of endogenous risk arises and further macroprudential policy instruments may have a role. Introducing these processes into models of macroeconomic behaviour is a largely undeveloped field of economic modeling.

In order to model a disruption of financial flows, it is not enough just to introduce financial contracts or financial institutions into standard models (as for example in the financial accelerator of Bernanke, Gertler and Gilchrist (1999) in which access to finance depends on the net worth of the borrower or the related collateral model of Kiyotaki and Moore (1997) in which access depends on property values). Microfinancial frictions of this kind create a linkage between the

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6 See Allen and Gale (2009) who argue that liquidity shocks (a temporary need for consumption or investment) need not impose economic costs when full risk insurance is available, but are economically damaging when households and firms cannot fully insure themselves against aggregate risks.

7 For a related and more detailed discussion of the relationship between the microeconomics of financial markets and the possibility of systemic financial crises, see Allen and Gale (2009), especially chapters 5 and 6.
private sector corporate or household net worth or the value of collateral assets and the cost of external finance, but the resulting external finance premium itself behaves in an orderly manner, altering smoothly down and up in economic expansions and recessions. Similarly modeling macro-banking instability requires more than introducing a banking sector into standard dynamic macroeconomic models.⁸

What then can trigger widespread disruption of financial flows? As documented by Reinhart and Rogoff (2009), virtually all financial crises have been associated with large scale and ultimately unsustainable increases of indebtedness. Widespread availability of credit can lead to substantial rises and subsequent correction of asset prices. Over recent years there has been a growing interest in the possibility that psychological mechanisms such ‘framing’ or ‘regret’ may allow asset prices to rise to much higher levels than can be justified on fundamental grounds. Shiller (2002) makes a more general case for believing that wider social and cultural mechanisms can also fuel asset price bubbles.

But asset price rises do not always cause financial instability. Calvo and Loo-Kung (2009) have recently argued that asset price bubbles and economic fluctuations are economically beneficial, encouraging socially worthwhile innovation in booms and allowing the removal of unwanted capacity in downturns. In any case the correction of such departures from fundamentals need not necessarily have much impact on financial flows and expenditure (for further discussion see Collyns et. al. (2009) in this volume). Yes, the emergence and subsequent correction of asset price bubbles is likely to have a substantial distributional impact, with major losers (those who have bought into the bubble at a late stage) as well as major gainers (those who have bought early). But there is little clear evidence that stock prices, for example, whether rising or falling, have any major direct impact on financial flows or aggregate demand.⁹ Declines in property prices appear to have a bigger impact on expenditure than stock prices, but this arises mainly because of the role of property as collateral for borrowing and the consequent reduction in access to credit when property prices decline, but property prices (in comparison to stock prices) typically rise and fall relatively gradually. Once again this should not necessarily lead to disruption of financial flows. There was no obvious reason to expect the magnitude of disruption to financial flows and expenditure that was to take place in 2007 and 2008, once US house prices began to fall.¹⁰

⁸ See Kilponen and Milne (2008) for an example of a standard dynamic macro-model with a banking sector; they find that allowing banking interactions makes only a relatively small difference to output inflation tradeoffs. There is now something of an explosion of similar work on dynamic macroeconomic models, incorporating bank intermediation, but none this work models disruption of financial flows.

⁹ On the contribution of stock and property prices to macroeconomic fluctuations see Case, Quigley and Shiller (2001) and Muellbauer and Murphy (2008).

¹⁰ The papers presented at the 2007 Jackson Hole conference (including Mishkin (2007) and Muellbauer (2007)) provide a thorough discussion of the role of house prices in monetary transmission and consumer expenditure, but do not anticipate their potential for triggering a sharp reversal of financial flows.
What mechanisms then lead to the end of a credit and asset price boom triggering a widespread disturbance of financial flows, especially of bank credit? How are these mechanisms to be analysed? The general point, which is only very recently becoming widely accepted, is that such disruption arises because of ‘network’ interconnections leading to domino-effects operating within the financial system, with solvency or liquidity problems in one institution can lead to similar problems in other institutions.\(^\text{11}\) Recently there has been a considerable interest in modeling these kinds of events and of studying the possibility of highly non-linear responses to external shocks. Such studies focus on the fact that systems which appear to be in a stable equilibrium state can collapse after what seems to be a small shock. This is a property of complex adaptive systems in various contexts including ecology and epidemiology. For applications to banking see for example Nier et. al. (2008), Aikman et. al. (2009) and May and Arinaminpathy (2009).\(^\text{12}\)

Haldane (2009) provides an overview of this type of ‘network’ modeling, viewing the financial sector as a complex adaptive system. His discussion emphasizes two aspects of network interconnections in the financial sector, namely complexity and lack of diversity. Connections within the international financial system have become increasingly complex over time and characterized by the increasing importance of a small number of nodes (large global institutions) that are connected to a large proportion of other nodes (other financial institutions.) Also and increasingly, the portfolios of financial institutions has become less diverse, with the transfer of risk resulting in large common exposures. He argues that the risk of destabilizing reaction can be reduced by various measures, including putting in place a system to map the global financial network, appropriate control of the failure of large, interconnected institutions and more widespread implementation of central counterparties and intra-system netting arrangements, to reduce the financial network’s dimensionality and complexity.

While the importance of network interactions as a source of financial instability is now widely recognized, modeling and quantifying these phenomena is a considerable challenge. Standard macroeconomic modeling relies on linearization around steady-state solutions. This is a natural approach to the modeling of monetary transmission but unhelpful for understanding financial instability, because the mechanisms that disrupt flows of financial intermediation are inherently non-linear, having little impact on small scale but becoming much more powerful on a larger scale. We also need to abandon our usual ‘representative agent’ assumptions, meaning that we have to rely on numerical rather than analytical solution.

\(^\text{11}\) There is earlier work on modeling financial instability, for example models of multiple equilibria reviewed in Masson, (1999), and models of interbank exposures as a source of contagion reviewed by Upper (2005) and also the ‘sudden stop’ models of capital flow instability in small open economies (Calvo and Reinhart (2001)). De Brandt and Hartmann (2002) provide a survey. The increasing interest in network models is in part because none of this earlier analysis suggested the possibility of a widespread crisis such as occurred in 2007-2008.

\(^\text{12}\) Complex adaptive systems modelling has been applied to other economic phenomena, such as technological innovation and business strategy, as well as to financial instability. See Beinhocker (2007) for a lively review.
The challenge however is more than just technical. Financial instability is not only triggered by network complexities alone, but also by the reversal of an unsustainable build up of debt and asset prices. This implies that assessing the risks of such a crisis taking place requires us to model both financial networks and macroeconomic balance sheets and asset pricing. Despite recent advances and many new insights, this remains a largely undeveloped field of economic modeling and is a long way from providing a reliable basis for forecasting and risk-quantification.

3. The financial sector vulnerabilities that magnified the recent crisis

While we do not have precise models, we can examine retrospectively the macroeconomic mechanisms and network vulnerabilities that resulted in the massive disturbance of financial flows in the recent crisis. The discussion here focuses on the network vulnerabilities within the financial sector rather than on the global imbalances of savings discussed in more detail by Collyns et. al. (2009) in this volume. At the heart of the crisis was the rapid growth and extensive securitization of US sub-prime residential mortgage lending. But as Table 1 (from Milne (2009a)) indicates, the total volume of subprime residential mortgage-backed securities (loans to US borrowers with low or unstable incomes and so not eligible for the standard low interest rate prime mortgages taken out by most borrowers) was not so large, amounting to only around $800bn, or about one-ninth of the total issue of loan backed and other structured credit securities in the US and Europe. Total US sub-prime residential mortgage lending, both securitized and retained on balance sheet peaked, at about $1.2 trillion, about 10 per cent of all US mortgage lending and around 1½% of total global banking assets. It is true that underwriting standards deteriorated badly in sub-prime lending, especially in 2006 and 2007, the final years of the US credit boom. But total loan losses (net of recoveries) on sub-prime lending, even if they climb as high as $250bn or 20% of total lending, are far too small to explain the subsequent impact on the global financial system.

There were a number of closely related mechanisms that amplified the impact of sub-prime losses on the global financial system. Here are three such mechanisms:

13 The following account of the crisis draws on Brunnermeier (2009) and on Milne (2009a). See also the various issues of the IMF global financial stability report for detailed assessment of the evolution of the crisis.

14 For more detailed discussion of these statistics see Milne (2009a) chapter 2.

15 A point documented by Demyanyk and Van Hemert (2009)

16 The losses reported for individual securities on www.absnet.net reveals average loss given default on the loans packaged in US subprime RMBS of around 15%, as of September 2009, so it is difficult to envisage ultimate losses exceed 20% of principal, i.e. around $250bn.
(a) The first was the high degree of financial institution leverage, relative to the magnitude of their risk exposures. Financial institutions engaged in wishful thinking, using apparently sophisticated statistical models and risk transfer techniques to persuade both themselves and financial regulators that the potential risk exposure was low and they could operate with relative low levels of capital. But these models were estimated using relatively short runs of data from an atypical and relatively benign period. Then, when the unexpected risks materialized, they were unable to absorb them without reducing lending or selling assets.

A major contributing factor to this excess leverage the widespread underestimation of correlations in the loans underlying the new structured credit securities, used to finance the global credit expansion. Banks holding these securities, as well as the rating agencies, insurance companies, and regulators, assessing their risk, all made the same mistake. They failed to appreciate that in the event of a large common shock, many tranches of these securities that in more normal economic circumstances would be expected to repay in full, would default and return little or nothing to investors. Their assessment of this correlation risk was based on data drawn for a period of only a few years, a period in which correlations of house prices and mortgage and other loan default were relatively low (for example there was no nationwide fall in US house prices). The re-assessment of correlation of default revealed that many of these securities were much riskier than previously thought, and created a loss of investor confidence in the entire asset class.

(b) The second vulnerability was unstable short term funding. Instead of bank lending being financed by retail deposits, or from the issue of long-term securities (bonds and equity), banks relied on short term unsecured wholesale borrowing or on the packaging of loans into securities so that they could be financed through collateralized borrowing in repo markets or through the issue of asset backed commercial paper (ABCP) by off balance sheet vehicles. Much of this intermediation operated through a parallel system of banking and ended up in the trading portfolios of the large investment banks, such as Bear Stearns, Merrill-Lynch, UBS and others; in the investment portfolios of many European banks with an excess of retail deposits to invest; and also held by the two giant US government sponsored enterprises Fannie Mae and Freddie Mac.\textsuperscript{17} The short term funding was rapidly withdrawn once doubts about liquidity and solvency

\textsuperscript{17} The phrase ‘parallel’ banking is more appropriate than the phrase ‘shadow banking’ widely used by journalists, since this intermediation did not operate in the shadows. As documented by Adrian and Shin (2008) the build up of these portfolios was quite obvious from the accounting statements of the US broker dealers and other institutions.
emerged, triggering a cumulative collapse of transactions and pricing in the markets for structured credit products.\(^1\)

(c) The third vulnerability was the unappreciated extent of counterparty risk. For securities held in trading books or as investments, it became standard practice to purchase insurance against the possibility of either mark-to-market or cash flow credit losses. This insurance was purchased from a relatively small number of specialized ‘monoline’ insurance companies, such as AMBAC and MBIA, and from the financial products division of the global insurance giant AIG, often using the traded credit default swap. On the face of it, seemed like prudent housekeeping, to hedge risks and to lock in profits. But in practice the insurance was illusory because the sellers of this insurance, while claiming large profits from the premiums they received, had far too little capital to honour their promises in the event of a large aggregate shock.

Several other factors increased the susceptibility to systemic financial collapse. These included the legal uncertainties following the failure of Lehman Brothers; compensation arrangements that encouraged traders to hold large highly leveraged positions; failures in the ratings of complex ‘restructured’ instruments, gross weaknesses in the regulation, oversight and government support of some internationally active institutions (the ‘Icelandic’ problem of banks too big to save); accounting standards that encouraged excessive risk exposures and amplified the impact of illiquidity on bank balance sheets; and weaknesses of governance in a number of individual institutions (although certainly not all) that led them to making some very imprudent lending and investment decisions.\(^2\)

In the crisis all of these processes appear to have been at work, leading to a cumulative collapse in liquidity and sharp falls in the valuations and trading volumes of the new structured credit instruments. These were extreme manifestations of the ‘endogenous risk’, highlighted by Adrian and Brunnermeier (2009) and by Brunnermeier et. al. (2009). This collapse was driven by what engineers call ‘positive feedback loops’, with falling asset prices and worsening bank balance sheets triggering widespread withdrawal of short term money market deposits, which further worsened bank balance sheets and forced them to sell structured securities. The resulting weakening of bank balance sheets also lead to reduced lending and so worsened the macroeconomic downturn and further undermined bank balance sheets. These feedback loops culminated, after the failure of Lehman Brothers in September 2008, in the collapse of wholesale money markets and a major global contraction in both credit availability and in household and

\(^{1}\) For discussion of the modeling of liquidity risks see Freixas (2009) in this volume and also Allen and Gale (2009) and Hölstrom and Tirole (2008).

\(^{2}\) Milne (2009a) chapter 8, provides a comparative review of how some of the largest global institutions have fared during the crisis.
consumer expenditure. According the IMF (2009) the resulting impairment and writedowns on bank credit exposures will rise to 2.8 trillion by end 2010.

The initial disturbance and its global financial impact are illustrated by Figures 1 and 2 (updated from Milne (2009a)). Figure 1 shows the peaking and then steady decline of US house prices, and how this in turn triggered first a collapse in the price of sub-prime mortgage backed securities (measured by the ABX indices) and the impact on bank share prices. Figure 2 shows how this also produced major stresses in short-term money markets, as revealed by the spreads, between unsecured and collateralized 3-month borrowing rates. Eventually these stresses have abated, helped by government and central bank support for the financial system and exceptionally loose fiscal and monetary policy, but still normal relationships between interest rates have not been fully restored.

Figures 1 and 2 about here.

4 The policy responses

There have been many policy proposals for preventing a recurrence of anything comparable to the recent global financial crisis. Amongst the most prominent have been the Geneva Report (Brunnermeier et. al. (2009)), a volume on the crisis written by faculty of the NYU-Stern School (Acharya and Richardson (2009)) and the various reports of the ‘Squam Lake Group’. The Geneva reports focuses on the tendency for both internal risk controls and regulatory capital requirements to become increasingly lax in credit booms and the tendency for maturity mismatch and leverage to increase in periods of credit expansion. It also emphasises the possibility of ‘endogenous risk’ with falling asset prices triggering asset sales and further price falls. To address these concerns it proposes the introduction of pro-cyclically varying capital requirements, based on both with the rate of credit growth and the level of maturity mismatch.

The NYU-Stern book is wide-ranging, stressing also the need for regulation of bonuses and remuneration, so as to discourage excessive risk-taking, the desirability of charging for public sector deposit and liquidity insurance, the advantages of ‘taxing’ large complex financial institutions through capital requirements or insurance charges for the risks they impose on the rest of the system, and the benefits of central counterparties in over the counter derivative markets to limit counterparty risk. The Squam Lake Group have made further proposals. One that has attracted widespread support is Squam Lake Group (2009), proposing that financial institutions are required to issue hybrid securities that transform into equity in a systemic crisis. These proposals have not gone unheeded. Financial regulation has been a top level agenda item at the twice yearly meetings of the G20 meetings of the world’s political leaders, and the subject of several studies coordinated by the Financial Stability Board (formerly the Financial Stability Forum) and the various Basel regulatory committees (see in particular Financial Stability Board (2009)). By the early autumn of 2009 these bodies had agreed on several changes in financial regulation.
While explicit mechanisms for the pro-cyclical variation of capital requirements have not yet been agreed, there will be substantial increases in the level of required regulatory capital requirements, especially for trading activities, and a framework for ensuring banks hold further buffers of capital that are built up in periods of expansion and can then be drawn down in subsequent downturns. In addition new and quite demanding liquidity requirements have already been announced in the UK and Switzerland and will be introduced in other countries.

Other regulatory measures are also being taken, for example improved oversight of hedge funds, of credit rating agencies and of off-shore financial centres; the promotion of central clearing arrangements in over the counter markets; arrangements for the more orderly resolution of large firms when they are in financial distress; and new rules on retaining risk when loans are securitised. The most contentious issues, on which there is not yet an international agreement, are on control of bonuses (the issue here is whether regulators should limit themselves to the mechanics of bonus payments; or should also attempt to control their level) and on the regulation and supervision of internationally active firms with substantial cross-border activities (the problem here is how in practice to do this job, should it be the responsibility of the authorities in the ‘home country’ where the group is headquartered or the various authorities in the ‘host countries’ where branches and subsidiaries operate; and how are these different authorities to co-ordinate their work). Regulators are also working on so called ‘living wills’, requiring large financial institutions to have in place effective arrangements for winding down their businesses in the event of financial distress.

Finally a new architecture of macroprudential bodies is being established in several jurisdictions. The EU has made most progress. The three existing high level supervisory committees in the European Union – for banking, securities markets, and insurance – are to be transformed into supervisory bodies with their own resourcing and the power to impose rules on cross-border institutions (these new bodies will be referred to as European System of Financial Supervisors (ESFS)). There will be a new European Systemic Risk Board (ESRB) that will issue warnings about systemic financial risk and, where necessary, supplementary policy recommendations.

The Obama administration issued a ‘white paper’ in mid-June, 2009, setting out their proposals for reform of the US regulatory structure, including two new regulatory bodies, a National Bank Supervisor and a Consumer Protection Agency. The National Bank Supervisor will supervise all federally chartered banks (combining Office of Thrift Supervision and Office of Comptroller of the Currency). In addition a third body, the ‘Financial Oversight Council’ will identify systemic risks and seek to improve co-operation among US regulators. Finally the administration proposes to complement the role of the national bank supervisor, by give the Federal Reserve supervisory authority over other institutions that could represent a threat to financial stability, including both bank holding companies and non-bank financial institutions. By August, 2009 the administration

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20 See Milne (2009b) for more detailed discussion. Key references on the regulatory developments include Basel Committee on Banking Regulation (2009a, 2009b)) and the websites of the Financial Stability Board, the European Commission, the US Treasury and the UK Financial Services Authority and HM Treasury.
had sent some nine pieces of legislation to Congress covering these and other regulatory reforms, but these proposals are contentious and several competing proposals have emerged in the US Congress.

The UK authorities have issued a white paper (HM Treasury (2009)) which amongst a range of recommendations, proposes a Council for Financial Stability (CFS), chaired by the Chancellor of the Exchequer (the UK minister of finance), providing oversight of the regulatory system and its effectiveness in responding to systemic financial risk. The white paper also proposes altering the statutory objectives of the UK Financial Services Authority to include a responsibility for addressing systemic financial risk and strengthening the powers of the FSA to better enable it to pursue this objective.

Amongst the largest developed economies, only Japan has not established a body with specific responsibility for co-ordinating the response of the financial authorities to systemic financial risk. Japanese financial institutions have been relatively unaffected by the financial crisis and because Japan is in any case only partway through a major programme of regulatory reform (see Japanese FSA (2009)). Some countries, for example Switzerland and Belgium, have also transferred responsibility for bank supervision into their central banks, so that responsibility for financial and monetary stability is handled by one institution.

5 Promoting resilience in the financial system

This section considers how regulatory instruments might be used to promote the resilience of the financial system, reducing the extent to which external shocks are amplified and lead to disruption of credit and other financial flows.

The view of Bank of England Governor Mervyn King, quoted in the introduction, is that financial authorities have lacked sufficient policy instruments to achieve financial stability. This is reminiscent of the once widely accepted framework of ‘two targets – two instruments’ and the control of both external and internal balance that was core macroeconomics in the early 1970s. In the Bretton-Woods world of fixed exchange rates it was appropriate to target both price stability (keeping aggregate output close to aggregate supply) and current account balance. The two independent instruments that could be applied to this task were monetary and fiscal policy.

This desire to maintain an external current account balance was a reflection of a national or in effect government solvency constraint, limiting the ability to borrow foreign currency reserves. Even when Bretton-Woods had broken down, capital controls were still widespread and as a result international capital markets remained relatively thin. Thus even developed countries faced the threat that inability to finance current account deficits would bring about a disorderly fall of the exchange rate, costly disruption to the flow of funds to government, household and corporate borrowers, and the ignominy of a ‘bailout’ (for example when the UK turned to the IMF in 1976.) This issue never went away entirely for smaller countries. For example there are the well known
problems faced by many emerging markets in maintaining access to external capital flows, and the substantial literature on ‘sudden stops’ in emerging markets, when they are suddenly cut off from access to external borrowing.\textsuperscript{21}

While the general principal of targets and instruments is still relevant today, we are no longer in a world of just two targets (internal and external balance) and two instruments (monetary and fiscal policy). Now we must rather think in terms of ‘n-targets – n instruments’.\textsuperscript{22} In the 1960s policy makers could pursue a single and simple measurable target, the avoidance of a large current account deficit, and be confident that by achieving this target they could avoid a costly disruption to financial flows. But this approach to policy is no longer applicable in a world of deregulated banking and financial markets and external capital account liberalization in which there can easily be disruption of financing flows to any individual sector – household, corporate or government – and to financial intermediaries.

Section 4 has discussed the different ways in which such disruption arose in the current crisis. The ‘n-targets – n-instruments’ perspective suggests we need to have at least one different macroprudential instrument for each one of these potential disruptions:

(a) The first mechanism of disruption noted above was the excessive leverage and associated underestimation of risks in financial institutions. Risk management systems failed to anticipate the scale of deterioration of asset values that occurred in the recent crisis; or the related issue of high level of correlation of returns between different exposures. This major risk management failure was a source of ‘endogenous risk’ and contributed substantially to the magnification of the initial sub-prime shock. With the benefit of hindsight we can see that risk managers and regulators alike relied far too much on quantitative models, which should never have been expected to accurately quantify tail risks. Rather financial institutions should always have maintained sufficient buffers of capital that they can absorb any potential losses, even in a highly unlikely extreme scenario. Capital and leverage regulation will have to be amended to ensure that such buffers of free capital are available in the future.

(b) A second mechanism was the withdrawal of short term funding. Reducing this risk depends on having an appropriate liquidity policy, ensuring that all financial intermediaries that make substantial use of short term funding have considerable protection against unexpected loss of this funding, whether through assets sales, or by borrowing from other firms or from the central bank.

(c) A third mechanism was the high level of unrecognized counterparty risks. This requires a different approach, a summary of counterparty risks at an aggregate level, ensuring that

\textsuperscript{21} A point highlighted by Calvo and Reinhart (2002)

\textsuperscript{22} This necessary condition is one part of the Tinbergen (1963) theory of economic policy. For a general discussion of the importance of this theory to macroeconometric modelling and policy see Hughes-Hallet (1989)
individual firms are aware not just of their own exposures to other firms, but also of how these other firms are in turn exposed across the entire market. There is a strong case for institutionalizing this aggregation by establishing a central register of counterparty risks for all significant insurance and trading risks. This would impose substantial costs in terms of data requirements, but these are costs which are difficult to avoid if counterparty risk is to be effectively controlled. Many argue that this should be taken further and that all over the counter contracts should be held against a central counterparties, so that no market participants are directly exposed to each other; 23 but this is an ambitious agenda creating considerable challenges for the effective risk management of the central counterparty.

All three of these mechanisms are particular instances of ‘network interconnections’. But each aspect of network interconnections needs a somewhat different policy response, in order to prevent it leading to domino-like failure when the system is subject to a major disturbance.

But there is still much to be decided on how new regulatory instruments, including capital and leverage and liquidity requirements, will be used to address these vulnerabilities. A central debate is about the level of capital requirements imposed on banks and in particular whether these should be based on quantitative formulae. A recent Bank of England discussion paper (Bank of England (2009)) addresses this issue, proposing that further institution specific capital charges could be introduced to deal with network effects, and in particular that these should be higher the greater the spillover effects of an individual bank decisions on risk in the rest of the financial network.

To assess such proposals it is useful to refer to a distinction drawn by Borio (2009) between the cross-sectional and time series aspects of systemic financial risk (this corresponds with a distinction made in Bank of England (2009) between network risk and aggregate risk). As Borio puts it, when market participants have large common exposures or all rely on short term funding, then they can react in a similar way to a disturbance and this common response can lead to an amplification of the initial disturbance, perhaps because of ‘fire sales’ of assets at deeply discounted prices. This can disrupt a particular part of the financial system, for example markets for relatively illiquid securities or for short term money. The main driver is the pattern of assets and liabilities amongst financial institutions, households and firms. This is the cross-sectional or network dimension of systemic risk.

The question then arises whether new macroprudential instruments – such as liquidity and capital requirements – need to be used to respond to the cross-sectional element of systemic risk and if this will be according to a formula or on a discretionary basis. Adrian and Brunnermeier’s concept of CoVar, discussed in Section 2 above, has been put forward as a way quantifying the level of systemic risk and could at least in principal be used to measure the ‘externality’ posed by financial firms exposure, through quantifying the contribution fo each individual firm to system wide risk. Adrian and Brunnermeier (2009) suggests various practical metrics, such as maturity mismatch,

23 A shift to such central counterparty arrangements is already taking place in the market for credit default swaps.
size and leverage and present econometric estimates of the contribution of these metrics to CoVar and hence might be used as a basis for regulatory capital requirements to offset this systemic externality.

This is an attractive suggestion, but there needs to be a degree of caution. As the discussion of section 2 has indicated, we do not now have and may never have reliable and robust models that can be used for this quantification. Even if we reach a consensus on the specification of these models we are unlikely ever to have data to accurately estimate the parameters. Furthermore as Borio (2009) points out, having minimum capital requirements that increase say with the past rate of loan growth along the lines suggested by Brunnermeier et. al. (2009) does not provide useful buffers in a crisis, because the capital requirement are backward looking and remains high even when there are growing concerns about the solvency and liquidity of financial institutions. The Adrian and Brunnermeier (2009) measures are subject to the same criticism, they do not ensure that there are sufficient buffers of free capital available, when they are to prevent the amplification of initial shocks.

For this reason regulators appear to be moving in another direction, seeking to establish a more discretionary framework that will ensure that firms have sufficient capital to cope with any likely external shock. Models of network vulnerabilities will be used to inform this process, but ultimately this will be a judgmental framework for setting high levels of additional buffers that firms must hold above the minimum required levels of capital. The authorities will then expect firms to use these buffers to absorb risk when they are affected by external shocks. Also, as Bank of England (2009) indicates, the authorities will be especially focused on ensuring that highly interconnected firms, whose failure could have a major impact on other institutions, have sufficient capital to survive a major shock.

A concern is that if the authorities are successful in containing the cross-sectional contribution to systemic risk in this way, then this may actually increase the overall risks to the system. If individual markets and institutions are better able to carry a large amount of intermediation, then overall stocks of domestic borrowing and lending can be increased to comparatively high levels. So if, for example, we force banks to hold relatively large amounts of liquid assets, we reduce maturity mismatch and the threat of a ‘run’ on weaker banks, such as occurred in the autumn of 2008. But if this allows bank lending to increase to even higher levels, and the disruption when it does eventually arise, may then be even greater. Disruption can be seen as a safety valve that dissipates pressures building up in the financial system, and if we protect one part of the pipeline from blowing, then the explosion may still happen elsewhere and be even larger.

On the other hand it can also be argued that efforts to deal with the ‘cross-sectional’ or network risks will in turn encourage individual banks to take better account of aggregate risks. A major underlying cause of the current crisis is moral hazard. Shareholders, bond holders, bank

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24 At the time of writing, in November 2009, the detailed proposals on the reforms to bank capital regulation had not yet been announced by the Basel committee
management and employees all felt they could rely on a government backed safety net to protect them from extreme losses, and this encourage both risk taking and operation with inadequate liquidity and capital buffers. There were also major ‘principal-agent’ problems, in far too many firms. Traders and business divisions were allowed to take on excessive risks that were clearly not serving the interests of shareholders. Current efforts to establish workable arrangements for resolving distress in large systemically important financial institutions, including raising additional private capital in times of crisis, will ensure that a greater share of the costs of failure falls on shareholders and bond holders than in the past. This will in turn create stronger incentives to address these moral hazard and principal agent problems.

These changes are likely in turn to make banks and other intermediaries more cautious about extending credit and make it more likely that there is a ‘soft landing’ following a credit expansion, rather than a ‘hard landing’ with disruption of financial flows and sharp reductions of aggregate output and expenditure.

Measures taken by the macroprudential authorities can be expected to contain the network vulnerabilities that emerged in the current crisis. The more difficult challenge for policy makers will come when they need to adapt to new innovations in the financial system. The staff and managers of financial institutions are generally much better at understanding and coping with familiar risks where they have many years of experience of the underlying risk exposures and long runs of data to use for modeling and quantification. There is much greater likelihood of systemic interactions when financial institutions are holding new products and instruments of which they have only little experience and for which there is only limited data. We can only hope that the authorities respond appropriately to such new emerging risks.

6 Addressing unsustainable credit expansions

The previous section suggests that regulatory instruments such as capital and liquidity requirements can be effective in strengthening specific parts of the financial system against system wide disturbance (the cross-sectional or network dimension); but it is far from clear that they will be enough to prevent unsustainable increases of credit and asset prices (the time series or aggregate dimension).

There are two potential problems in addressing the time-series dimension of systemic risk.

- The first is political opposition to the discretionary use of regulatory instruments to offset credit expansion and asset price booms

This is a problem for the discretionary use of any public policy instruments. There will political resistance whenever these instruments have an impact on particular business interests, for
example particular industries such as construction and property development or finance. The losers from such measures may be politically powerful and able to bring considerable pressure to bear on the authorities that are supposed to wield them.

In the case of monetary policy a degree of independence of such political pressures has been achieved by giving central banks operational independence and making the control of inflation their central policy objective. But it is more difficult to achieve such operational independence for financial stability, because the goal itself cannot be easily quantified and because fiscal and regulatory policy impact more obviously on particular interest groups. Moreover, once a sustained asset price and credit expansion is established, the macroprudential authorities will be very reluctant to take action for fear of triggering the very crisis that they are supposed to prevent.

- The second problem is that the discretionary use of regulatory instruments, such as procyclical increases in capital requirements, to limit increases in credit, leverage and asset prices, may turn out to conflict with the operation of monetary policy and the control of inflation.

The danger is that macroprudential policy and monetary policy end up like pantomime horses, pulling the cart (aggregate expenditure) in two different and entirely opposed directions at once. Thus it may turn out that monetary policy committee are lowering interest rates to raise asset prices and stimulate aggregate demand and so bring inflation back up towards target, while at the same time the financial stability committee is increasing capital requirements in order to reduce debt and leverage and contain systemic financial risk.

There is scope for using macroprudential instruments to address the build up of systemic risk over time, but in order to avoid political interference and conflict with monetary policy, it will be much better if this is done according to fixed rules rather than on a discretionary basis. It is especially important that changes in capital requirements over time are predictable and so can be taken into account by banks and monetary policy makers, otherwise there is a very real danger that bank lending and the transmission of monetary policy will be permanently inhibited.

A further complementarity between the application of monetary and macro-prudential tools may be achieved by imposing constraints such as limits on mortgage loan to value ratios. This may serve to restrain the ‘hot spots’ in particular markets, such as regional housing markets. Employed in the years 2004-2006, this might have limited the housing boom in those few US states (such as California and Florida) experiencing the most pronounced appreciation of house prices and where many ‘sub-prime’ losses have been concentrated (although this would not have done much for ‘rust belt’ states such as Michigan and Ohio which also experienced high levels of sub-prime losses). Such measures have particular potential in a large monetary areas and might have restrained expenditure in member countries of the European union, such as Ireland and Spain, for whom Eurowide interest rates were inappropriately low. During boom periods this will serve to shift financial flows from the banking to the non-bank system or from rapidly expanding regions to slow growing regions. In effect such measures could promote financial stability by reducing the
cross-sectional component of systemic risk in compensation for the increased time series component of systemic risk.

But macroprudential measures will not eliminate all risk of financial instability. Policy makers need to be prepared, if necessary, to use a further aggregate instrument to respond to the ‘time series’ element of systemic financial risk and so achieve the desired policy goal of avoiding widespread disruption of financial flows. The obvious candidate for this role, just as in the Bretton-Woods era, is fiscal policy.25

The use of fiscal policy to promote financial stability leads into a number of contentious issues, going well beyond the scope of the present paper. These can be briefly mentioned:

- Ricardian-equivalence arguments suggest that changes in taxation have no impact on private sector wealth and hence no impact on private expenditure. These arguments rest on strong assumptions, but even when they are put to one side it has to be recognised that government expenditure and taxation are clumsy and ineffective tools for exercising short term influence over output and expenditure. There is therefore no reason to depart from the general consensus that in normal economic conditions the control of aggregate expenditure is the task of monetary policy alone. The use of fiscal stimulus to increase output should be a temporary measure used only in times of economic crisis.
- Anticipating the need for expansionary fiscal policy in times of crisis, suggests that we should expect the fiscal authorities to reduce public sector debts and deficits during a period of sustained and strong economic expansions, and to do so actively by increasing tax rates and tightly controlling government expenditure, not just by relying on buoyant tax revenues.
- We cannot expect fiscal policy alone to correct the current unsustainable global macroeconomic imbalances. These reflect deep-seated underlying structural features of the global economy, including high savings rates in many emerging markets (in turn a consequence of other factors such as low levels of social security provision, misalignment of exchange rates and limited access of both households to domestic credit) and corresponding low levels of saving in many developed markets (also encouraged by structural features such as generous tax deductability of debt interest).
- The use of fiscal policy to address global imbalances is further constrained by the problems of international policy co-ordination. Each country would rather rely on other governments and hence on the taxpayers of other countries to provide fiscal stimulus. As a consequence fiscal policy may end up being used, as has happened since the outbreak of the current global crisis, to maintain rather than correct global imbalances of savings.
- It may take some years, but if fiscal policy in the developed continues to be used in the way it is now, to maintain unsustainable credit flows, then the eventual outcome will be a loss of fiscal credibility. This in turn would create a global financial crisis much deeper than that we have recently experienced. There is plenty of time to act, but the underlying structural problems of the global economy must not remain unaddressed.

25 Exchange rate policy can also be considered for this purpose, but the foreign exchange rate is an independent policy instrument, with an impact additional to fiscal and monetary policy, only when there are controls on capital flows.
Still, despite these reservations, it is well worth exploring the application of regulatory instruments as a supplementary tool to restrain credit expansions; but we must not expect these to entirely remove the aggregate or time series contribution to the risk of financial instability.

7 Conclusions

This paper has discussed the new ‘macroprudential’ approach to economic policy making and what this can hope to achieve. It argues that while financial markets and financial institutions are very different from those of fifty years ago, the policy challenges have not really changed. Policy makers still should seek to achieving financial stability, here interpreted as protect households and firms from widespread disruption of financial flows, alongside price stability. Macroprudential policy in this sense is far from being new.

There are two related but distinct sources of financial instability. Many proponents of macroprudential policy seem to have in mind the need to contain booms and busts in credit and asset prices. This is what has been referred to here in the terminology of Borio (2009) as the time-series dimension of systemic financial risk. The suggestion is to use regulatory instruments, such as capital and liquidity requirements, to respond to unsustainable national or sectoral debts or deficits, for example through cyclically increasing bank capital requirements during credit expansions.

While this is an attractive suggestion we should not expect too much from it. It has the great advantage that the responsibility for price stability would remain the main objective of monetary policy makers, allowing them to focus on the control of inflation. But raising capital and liquidity requirements, in order to prevent unsustainable credit booms and asset price bubbles, even were macroprudential authorities able to recognize these dangers in a timely enough fashion to take action, would result in an unacceptable degree of conflict with monetary policy. The best we can expect from macroprudential policy in addressing these aggregate risks is something much more limited, acting a complement to monetary policy decisions by encouraging individual institutions to take better account of the risks they are taking and ensures that particular markets or regions do not overheat.

Ensuring financial stability, in this macroeconomic sense of limiting booms in credit and asset prices that so often trigger disruption of financial flows, requires relatively conservative fiscal policy during booms, and a political willingness to take fiscal, exchange rate or other policy actions when credit expansion and asset prices have clearly got out of hand. It is not so much that we need additional policy instruments, as Governor Mervyn King as argued, as that we need to use better the ones that we already have. Creating new macroprudential institutions, even if these are given responsibility for oversight of fiscal policy and its contribution to systemic financial risk, does not overcome the fundamental institutional and political sources of financial instability.
What we can expect from macroprudential policy is an effective response to the ‘endogenous risk’ or network interactions within the financial system, such as those triggered by maturity mismatch, excessive leverage combined with exposure to common sources of risk, and by hidden or mismanaged counterparty risks. In Borio’s terminology this is the cross-sectional component of systemic financial risk. Endogenous risk is again nothing new. It appeared frequently as far back as the 18th and 19th centuries, in the occasional episodes where loss of confidence triggered banking panics. But in today’s relatively sophisticated and rapidly innovating financial systems endogenous risk has emerged in new manifestations, in forms that could not have occurred in the highly controlled financial systems of the 1960s. We should thus expect macroprudential authorites to address past vulnerabilities, such as the excessive leverage, maturity mismatch and counterparty risk that transmitted disturbances in the current crisis; and also to be alert to new sources of systemic financial risk emerging from within the financial sector and take steps to avert new potential sources of disruption.
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Table 1. Approximate magnitudes of the European and US structured credit market

<table>
<thead>
<tr>
<th></th>
<th>Europe</th>
<th>US</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency RMBS</td>
<td>5.9</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td>Sub-prime RMBS</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Other RMBS</td>
<td>1.0</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>ABS</td>
<td>0.2</td>
<td>1.8</td>
<td>2.0</td>
</tr>
<tr>
<td>CMBS</td>
<td>0.2</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>CDO</td>
<td>0.4</td>
<td>1.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>1.8</td>
<td>11.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Total non-agency</td>
<td>1.8</td>
<td>5.2</td>
<td>7.0</td>
</tr>
</tbody>
</table>

This is Table 2.2 of Milne (2009a). Sources: ESF, SIFMA. US CMBS and CDO are author’s estimates of stock outstanding based on published data for issuance flow. US ABS excludes $1trillion of ‘other’, mostly government guaranteed ABS. European data converted to dollars using end-2007 exchange rate of $1=€0.6794. RMBS=Residential Mortgage Backed Securities. CMBS= Commercial Mortgage Backed Securities. ABS= Asset backed securities i.e. backed by non-mortgage household and small business loans. CDO= backed by other loans and debt, including leveraged loan, bond, and synthetic structures.
Figure 1. Housing problems spread to banks. *Source* Bloomberg, HSBC.
Figure 2. Libor vs. good collateral repo rates (three-month) Source: Bloomberg