

The Role of Liquidity in Financial Crises

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I. Introduction

The crisis that started in the summer of 2007 came as a surprise to many people. However, for others it was not a surprise. John Paulson, the hedge fund manager, correctly predicted the subprime debacle and earned \$3.7 billion in 2007 as a result.¹ The vulnerabilities that the global financial system has displayed were hinted at beforehand in the Bank of England and other Financial Stability Reports.² *The Economist* magazine had been predicting for some time that property prices in the U.S. and a number of other countries were a bubble and were set to fall.³

Although the fall in U.S. property prices that is the fundamental cause of the crisis was widely predicted, the effects that this had on financial institutions and markets were not. In particular, what has perhaps been most surprising is the role that liquidity has played in the current crisis. The purpose of this paper is to use insights from the academic literature on liquidity and crises to try to understand the role of liquidity during the last year. We focus on four possible effects of liquidity: on pricing, on interbank and collateralized markets, on fear of contagion, and on the real economy.

One of the most puzzling features of the crisis has been the pricing of AAA tranches of a wide range of securitized products. It appears that the market prices of many of these instruments are significantly below what plausible fundamentals would suggest they should be. This pricing risk has come as a great surprise to many. We argue that the sharp change in pricing regimes that started in August 2007 is consistent with what is known in the academic literature as “cash-in-the-market” pricing. Holding liquidity is costly because less liquid assets usually have higher returns. In order for providers of liquidity to markets to be compensated for this opportunity cost, they must on occasion be able to make a profit by buying up assets at prices below fundamentals. Once the link between prices and fundamentals is broken, then arbitrage becomes risky and the usual forces that drive prices and fundamentals together no longer work. This limit to arbitrage means that prices can deviate from fundamentals for protracted periods.

The second surprise has been the way in which the money markets have operated. The interbank markets for terms longer than a few days have experienced considerable pressures. In addition, the way that the collateralized markets operate has changed significantly. Haircuts have increased and low-quality collateral has become more difficult to borrow against. The Federal Reserve and other central banks have introduced a wide range of measures to try to improve the smooth functioning of the money markets. The extent to which these events affect the functioning of the financial system and justifies central bank intervention depends on the possible explanations as to why the markets stopped operating smoothly. One of the main roles of interbank markets is to reallocate liquidity among banks that are subject to idiosyncratic shocks. If banks hoard liquidity and as a result they are able to cover idiosyncratic shocks from their own liquidity holdings, then their unwillingness to lend to other banks is not a problem. If, on the contrary, the liquidity hoarding prevents the reshuffling of liquidity to deficient, but solvent banks, then the badly functioning interbank market is a problem warranting central bank liquidity provision. Allowing banks to exchange mortgage-backed securities for Treasuries is desirable if it improves collateralized lending in the repo market, but is not if it simply leads to more window dressing by financial institutions.

In this case, the actions of the Federal Reserve are simply removing market discipline.

The third aspect of the crisis that we consider relates to contagion risk. The controversial use of public funds in the arranged merger of Bear Stearns with J. P. Morgan was justified by the possibility of contagion. If Bear Stearns had been allowed to fail, its extensive involvement as counterparty in many derivatives markets may have caused a string of defaults. There is a large literature on the likelihood of contagion between banks based on simulations. The conclusion of this literature is that contagion in banking is unlikely. However, some have argued that these simulations do not capture important elements of the process. Whatever one's view of the likelihood of contagion in banking, it is important to conduct similar studies in the context of counterparty risk in derivatives and other markets.

Much of the academic literature on the role of liquidity in financial crises has focused on the effects on the real economy, mainly through the provision of liquidity to non-financial firms. We argue this has not been a significant factor to date in the current crisis. However, this may change going forward.

There is a growing literature on understanding the current crisis. Brunnermeier (2008) provides an excellent account of the sequence of events in the crisis focusing on a wide range of factors. Adrian and Shin (2008) argue that the dynamics of the crisis are driven by deleveraging. What sets our study apart from these papers is its primary focus on liquidity.

We start in Section II with a brief overview of the crisis focusing on the factors that are important for our subsequent discussion. Section III considers what liquidity in our context actually is and how liquidity created by banks, which is the focus of our study, can be measured. In Section IV we explain a theoretical framework for understanding liquidity provision. Section V applies this framework to gain insights into the current crisis. Finally, Section VI contains concluding remarks.

II. Liquidity and the Crisis

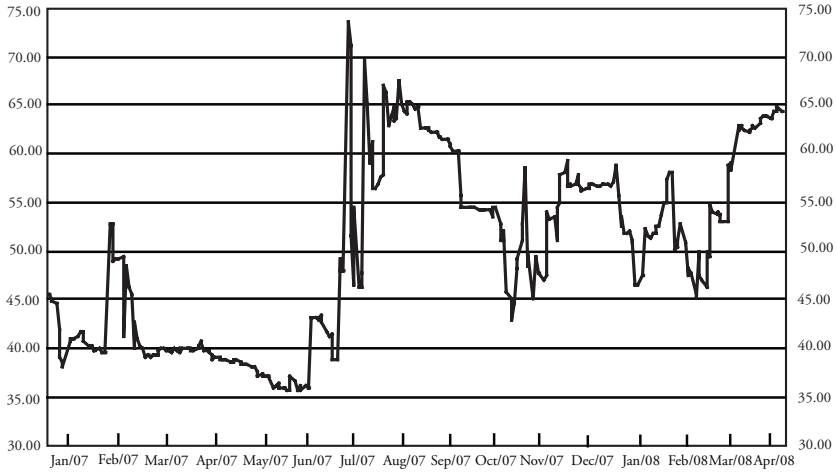
The crisis that started in the summer of 2007 is one of the most dramatic and important crises of recent decades. Its causes and unfolding have highlighted a number of new concerns and issues for policy makers, practitioners as well as academics interested in financial and monetary issues.

In the following we briefly outline the sequence of events. This provides a starting point for our discussion in subsequent sections. This description is mostly drawn from Federal Reserve Bank (2008a, 2008b) (see also Bank of England, 2008; Bernanke, 2008; European Central Bank, 2008; International Monetary Fund, 2007 and 2008; and Kohn, 2008).

The crisis started in the first half of 2007 when the credit quality of subprime residential mortgages, in particular adjustable-rate ones, started to deteriorate. Mortgage companies specializing in subprime products experienced funding pressures and many failed. Although problems were initially confined to the subprime mortgage markets, further deterioration of credit quality and increases in the delinquency rates led to a spread of the crisis to other markets and products. By mid-2007 investors started to retreat from structured credit products and risky assets more generally, as rating agencies started downgrading many mortgage-backed securities. The securitization market for subprime mortgages simply broke down. Chart 1 shows that in July 2007 there was a tremendous jump in the co-movement of AAA-rated tranches of subprime mortgage-backed securities, commercial mortgage-backed securities, and securities linked to corporate credit quality.

A general loss of confidence started to become pervasive. Signs of strain appeared in the leveraged syndicated loan market and in other leveraged lending markets in late June 2007, in the asset-backed commercial paper (ABCP) and in the term bank funding markets in August 2007. Spreads of collateralized loan obligations (CLOs) increased while the issuance of such debt reduced significantly, thus also reducing leveraged lending. Spreads on U.S. ABCP widened significantly in mid-August, while the volume of ABCP outstanding dropped significantly. This put substantial pressure on the structured

Chart 1
Co-movement between AAA-rated U.S. Structured
Financial Instruments
(in percent)



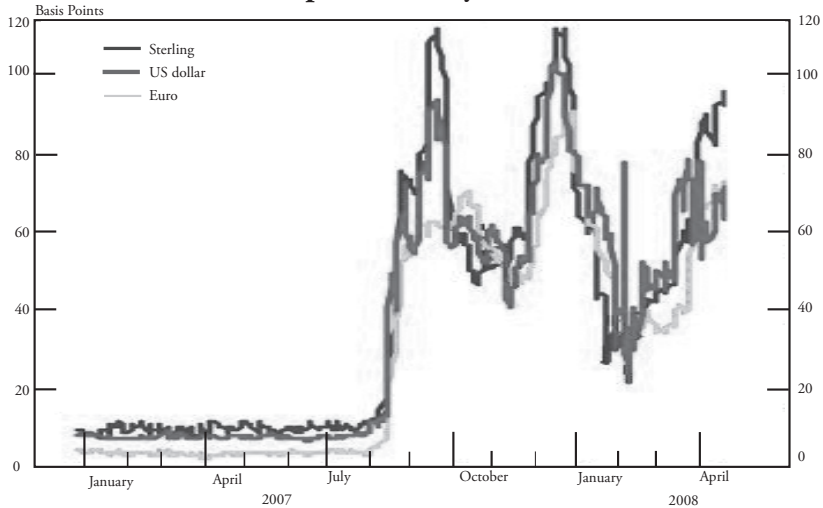
Source: Bank of England calculations using data from JP Morgan Chase and Co. – Bank of England *Financial Stability Report* (2008, p. 24, Chart 1.19).

Graph plots the proportion of the variation in exponentially weighted daily changes in credit default swap premia for the most senior tranche of the ABX HE 2006 H1, CMBX NA Series 1 and CDX NA explained by the first principal component over a three-month rolling window.

investment vehicles (SIVs) that had heavily invested in structured financial products. Many had to activate the contingent liquidity support from their sponsor banks.

At the same time, problems arose in the term interbank funding markets in the U.S., Europe and the U.K. Banks suddenly became much more unwilling to provide liquidity to other banks, especially for maturities longer than a few days. Reflecting that, Libor spreads rose significantly (Chart 2). The apparent reason for this liquidity hoarding was twofold. On the one hand, banks wanted to protect themselves against potential larger-than-anticipated liquidity needs deriving from the disruptions in the mortgage, syndicated loans and commercial paper markets. On the other hand, uncertainty about the counterparty risk increased as banks could not precisely assess their counterparties' exposure to the subprime related securities and also to the other disrupted markets.

Chart 2
Three-month Interbank Rates Relative
to Expected Policy Rates



Sources: Bloomberg and Bank calculations – Bank of England (2008), Chart 10, p. 11.

Spread of three-month Libor to three-month overnight indexed swap (OIS) rates.

After a relief of the tensions in September and October following a 50 basis point reduction in the federal funds rate, tensions mounted again in November and December when end-of-the-year considerations became an additional element fueling the uncertainty deriving from the subprime market crisis. Spreads widened significantly again in all affected markets, and a flight to quality led to a strong demand for safe assets and a sharp drop in Treasury bill yields.

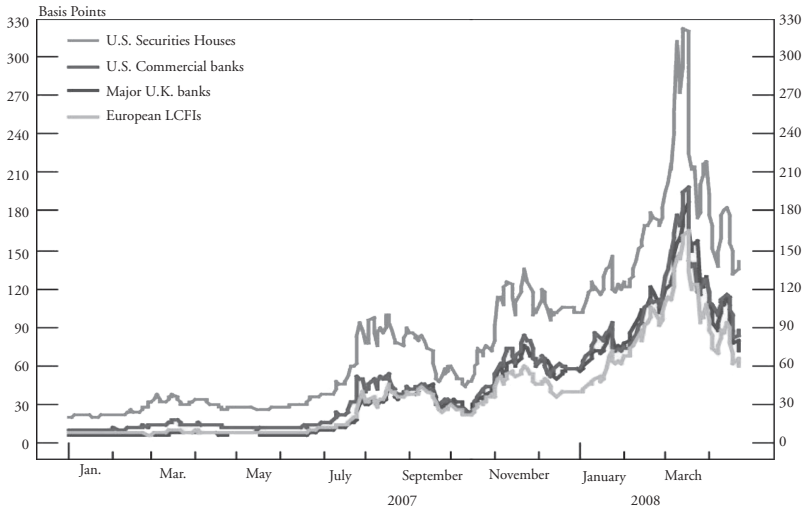
Problems mounted again in March 2008 when the release of news of further losses and write-downs due to the use of mark-to-market accounting increased concerns about the creditworthiness and the capital position of several institutions. Financial markets continued to be under great stress, particularly the markets for short-term uncollateralized and collateralized funding. Tensions culminated in mid-March 2008 when a sudden wholesale run on Bear Stearns impeded the investment bank obtaining funding on both unsecured and collateralized short-term financing markets. Indicators of counterparty risk started being more significantly affected. For example, the cost of

insurance against the default of large complex financial institutions (LCFIs), as measured by the credit default swap spreads, rose steadily in 2008 and reached an unprecedented peak around the time of the collapse of Bear Stearns (Chart 3).

Central banks around the world accompanied the unfolding of the crisis with numerous interventions. Some of these interventions concerned reductions in policy rates (but the Fed also reduced the discount window rate in September 2007) as well as liquidity injections into the system. Other interventions concerned changes in the standard operational frameworks or the creation of more unusual, innovative forms of special liquidity schemes. Changes involved extensions in the maturity of central bank lending (in the U.S. both with respect to the discount window loans in September 2007 and the open market operations in March 2008) and widening of the collateral accepted. Special liquidity schemes introduced during the crisis include the Term Auction Facility in December 2007, through which credit is auctioned to depository institutions against Discount Window collateral; the Term Securities Lending Facility in March 2008, which allows primary dealers to swap less-liquid mortgage and other asset-backed securities for Treasury securities; and, after the collapse of Bear Stearns, the Primary Dealer Credit Facility, through which the discount window was extended to primary dealers. Similarly, a special liquidity scheme was introduced in the U.K. in April 2008, according to which institutions eligible for the standing facilities can swap collateral with Treasury bills. Furthermore, both the Bank of England and the Federal Reserve were directly involved in managing and orchestrating the rescue, respectively, of Northern Rock and Bear Stearns, and the Federal Reserve recently established a temporary arrangement to provide emergency liquidity to Fannie Mae and Freddie Mac, should it become necessary. More recently, the U.S. Treasury has been given the power, though on a temporary basis, to extend unlimited credit to (and invest in the equity of) the two government-sponsored enterprises.

Although the real effects of the crisis have so far been contained to some extent, initial signs of propagation seem to be emerging. Credit standards and terms on both commercial and industrial (C&I) loans

Chart 3 Major Large Complex Financial Institutions Credit Default Swap Premia



Sources: Markit Group Limited, Thomson Datastream, published accounts and Bank calculations – Bank of England (2008), p. 11, Chart 9.

and commercial real estate loans tightened, and the yields on corporate bonds increased significantly over the first half of 2008 (see Federal Reserve Bank 2008, p. 12), indicating increasing pressures and risks for the nonfinancial corporate sector. Credit has remained available to the business sector so far, but household borrowing has slowed. Similar changes are occurring in the U.K. and Europe. The exchange rate of the dollar fluctuated during the crisis with a general trend towards depreciation against most currencies. Private payroll employment started falling substantially in February 2008, and inflation started also to be a source of concern. Economic growth remained slow in the first half of 2008, and the persistent weaknesses in the housing markets, together with the tightened conditions for credit to businesses and households, also weakened the projections for the second half of the year.

III. Liquidity Provision by Banks

The term liquidity is used in many different ways. For our purposes, liquidity is the ability to buy financial assets and real goods and services

immediately. The most liquid asset is cash. Current and deposit accounts and assets such as Treasury bills are also very liquid. They can be sold to raise cash at short notice with very little fall in price.

How should the liquidity of the financial system be measured? The focus of our study is on financial institutions and in particular on banks. Berger and Bouwman (2008a) have suggested a method for measuring liquidity created by the banking system and have applied it to the U.S. They start by classifying all bank assets and liabilities together with off-balance sheet items as liquid, semi-liquid and illiquid. They then assign weights to these three categories and calculate the amount of liquidity created by the banking system. They consider several possible measures. Their preferred measure includes off-balance sheet activities. According to this measure, in 2003 the U.S. banking system created \$2.843 trillion of liquidity. This represented 39% of gross total assets and 4.56 times the overall level of bank capital. The amount of liquidity created by the banking system increased every year between 1993 and 2003 and during this period almost doubled.

In a subsequent paper, Berger and Bouwman (2008b) use their measure of liquidity to investigate the relationship between liquidity and crises. Their sample period from 1984-2008Q1 includes two banking crises, the credit crunch of the early 1990s and the current crisis. They focus on “abnormal” liquidity creation. This is defined to be the deviation from the time trend of liquidity creation adjusted for seasonal factors. They find that both banking crises in their sample have the feature that they were preceded by abnormal positive liquidity creation. This was particularly true for the current crisis. This reflects a build-up of capital and a loosening of lending standards. During the credit crunch of the early 1990s, liquidity fell. For the current crisis there is an indication of a fall after the start of the crisis, but unfortunately, their data set only goes up to the end of 2007.

In order to understand the role of liquidity in the current financial crisis, it is necessary to develop a theoretical framework for understanding liquidity creation by the banking system and how this relates to crises.

IV. A Theoretical Framework of Liquidity Provision

Liquidity has clearly played a very important role in the current crisis. Therefore it is important to have a theoretical framework for thinking about liquidity provision by the banking system and its contribution to the occurrence of crises. What follows is not meant to be a literature review, but rather a very brief description of the relevant concepts related to the crisis using a few papers.

Private Provision of Liquidity by the Financial System

Asset pricing theory in financial economics that provides the tools for asset valuation and risk management relies on the assumptions of fully rational agents and perfect and complete markets. In these models, agents understand the risks involved in the investments they undertake and price them correctly. In a similar spirit, much of the theory that underlies central bank inflation-target policy in recent years relies on similar assumptions. In this frictionless world, financial institutions have no role to play, and financial crises should never occur. However, they do occur, and as the current crisis shows, badly functioning money markets, financial institutions and their role as liquidity creators can be at center stage. Understanding recent events in terms of models without financial intermediaries is difficult, to say the least.

The first step in analyzing the role of liquidity in financial crises is to develop a model of liquidity provision in the context of financial institutions and markets. We need to understand how a financial system can provide liquidity efficiently and what can go wrong. We also need to consider the potential role of central banks in improving the allocation of resources and maintaining financial stability when there is a problem.

The standard model of banking that allows consideration of the role of banks as liquidity providers was introduced by Bryant (1980) and Diamond and Dybvig (1983). There is a short asset that provides liquidity in the next period and a long asset that provides a higher return but at a later date. Consumers are initially unsure when they will require liquidity, and they cannot directly insure this risk. In this

view of the world, the role of banks is to provide liquidity insurance to depositors.

The original banking models do not include financial markets. To understand the current crisis, it is essential to have a framework with both financial intermediaries and markets. Allen and Gale (2004a, 2007), among others, develop such an approach. They argue that in modern financial systems financial markets are essential for financial institutions. Consumers invest in financial intermediaries such as banks and mutual funds, and these institutions then invest in financial markets. Information and transaction costs make it too costly for individual investors to trade directly in the full range of financial markets. Both financial intermediaries and markets play an important role in this environment. Financial intermediaries provide liquidity insurance to consumers against their individual liquidity shocks. Markets allow financial intermediaries (and hence their depositors) to share aggregate risks. This general equilibrium framework allows a normative analysis of liquidity provision by the financial system. It is like the Arrow-Debreu model of resource allocation but includes financial institutions. It provides a benchmark for the efficient provision of liquidity by intermediaries and markets and an ideal allocation for a central bank to aim at implementing.

Banks allow consumers to deposit funds that they can withdraw when they have liquidity needs. This liquidity provision allows banks to accumulate funds that they can use to lend to firms to fund long-term investments. Banks must manage their liquidity so that they can meet the liquidity needs of their depositors. There are two types of uncertainty concerning liquidity needs. The first is that each individual bank is faced with *idiosyncratic* liquidity risk. At any given date its customers may have more or less liquidity needs. The second type of uncertainty that banks face is *aggregate* liquidity risk. In some periods aggregate liquidity demand is high, while in other periods it is low. Thus, aggregate risk exposes all banks to the same shock, by increasing or decreasing the demand for liquidity that all banks face at the same time. The ability of banks to hedge themselves against these liquidity risks crucially depends on the functioning, or, more precisely, the completeness of financial markets.

If financial markets are *complete*, the financial system provides liquidity efficiently in that it ensures that banks' liquidity shocks are hedged. One way to implement complete markets that allow every bank to hedge itself against idiosyncratic liquidity risk is as follows. Each bank issues a small amount of a security contingent on the idiosyncratic liquidity shock experienced by each *other* bank. With the funds generated by these securities, each bank buys all of the securities issued by the other banks that are contingent on its *own* idiosyncratic shock. Thus when a bank is hit by a high liquidity shock, it obtains the funds it needs to cover its liquidity requirements.⁴

The equilibrium prices of all these bank-specific securities, together with securities that allow aggregate risk to be hedged, lead to the efficient provision of liquidity by the financial system. The invisible hand of the market ensures that the pricing of the complete set of securities provides the correct incentives for the provision of liquidity by the banking system in every state of the world.

The key point here is that the implementation of complete markets requires a large number of bank-specific securities, but in practice we do not see anything that resembles this kind of situation or provides an equivalent allocation. One possible reason is that the infrastructure needed to support all the securities required for markets to be complete can be very costly in practice and thus not convenient. Although the current U.S. financial system has many securities and many are specifically contingent on the particular experiences of specific firms such as credit default swaps, it is still a far cry from enabling the type of hedging transactions that correspond to the theoretical benchmark of complete markets.

If markets are *incomplete*, banks can trade only a limited number of assets and their ability to hedge liquidity risk changes dramatically. The incompleteness of markets leads to inefficient provision of liquidity by the financial system. This can generate *cash-in-the-market pricing*, where even the prices of safe assets can fall below their fundamental value, and lead to *financial fragility*, where even small shocks have large effects on asset prices. In addition, there can be *contagion* where shocks spread from one institution to another, leading to a

chain of bankruptcies. These effects provide an explanation of what can go wrong in imperfect financial markets.

Financial Fragility and Cash-in-the-Market Pricing

The problem with incomplete markets is that liquidity provision by the financial system is inefficient. The nature of risk management to ensure that the bank or intermediary has the correct amount of liquidity changes significantly from the case of complete markets. When markets are complete, it is possible, as explained above, to use securities to ensure liquidity is received in the situations when it is needed. The price system ensures adequate liquidity is provided in every state and is priced properly state by state. In this case, banks and other intermediaries buy liquidity in states where it is scarce by selling liquidity in states where it is plentiful for them, and the financial system allows risk sharing and insurance.

In contrast, when markets are incomplete, liquidity provision is achieved by selling assets when liquidity is required. When liquidity is scarce, asset prices are determined by the available liquidity, or in other words, by the cash in the market. It is necessary that a proportion of financial institutions hold extra liquidity that allows them to buy up assets when liquidity is scarce. These suppliers of liquidity are no longer compensated for the cost of providing liquidity state by state. Instead, the cost must be made up on average across all states, and this is where the problem lies.

The providers of liquidity have the alternative of investing in a productive long asset. There is an opportunity cost to holding liquidity since this has a lower return than the productive long asset. In order for agents to be willing to supply liquidity they must be able to make a profit in some states. If nobody held liquidity, the price of the long asset would collapse to zero. This would provide an incentive for some agents to hold liquidity since they can acquire assets cheaply. But if the price increased too much, then nobody would hold liquidity as this would not make any profit. Thus, in equilibrium prices will be bid to the level where the profit in the states where banks face high liquidity demand is sufficient to compensate the providers of liquidity for all the other states where they do not make any profit

and simply bear the opportunity cost of holding liquidity. In other words, prices are low in the states where banks need more liquidity. But this is exactly the wrong time from an efficiency point of view for there to be a transfer from the banks who need liquidity to the providers of liquidity. There is in effect negative insurance and suboptimal risk sharing. Asset price volatility is costly because depositors are risk averse and their consumption varies across banks with high and low idiosyncratic liquidity risk.⁵ This leaves scope for central bank intervention. By engaging in open market operations to fix the price of the long asset (or equivalently fix the short-term interest rate), central banks can remove the inefficiency deriving from the asset price volatility and achieve the same allocation as with complete markets (Allen, Carletti and Gale, 2008).

To summarize, when markets are incomplete, asset prices must be volatile to provide incentives for liquidity provision. This asset-price volatility can lead to costly and inefficient crises. There is a market failure that provides the justification for central bank and other kinds of intervention to improve the allocation of resources. Liquidity provision in the complete markets allocation provides a benchmark for judging the effectiveness of such intervention.

Contagion

A second important concept when markets are incomplete is contagion. The linkages between banks that interbank markets provide imply that problems in one bank can spread to other banks and can potentially disrupt the whole financial system. Allen and Gale (2000) analyze a variant of the basic model of liquidity provision described above to consider how this process works and the inefficiencies involved.⁶ As with financial fragility, the problem is concerned with liquidity provision but in a somewhat different way. The possibility of contagion arises from the overlapping claims that different banks have on one another rather than from asset price volatility. When one bank suffers a shock and defaults as a consequence, the other banks suffer a loss because their claims on the troubled bank fall in value. If this spillover effect is strong enough, it can cause a crisis throughout the system. In extreme cases, the crisis passes from bank to bank,

eventually having an impact on a much larger set of banks than the one in which the original shock occurred.

If there is a large degree of interconnectedness between banks in the sense that many hold the assets of others, there are many links through which a crisis can spread. On the other hand, the importance of each link will be smaller. This means that a shock can be more easily absorbed by the capital buffer of each institution. If there are a few links but each involves a larger amount of funds, crises are more likely to spread because each bank's capital buffer will be overwhelmed if another bank fails. Thus the case of some interconnectedness but not too much represents the most likely situation for contagion to occur.

Contagion is an extremely worrying phenomenon for policy makers. The costs of bankruptcy of financial institutions can be large. A whole string of bankruptcies among banks can cause tremendous damage to the financial system, and this in turn has the potential to have large spillovers to the real economy. If firms no longer have access to funding from banks or other financial institutions then they may have to cut investment and their level of output significantly.

Many factors affect the probability and the extent of contagion. One that seems to have played a role in the current crisis relates to the use of mark-to-market accounting. This accounting method has the benefit of reflecting the market value of the balance sheets of financial institutions and therefore of allowing regulators, investors and other users of accounting information to better assess the risk profile of financial institutions. This is true provided financial markets operate perfectly and prices correctly reflect the future earning power of assets. However, when markets do not work perfectly and prices do not always reflect the value of fundamentals as in the case where there is cash-in-the-market pricing, mark-to-market accounting exposes the value of the balance sheets of financial institutions to short-term and excessive fluctuations, and it can ultimately generate contagion. If there is cash-in-the-market pricing in one sector of the financial system, then other sectors can be affected by the change in the prices and may be forced to write down the value of their assets.⁷

Asymmetric Information

In our discussion of liquidity provision so far, asymmetric information has played a relatively small role. In particular, the assets that are traded are not characterized by asymmetric information. In the current crisis, many people believe that asymmetric information has played an important role (see, for example, Gorton, 2008). Bolton, Santos and Scheinkman (2008) have provided an interesting theory of liquidity provision with asymmetric information.

In their model there are three sets of agents. These are investors with a short horizon, intermediaries and investors with a long horizon. The basic source of inefficiency is asymmetric information about asset values between long-horizon investors and financial intermediaries. Long-horizon investors cannot distinguish between an asset sale that is due to a liquidity need and an asset sale to offload low-quality securities. This asymmetric information leads to an adverse selection problem and consequently to a price discount. Bolton, Santos and Scheinkman assume that as time passes, the intermediaries learn more about the assets that they hold. This ensures that over time the adverse selection problem gets worse, and the price discount if an intermediary sells becomes greater.

The basic problem an intermediary faces if it is hit by a liquidity shock is whether to sell its assets now at a discount or to try and ride out the crisis. The danger of doing this is that the intermediary runs the risk of having to sell at a greater discount if the crisis lasts longer than expected. It is shown that two types of rational expectations equilibrium exist. In what they call the *immediate trading equilibrium*, intermediaries sell assets immediately to ensure they have enough liquidity. In the *delayed trading equilibrium*, intermediaries try to ride out the crisis and only sell if they are forced to.

For some parameter values, only the immediate trading equilibrium exists, while for others both do. Surprisingly, the authors are able to show that the delayed trading equilibrium is Pareto superior when both exist. The reason is that short-horizon investors undervalue long

assets while long-horizon investors undervalue cash. There is a gain from inducing short-horizon investors to hold more long assets and long-horizon investors more cash. This is what the delayed trading equilibrium does. The worse is the asymmetric information problem, the less is the gain as it impedes the operation of the market for the long assets.

Spillovers to the Real Economy

Much of the literature on liquidity provision has been concerned with the provision of liquidity to firms and resulting spillovers to the real economy. One of the important issues in crises is why problems in the financial system spill over into the real economy. The seminal contribution here is Holmström and Tirole (1998). In their model, entrepreneurs operate firms. These entrepreneurs need to provide costly effort for the firm to be successful. In order to ensure they are willing to do this, they need to be provided with part of the equity of the firm. This limits the ability of the firm to raise funds by issuing securities to outside investors. If a firm is hit by a liquidity shock and needs more funds to continue, it may be unable to raise them in the market. If it cannot continue because of this, then it may go bankrupt, and this can cause a significant loss in welfare. The occurrence of this event is more likely when credit markets are disrupted. In order to overcome this problem, the firm may need to hold liquid securities that it can sell in the event of a liquidity shock. If the private supply of such securities is insufficient, the government may be able to improve welfare by issuing government debt that can be held by firms. Now when firms are hit by a shock, they will have sufficient liquidity to continue.

Another important contribution is Kiyotaki and Moore (1997). They show that small shocks can lead to large effects because of the role of collateral. A shock that lowers asset prices lowers the value of collateral. This means that less borrowing is possible, asset prices are further lowered and so on in a downward spiral. Disruptions in liquidity provision can be the shock that initially lowers asset prices and starts the problem.

V. Insights into the Current Crisis

In this section, we focus on four of the crucial features of the crisis that we argue are related to liquidity provision. The first is the fall of the prices of AAA-rated tranches of securitized products below fundamental values. The second is the effect of the crisis on the inter-bank markets for term funding and on collateralized money markets. The third is fear of contagion should a major institution fail. Finally, we consider the effects on the real economy.

1. *Effects of Liquidity on Pricing*

One of the most surprising aspects of the crisis has been the collapse in prices of even the AAA-rated tranches of mortgage-backed securities and other structured credit products. Some banks have had to write down the AAA-rated super senior tranches of mortgage-linked collateralized debt obligations by as much as 30% (Tett, 2008) due to a fall in their market prices. According to the Bank of England (2008, pp. 18-21), if this change in price was due to deterioration in fundamentals, then it would be necessary to believe that the ultimate percentage loss rate of securitized subprime mortgages would be 38%. This would be justified, if, for example, 76% of households with subprime securitized mortgages would default and the loss given default rate was 50%. This seems, however, implausible given that none of the AAA-rated tranches have yet defaulted and, as the Bank of England also estimated, there should not be any future default in AAA-rated subprime mortgage-backed securities, even with a continued decline in U.S. house prices.

It is not only AAA-rated tranches of subprime mortgage-backed instruments that have suffered but also commercial mortgage-backed securities and securitizations linked to corporate credit quality. As Chart 1 illustrates, at the start of the crisis the co-movement of these instruments rose dramatically. The high co-movement among different types of AAA-rated securities with different fundamentals suggests that it is probably not fundamentals driving the falls in prices.

The framework developed in the previous section provides some insight into what could be determining prices. The movements

observed are consistent with the cash-in-the-market pricing of securities explained above. In this framework, it can be shown that aggregate shortages of liquidity can cause even risk-free securities to trade at a significant discount to their fundamental. Usually the theory is developed in terms of a single asset. However, the analysis can be applied to the case of multiple assets. With segmented markets, the theory can also explain why different but related types of securities would also be affected so their prices would tend to fall as well.

Participating in a market involves the initial fixed cost of finding out information about the security being traded. This fixed cost limits the number of participants. The structure of investment banks and other participants in markets is usually such that a desk will trade a number of related products to try to economize on this fixed cost. Risk management in these firms is such that in the short run there is a fixed limit on the total amount of cash available to purchase these securities. Our view is that as news about the subprime default problems came out, many investors changed their estimate of the risk of these securities and readjusted their portfolios. This led to a wave of selling and overwhelmed the capacity of the market to absorb sales. As a result, prices of even the AAA-tranches fell. The reason that the prices of other securities such as AAA-rated tranches of commercial mortgage-backed securities also fell is that they are traded by the same desks as securitized subprime products, and so sales of these also led to a drop in prices.

One important feature of this pricing of AAA-rated tranches at such large discounts is their persistence. One might expect cash-in-the-market prices to persist for a few days. But once the limits on each desk's ability to trade have had time to be adjusted, it would be natural to expect the desks to bid up the prices of the securities since there would appear to be a significant arbitrage opportunity. By going short in similar maturity Treasuries and investing in these AAA-rated tranches, a significant premium could apparently be earned. What prevents this? The answer is *limits to arbitrage* (Shleifer and Vishny, 1997). In particular, once the link between prices and fundamentals is broken, the difference between them may widen in the wrong direction during the period of holding the position.

It is well known that such limits to arbitrage can prevent even virtually identical securities from trading at the same price. The classic example is the shares of the Dutch company Royal Dutch Petroleum and the British company Shell Transport and Trading. Before July of 2005 when the two entities were formally merged into a single company, the shares of Royal Dutch Petroleum and Shell Transport and Trading were Siamese twins that shared in the profits of the oil major. Royal Dutch received 60% of the dividends and earnings of the joint company, and Shell Transport and Trading received the remaining 40%. Standard asset pricing theory suggests they should have traded at a ratio of $60/40 = 1.5$. In fact they traded at very different price ratios than this (see, for example, Brealey, Myers and Allen, 2008, p. 367).

It is interesting to note that although the prices of AAA-rated tranches of non-subprime mortgage-backed securities such as commercial mortgage-backed and securitizations linked to corporate credit quality were significantly affected, the prices of conforming prime mortgage-backed securities issued by Fannie Mae and Freddie Mac were much less affected. This is not surprising given that here the arbitrage is virtually risk free given the implicit government guarantee provided to the securities of these government-sponsored enterprises.

Once the value of AAA-rated tranches of securitized products fell significantly, it no longer became possible to fund the Structured Investment Vehicles (SIVs) and similar entities holding them using short-term finance. Thus the market for asset-backed commercial paper to finance such SIVs dried up since it was now clear the collateral was lower in value and also risky, whereas before it was thought to be safe. To avoid loss of reputation, the banks that had set up these SIVs were forced to bring the underlying assets back on to their balance sheets. Their need for liquidity was thus dramatically increased.

In our view, one of the important features of the current crisis is therefore that cash-in-the-market pricing combined with limits to arbitrage has significantly affected the pricing of large volumes of fixed-income securities for significant periods of time. Effectively this means that the creation by banks of uninsured off-balance sheet vehicles that borrow short and invest long has significantly increased risk in the financial system. Moreover, until significant experience has

been gained concerning this type of risk of the cash-in-the-market pricing of such assets, the ability of financial institutions to manage risk exposures will be considerably impaired.

Another possible explanation of the pricing anomalies in the AAA-rated tranches of securitized securities is that they are due to asymmetric information as, for example, in Bolton, Santos and Scheinkman (2008). Strong adverse selection and moral hazard problems provide a potential explanation for the large discounts in prices for risky securities like those backed by subprime mortgages. However, the fall of other AAA-rated securities as well as the co-movements of prices of these products as shown in Chart 1 are more difficult to explain. The deterioration in the fundamentals of the underlying instruments in commercial mortgage-backed securitizations and securitizations linked to corporate credit quality was much less. Some other factor must be at work for the asymmetric information to be consistent with what happened.

2. The Effects on Interbank Markets and Collateralized Markets

The second feature of the current crisis that has caused some surprise is the effect on the money markets. In particular, volumes in the interbank markets for maturities beyond a few days were significantly reduced. Less surprisingly, in the collateralized money markets, the haircuts on collateral increased significantly, particularly for mortgage-backed securities as shown in Table 1. We consider each of these in turn.

One of the important issues with the interbank markets is the cause of the increase in spreads shown in Chart 2. These strains were particularly severe in December of 2007 and led the Fed to introduce special measures to provide liquidity, including the introduction of the Term Auction Facility to lend against discount window collateral. Subsequently in March 2008, they lengthened the term they were willing to lend for in open market operations, introduced the Term Securities Lending Facilities to lend Treasuries against a broad range of collateral, and announced the Primary Dealer Credit Facility to lend bilaterally to primary dealers.

Table 1
Typical “Haircut” or Initial Margin
(in percent)

	January-May 2007	April 2008
U.S. treasuries	0.25	3
Investment-grade bonds	0-3	8-12
High-yield bonds	10-15	25-40
Equities	15	20
Investment grade CDS	1	5
Synthetic super senior	1	2
Senior leveraged loans	10-12	15-20
2nd lien leveraged loans	15-20	25-35
Mezzanine level loans	18-25	35+
ABS CDOs:		
AAA	2-4	15
AA	4-7	20
A	8-15	30-50
BBB	10-20	40-70
Equity	50	100
AAA CLO	4	10-20
AAA RMBS	2-4	10-20
Alt-a MBS	3-5	20-50

Sources: Citigroup; and IMF staff estimates – from International Monetary Fund (2008), Table 1.2, p. 23.

Note: ABS = Asset-backed security; CDO = collateralized debt obligation; CDS = credit default swap; CLO = collateralized loan obligation; RMBS = residential mortgage-backed security.

An important question is why these strains occurred and whether the actions of the Federal Reserve were warranted. As mentioned in Section II, two explanations are typically given as to why the inter-bank markets came under such strain. The first is that banks were hoarding liquidity in anticipation that they would have significant liquidity needs going forward. For example, they faced the possibility of having to bring many assets in SIVs and other off-balance sheet entities back on balance sheet as asset-backed commercial paper markets dried up. Also, banks faced the prospect as the economy slowed down of corporations drawing down their lines of credit. All in all, liquidity had become scarce, and the prospect of uncertainty in aggregate demand for liquidity going forward meant banks wanted to hold onto as much as possible.⁸

The second explanation for the drying up of interbank markets is that increased uncertainty about the solvency of banks meant that they became unwilling to lend to each other. It is argued that uncertainty over which banks held subprime mortgages and the value of these, together with the uncertainty concerning other securitized assets, made it very difficult for banks to judge which banks they should lend to. If this is the explanation of the drying up of markets, then one would expect to see distrust of banks' prospects going forward to be reflected in the pricing of credit default swaps on banks. It can be seen from Chart 3 that the spread on credit default swaps on banks were elevated in December 2007 but by a relatively small amount. This was much less than the spreads that occurred in March 2008 at the time that Bear Stearns collapsed. The relatively low spreads in December 2007 suggest that banks' reluctance to lend to each other probably plays a relatively small part in explaining why markets dried up. Liquidity hoarding is probably a more important factor.

If liquidity hoarding is the explanation, then the drying up of interbank markets may in fact not be a problem. It can be argued that the main role of interbank markets is to reallocate liquidity between banks to allow them to meet idiosyncratic liquidity shocks. If there is increased aggregate uncertainty about liquidity demand, banks will hold more liquidity and can then cover idiosyncratic demands without resorting to the interbank market. In this case, the drying up of liquidity does not pose a threat to financial stability. In contrast, if the unwillingness of banks to provide liquidity prevents the efficient reallocation of liquidity to banks in need of liquidity, then financial stability can be affected and central bank intervention is warranted.

We next turn to the collateralized money markets. Much of the lending that occurs between financial institutions takes the form of short-term collateralized repurchase agreements. In normal times, a wide range of assets from Treasuries to mortgage-backed securities are used as collateral, and they are regarded as close substitutes. Haircuts vary but by relatively small amounts. Table 1 shows that this changed as the current crisis progressed. This is partly because of the valuation issues discussed in the previous section that makes the securities more risky as collateral. In addition, there is the issue that if there is a

default, particularly of a major financial institution, there is likely to be a flight to quality. This should increase the value of Treasuries but reduce the value of lower quality collateral such as mortgage-backed securities. In extreme circumstances, the flight to quality may cause the value of the lower quality collateral to fall below the haircut the lender took. Thus Treasuries become a preferred form of collateral in times of crisis. In this view, the actions of the Federal Reserve and other central banks in making Treasuries more available by swapping them for lower quality collateral significantly helps the functioning of the repo markets.

One of the interesting characteristics of the strains in the inter-bank markets is that they were most severe in December of 2007 and around quarter's end in September 2007 and March 2008. This suggests that other considerations such as the desire of financial institutions to window dress may have also contributed to the strains. Musto (1997, 1999) presents persuasive evidence that financial institutions' desire to look good at year's end and the end of quarters leads to significant pricing effects in the money markets. Such desire may have been even more accentuated during the recent crisis. In this case, the actions of the Federal Reserve in exchanging Treasuries for mortgage-backed securities and lower quality collateral may actually hurt rather than help. Financial institutions can hold low-quality securities for the period where no reporting is required. They then briefly buy Treasuries so that the balance sheet they report to shareholders or regulators is high quality. Temporarily increasing the supply of Treasuries makes this kind of deception easier. It helps remove market and regulator discipline.

An important issue is the extent to which the strains in the market and the increased appetite for Treasuries occurred because of a need for improved collateral or because of a desire to window dress. More research is needed to settle this issue and evaluate the desirability of the actions undertaken by the Federal Reserve and other central banks. One piece of information that would shed some light on the importance of these two factors is the extent to which low-quality collateral was swapped for Treasuries and the extent to which these transactions were reversed afterwards.

3. *Fear of Contagion*

The justification that the Federal Reserve gave for arranging the takeover of Bear Stearns by J. P. Morgan was the fear of contagion (Minutes of the Federal Reserve, March 14, 2008). Bear Stearns was the counterparty in a large number of derivative transactions. The fear was that if they had gone bankrupt there would have been contagion through the network of derivative contracts that they were part of, and a large number of other financial institutions may have been adversely affected.

Contagion was discussed above in Section IV. Theories of contagion have mostly been developed in the context of banks and interbank markets. They show how a shock to one bank that causes bankruptcy can cascade through the financial system and cause a string of bankruptcies. If bankruptcy costs are high, then this string of failures can be very costly. The effect on asset prices may be large if failed institutions are forced to liquidate assets and there is cash-in-the-market pricing. Moreover, there may be significant spillovers into the real economy if a significant number of financial institutions fail. Contagion potentially provides a strong justification for central banks to intervene and save institutions such as Bear Stearns. The key issue is how likely this kind of damaging contagion is in practice. This depends on the number and size of counterparties active in the market as well as on the size of the interrelations among them. The more numerous are the counterparties and the smaller the interrelations, the less likely it is that a default of one counterparty leads to contagion. The reason is that the buffers of capital of the surviving intermediaries are more likely to be large enough to absorb the default, especially if each of them has only small claims with the troubled intermediary. Given the characteristics of the markets where Bear Stearns operated, it is quite possible that this would have been the case and no contagion would have occurred.

Upper (2007) provides a survey of simulation exercises that look for evidence of contagious failures of financial institutions resulting from the mutual claims they have on one another. Most of these papers use balance sheet information to estimate bilateral credit relationships for different banking systems. The stability of the interbank

market is tested by simulating the breakdown of a single bank. This methodology has been applied to the Belgian, German, Swiss, U.K. and U.S. banking systems, among others. These papers find that the banking systems demonstrate a high resilience, even to large shocks. Simulations of the worst-case scenarios show that banks representing less than 5% of total balance sheet assets would be affected by contagion on the Belgian interbank market, while for the German system the failure of a single bank could lead to the breakdown of up to 15% of the banking sector in terms of assets. These results heavily depend on how the linkages between banks, represented by credit exposures in the interbank market, are estimated. For most countries, data is extracted from banks' balance sheets, which can provide information on the aggregate exposure of the reporting institution vis-à-vis all other banks. To estimate bank-to-bank exposures, it is generally assumed that banks spread their lending as evenly as possible. In effect, this assumption requires that banks are connected in a complete network. Hence the assumption might bias the results, in the light of the theoretical findings that better connected networks are more resilient to the propagation of shocks.

The main finding of this literature is that contagion is unlikely. However, there are a number of reasons for caution in accepting this result and concluding that policy makers need not worry about contagion between banks. The first is that they do not model price effects of bankruptcy. Cifuentes, Ferrucci and Shin (2004) have argued that these price effects are the main transmission mechanism for contagion. As Upper (2007) points out, they also rely on the initial shock being confined to a single bank. If there is an initial shock that affects several banks simultaneously, then this can also lead to contagion being more likely.

In the case of Bear Stearns, it is not clear from publicly available information how much contagion there would have been had it been allowed to fail. Press reports stress the large number of derivative contracts that Bear Stearns was a counterpart in. However, as argued above, this could mean that contagion was less likely because there would be more institutions with capital buffers to absorb the defaults. In any case, more simulations like those undertaken for banks

are needed in the context of derivatives to assess the likelihood of contagion with this kind of default.

As a final point, one also has to keep in mind that even when there is a realistic risk of contagion that justifies central bank or government intervention, this also involves costs that should be traded off against the costs deriving from contagion. These costs of intervention include the future moral hazard associated with increased risk taking by financial institutions going forward.

4. Effects on the Real Economy

As discussed in Section IV, much of the academic literature on liquidity has been concerned with firm's access to funds. If firms are limited in the amount they can raise because of factors such as moral hazard and adverse selection, they may be limited in the amount they can invest or may even fail if they suffer a liquidity shock. By holding liquid assets they can avoid this problem.

So far the indications outlined in Section II indicate that firms' financing has not been affected too much, and in particular, firms have not had to greatly restrict their investment plans because of a lack of finance. However, credit standards and terms on corporate and real estate loans have tightened. In the first half of 2008, yields on corporate bonds also increased significantly. If the crisis continues to worsen, the effects on corporate finance discussed in the literature may begin to bite more seriously.

VI. Concluding Remarks

The fundamental cause of the current crisis has been the dramatic fall in property prices. Although this fall in property prices was widely anticipated, many aspects of the crisis that resulted were not, and these have considerably exacerbated the effects of the crisis. We have focused on three of the most important. These are the following.

- The significant fall in prices of many AAA-rated tranches of securitized products, including many unrelated to subprime mortgages.

- The drying up of interbank markets for maturities beyond a few days and the change in haircuts on collateralized lending.
- The fear of contagion.

We have argued that these phenomena are all intimately connected with the role of liquidity in financial crises. They have greatly exacerbated the effects of the crisis.

We suggest that the significant discounts on AAA-rated tranches of securitized products that are too large to be explained by the underlying fundamentals are the result of cash-in-the-market pricing. These price movements were unanticipated and have produced a whole set of problems for risk management going forward.

The drying up of liquidity in interbank markets is usually attributed to a mixture of liquidity hoarding by banks to counter the increased uncertainty over aggregate liquidity demand and fear of lending to other banks. At the end of 2007, the evidence seems to be that banks were to a large extent hoarding liquidity rather than refusing to lend to counterparts because credit default swaps on banks were only elevated somewhat. This is less of a problem than fear of lending as banks are not being refused credit.

In normal times, high-quality asset-backed securities and Treasuries are close substitutes for collateral in the money markets. However, in crisis times they are not because the possibility of default will cause a flight to quality. This leads to a demand for Treasuries rather than asset-backed securities. It is desirable for central banks to meet this demand to improve the efficiency of the money markets. However, in times of stress there is also a heightened demand for Treasuries for window dressing purposes at quarter and year end. Meeting this increased demand for Treasuries is not desirable as it removes an important market discipline. It is important that current facilities that allow asset-backed securities to be swapped for Treasuries be evaluated in this light.

Theoretical analysis suggests that the process of contagion where default cascades through the financial system represents a significant danger. Contagion was the justification for preventing the bankruptcy

of Bear Stearns as they were heavily involved as counterparties in the derivatives markets. However, little empirical work on the plausibility of contagion in the context of derivatives markets has been done. This is urgently needed.

In the remainder of this section, we consider some open issues related to the role of liquidity in financial crises that deserve attention. The first concerns mark-to-market accounting. One of the points we have emphasized is that cash-in-the-market pricing leads to prices that do not reflect fundamentals. If that occurs, mark-to-market accounting for financial institutions has the disadvantage that it can understate the value of banks and other intermediaries and makes them appear insolvent when in fact they are not. Historic cost accounting has the advantage that it does not do this. On the other hand, it leads to bankrupt institutions that deserve to be closed being able to continue and possibly gamble for resurrection. In Allen and Carletti (2008b), we suggest that in financial crisis situations where liquidity is scarce and prices are low as a result, market prices should be supplemented with both model-based and historic cost valuations. The rest of the time, and in particular when asset prices are low because expectations of future cash flows have fallen, mark-to-market accounting should instead be used.

The second issue is the “too big to save problem” of large banks in small countries. The Federal Reserve could easily prevent the threat of contagion posed by Bear Stearns. Even the threat of contagion posed by the failure of the largest banks in the U.S. such as Citigroup and Bank of America could be avoided by central bank and government intervention even though this may require the outlay of very large amounts of government funds. However, some banks are so large relative to the countries in which they are based that this is not the case. One example is Fortis in Belgium. This has assets that are greater in size than the GDP of Belgium. If it were to fail, it would be quite likely that a Belgian government (if one existed at the time) would be unwilling to intervene and assume fiscal responsibility because of the large size of the burden. In this case, the key issue would be how the burden would be shared between countries of the European Union. Ecofin (2008, p. 5) specifies that, “If public resources are involved,

direct budgetary net costs are shared among affected Member States on the basis of equitable and balanced criteria.” Unfortunately, this lack of specificity is likely to lead to substantial delays in dealing with the situation as each country vies to improve its fiscal position. During this time, the prospect of contagion could effectively freeze many European and some global capital markets with enormous effects on the real economy. It is an urgent matter for the European Union to agree on specific *ex ante* burden sharing criteria for the costs of preventing large banking crises. The work along these lines that is currently under way needs to proceed rapidly.

Even more worrying is the fact that there exist banks that may fail in small countries that are not part of a larger grouping. The classic example here is UBS and Credit Suisse in Switzerland. These two banks both have assets significantly in excess of Swiss GDP. It may literally be infeasible for the Swiss government to raise the funds to prevent their failure. In such cases, the potential damage caused by the prospect of contagion if one of them were to fail is very large. It is again an urgent task to devise a system to prevent this kind of problem from occurring. The International Monetary Fund or the Bank for International Settlements are obvious institutions to be assigned to deal with such problems. The alternative is to wait for the catastrophe to occur. In that case, consumers will subsequently be unwilling to invest in large banks in small countries. In the meantime, however, very large costs will have been imposed on the global economy.

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Endnotes

¹*Financial Times*, January 15, 2008, and June 18, 2008.

²See, for example, Bank of England (2006) and (2007).

³See, for example, *The Economist* (2005) and (2006).

⁴See Allen, Carletti and Gale (2008) for a full description of how complete markets can be implemented.

⁵Allen and Carletti (2006, 2008a) analyze in detail how this pricing mechanism works.

⁶For a survey of the literature on contagion, see Allen and Babus (2008).

⁷See Allen and Carletti (2008a) for an analysis of mark-to-market accounting when there is cash-in-the-market pricing.

⁸See Allen, Carletti and Gale (2008) for an analysis of the relationship between aggregate liquidity risk and liquidity hoarding.

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Commentary: The Role of Liquidity in Financial Crises

Peter R. Fisher

Allen and Carletti provide an insightful review of the literature on liquidity and financial crises and a useful framework for considering the role of liquidity in the events of the past year. I find myself in fundamental agreement with what I take to be their two key points: first, on liquidity hoarding as the more significant explanation of the breakdown in interbank markets and, second, on the impact of cash-in-the-market pricing on asset values. As a consequence of this agreement, my comments will necessarily digress into quibbling about how one reaches these conclusions, how they should be characterized and into my own thoughts on the key puzzle of the past year, the Federal Reserve's new facilities and suggested areas for further work.

Liquidity hoarding as “balance sheet defensiveness”

In their analysis of the drying up of interbank lending markets, the authors conclude that “liquidity hoarding” by banks has probably been the more-important factor than has uncertainty about the condition of borrowers (Allen and Carletti, beginning on pg. 399). I certainly agree. (See Fisher, 2008.) In public, bankers would always prefer to blame uncertainty about their borrowers' balance sheets than anxiety about their own balance sheets. However, in my own conversations with bank CFOs, treasurers, and trading desks

from August of 2007 through March of 2008, there was a frank acknowledgement of a defensive concern with their ability to finance their own positions and those of their key customers. The simultaneous and generalized widening of unsecured, interbank lending rates across U.S. dollar, sterling and euro markets last August and the persistence of these wider spreads for the past year also support the idea of a lenders' strike as the more useful explanation.

I see "liquidity hoarding" as a form of "balance sheet defensiveness" by bankers unwilling to rent space on their balance sheets to their competitors at traditional spreads.

A broad definition of liquidity as the growth of balance sheets, as expressed in the other recent work of Adrian and Shin (2008), should not be seen as a different subject but rather as the flip side of the same coin. This broad definition of liquidity as the growth rate of financial intermediaries' aggregate balance sheets helps explain both the abundance of liquidity earlier in this decade and the subsequent scarcity of liquidity that began last summer. More importantly, it locates the concept of liquidity in a *behavior* (the willingness and ability to expand one's balance sheet) that creates a *flow* rather than simply viewing liquidity as a *stock* to be allocated.

Allen and Carletti's discussion of aggregate as contrasted with idiosyncratic liquidity shocks (pg. 401) would benefit from further thinking about behaviors and flows rather than stocks. Having concluded that liquidity *hoarding* was the better explanation of interbank behavior, the authors surprisingly focus on "uncertainty in aggregate demand for liquidity" without corresponding attention to "aggregate supply."

Let me make a plea to the regulators and central bankers, however, to consider carefully the distinction between aggregate and idiosyncratic liquidity shocks before designing new liquidity rules or ratios or further altering central bank operations. It is critical that any new rules recognize the behavioral dimension of liquidity as something that a banking system creates (or destroys) and not as a stock to be rationed among banks. Thus, I would be skeptical as to whether different liquidity rules or ratios had they been adhered to, by themselves, would

have made things any better over the past year and I can easily see how they could have made things procyclically worse.

I would also suggest further work on the appropriate central bank response to aggregate as opposed to idiosyncratic liquidity shocks as the issue seems much less clear cut to me. I can see the case for central bank intervention in both cases, depending on circumstances. For example, an aggregate liquidity shock caused by a central bank firming of monetary policy would not be a likely candidate for an aggressive central bank reaction. An idiosyncratic shock to a single firm of an extraordinary scale (such as a computer malfunction of a major clearing bank) or one that raised solvency concerns in the interbank market which the central bank knew to be unfounded would both be candidates for central bank lending.

Cash-in-the-market pricing is an accurate description

Allen and Carletti's description of the impact of scarce liquidity on asset prices, in conditions of incomplete markets and as constrained by the limits to arbitrage (Allen and Carletti, 391-392, 397 citing Shleifer and Vishny 1997), is hauntingly familiar to the investment management practitioner, particularly one that thought *high-quality*, mortgage-related securities looked cheap in December, and in March, and again in June.

Unfortunately, "cash-in-the-market pricing" by itself describes but does not explain the divorce of asset pricing from fundamentals—meaning the credit fundamentals of the underlying cash flows, not macro-economic fundamentals. Allen and Carletti observe: "When liquidity is scarce asset prices are determined by available liquidity or in other words by cash in the market." But when liquidity is abundant asset prices are also determined by cash in the market, as was the case from 2004 through early 2007.

But it is also the case that balance sheet expansion and contraction, and the broader definition of liquidity, do not explain the divorce between asset pricing and credit fundamentals.

The puzzle that should haunt us

With the benefit of hindsight, we cannot claim to be puzzled by the fact of falling house prices nor by the fact of a financial crisis. If we are candid, however, we should admit that we are still perplexed by the severity and longevity of the crisis, by the loss of financial firms' ability to absorb losses and to provide liquidity and, thus, by the jeopardy this crisis poses to the real economy.

The key questions that should haunt us are: (1) How can a system that was thought to be so well capitalized just 18 months ago have proved itself to be much more highly-leveraged (so much more poorly capitalized) than we thought? And (2) How did this leverage so abruptly and persistently translate itself into both a lack of liquidity and falling credit asset values?

My own attempts to answer these disturbing questions focus on the prevalence of asset-based or "repo financing" and on the transformation—or degradation—this has wrought to our credit system.

Let me acknowledge that in our highly-evolved financial system there is a daisy chain of agency problems—of misaligned incentives—both in the creation of credit (from asset originators to asset distributors to asset managers) and in the investment process (from beneficial owners of assets, to boards of directors, to staffs, to consultants and again to asset managers). But these agency problems in finance have been with us for some time and could just have easily been described in 1978, 1988 and 1998 as today.

I see the daisy-chain of secured financing arrangements that have run through our financial system, and the asset-based rather than income- or cash-flow-based credit process which they reflect, as providing the more compelling insight into both the surge in liquidity and credit prices early in this decade and their subsequent collapse over the past year.

The theory of a lower capital charge for secured financing rests on the assumption that the addition of pledged collateral lowers the risk to the lender. In the presence of both belts and suspenders it is assumed that the lender need hold less of a cushion (in the form of

loss bearing capital) against the risk of loss, where the belt is presumably the borrower's ability to repay the debt out of cash flow and the suspenders are the borrower's pledge of collateral.

The degradation of our credit process comes about not by the fact of secured financing but *when lenders cease to pay attention to the borrowers' ability to repay out of cash flow* and make their lending decisions solely on the basis of the expected value of the collateral and whatever haircut (or down payment) the lender can secure *whether the borrowers be households or hedge funds*.

In our current system of transaction-based leverage the haircut becomes the loss absorber of first recourse. But the haircut is only a slice of the asset itself and, thus, the "capital" available to absorb losses on the asset is perfectly correlated with the asset. As the asset goes up in value this correlation appears to create an additional cushion and to justify the wisdom of the loan; but when the asset falls in value, the cushion decays at the same rate as the asset.

As lenders seek to protect themselves by increasing their implicit capital cushion through increasing haircuts (as many intermediaries attempted to do earlier this year) their actions both confess their failure to look to the borrowers' cash flow as the first recourse and demonstrate the procyclical nature of asset-based financing as the impact of rising haircuts on asset values becomes self-defeating. This is exactly parallel to the procyclical nature of secured financing described in a more general context by Kiyotaki and Moore (1997) as referenced by Allen and Carletti (pg. 395).

With all the discussion about underwriting standards for home mortgages, it strikes me as more than a little odd that we have been observing and discussing a crisis in the financial system for more than a year and yet nobody has spoken about underwriting standards for lending to hedge funds, or SIVs, or REITS, or CDOs or broker dealers or banks. I believe this is a reflection of how deeply we are immersed in a culture of asset-based finance. But perhaps after a quarter century of a bull market in credit asset values—brought on by the persistent decline in nominal interest rates caused, in sequence, by disinflation, productivity gains, and an extended period

of abnormally low real rates—we should not be surprised that our financial system has been re-engineered into an asset-based process that presumes rather than inquires into the cash flows of borrowers.

While there are significant differences between the events of 2008 and of 1998, I am struck by the parallel in the procyclical mechanics that repo-based financing played both in story of LongTerm Capital Management and in the systemwide dynamics that began to unfold last summer.

I would also suggest that the prevalence of repo-based financing helps explain the abruptness and persistence with which the de-levering has been translated into illiquidity and sharp asset price declines.

For some time, the marginal buyer (or seller) of assets has been a levered buyer (or seller). Not in the sense of balance sheet leverage but, rather, levered in the transactional sense of only being in a position to buy those assets which can be funded in the repo market. This is true not only of the firms that are thought of as highly levered, like hedge funds, but also of a great deal of “long only” activity where the high volume and velocity of transactions creates reliance on repo financing to support the timely purchase of assets and a subsequent sorting out of positions and cash flows.

As a consequence, “funding liquidity” has come to mean the ability to fund the purchase of an asset on leverage and illiquidity means the inability to fund (or extend the funding) of an asset on leverage. The procyclical nature of raising haircuts as a form of lender self-defense triggered both a shift in demand from secured to unsecured markets, overwhelming the traditional interbank markets, and a fall in asset prices that could not be sustained at higher haircuts.

While economists and commentators can distinguish between funding liquidity and asset market liquidity (or depth), in market practice the two terms are commonly conflated because they are so closely linked. While different types of assets are recognized as having different liquidity characteristics, outside of money market eligible instruments, this liquidity itself is thought of as an asset’s ability to be financed. Thus, liquidity is not so much an alternative to investment (as in “being liquid” or “being invested”) but, in a world of

transactional leverage, “liquidity” is the means of becoming invested and illiquidity is the corresponding explanation for downward pressure on asset prices.

In sum, the “cash in the market” that has driven asset prices both up and down is the cash that comes from lenders, not investors.

The Federal Reserve’s New Facilities

In discussing the Federal Reserve’s new facilities, Allen and Carletti focus principally on the swapping of Treasury securities for lower quality collateral and suggest contrasting perspectives on how this might be evaluated (pg. 401). On one hand, they point out that the collateral swap “helps the functioning of the repo markets in times of crisis” by expanding the supply of the preferred collateral. But on the other hand, to the extent that the swapping of Treasuries for lower quality collateral helps financial institutions window dress, they suggest that this may have contributed to the strains and “actually hurt more than help” by making it easier for the Fed’s counterparties to engage in the deception of hiding the quality of their balance sheets on reporting dates.

I have several reactions. First, these are essentially the same thing: you cannot help the repo market without affecting the balance sheets of repo market participants. Second, of course it is about window dressing—trying to make balance sheets look less leveraged—but it is always about window dressing. Ten years ago a broker-dealer CFO described to me the process of managing his balance sheet through quarter-end statement dates as like flying a jumbo jet under the Gateway Arch in St. Louis. Banks and broker-dealers are always trying to manage down their leverage on quarter-end dates and over the past year this has been particularly intense.

Twenty years ago, central bank orthodoxy, which came from the Bundesbank, held that no self-respecting central bank would want to use its balance sheet to monetize the profligacy of its own finance ministry. The irony was that accumulating foreign exchange reserves forced the Bundesbank to finance the profligacy of the U.S. Treasury—foreshadowing our current imbalanced relationship across the

Pacific. Today, a new orthodoxy suggests that a central bank should only hold sovereign credit on its balance sheet as a way of avoiding the messy business of credit judgments.

But in today's monetary world, a central bank that lends only against sovereign credit is like a gold-regime central bank that lends only against gold: in a crisis it will end up sucking all of the preferred assets out of the market—by hogging the base asset for the central bank's own balance sheet. To be relevant in a financial crisis, central banks have to lend against the assets the banks have not the assets they wish the banks had. The time to be fussy about the asset quality of the financial system's balance sheet is when the assets are being created, not when they need lender-of-last-resort financing.

The swapping out the Fed's balance sheet holdings of Treasuries, and the expansion of the Discount Window both to an auction format and to primary dealers, are useful and necessary steps that indirectly help give the banking system time to de-lever—to shrink balance sheets down to their sustainable capital and income base. But none of the Fed's facilities directly help the banks and broker-dealers to de-lever, *because you cannot de-lever by borrowing money.*

In creating the auction mechanism for the Discount Window the Federal Reserve has sought to re-activate the banking system's use of the lending facility that accepts a broader pool of collateral. As a former Manager of the System Open Market Account, a guilty conscience obliges me to confess that the non-use of the Discount Window by banks has been, to some extent, a self-inflicted wound.

By providing an entirely elastic supply of reserves at a constant, targeted price and aiming to minimize the volatility in the fed funds rate, the Open Market Desk habituated the banking system to the non-use of the Discount Window. While the stigma of weakness associated with use of the Discount Window in the late 1980s and early 1990s certainly played a role in banks' reluctance to seek borrowed reserves, by never forcing the banking system to take out borrowed reserves, the Federal Reserve habituated the banking system to a regime in which all needed reserves were provided through open market operations. Neither the Desk nor the Committee was willing

to tolerate the volatility in the funds rates that would, over time, have trained bank treasurers to use the Discount Window.

Thus, I fear we have had too little rather than too much volatility in the fed funds rate. If the Federal Reserve's actions have contributed to the practice of window dressing it is not through the advent of the recent swapping of Treasury securities for lower quality collateral but, rather, by the Fed's routine willingness to provide a super abundance of reserves on quarter-end dates. Finally, Allen and Carletti may want to reflect upon the seemingly perverse consequences of the Fed's efforts to limit the volatility of the fed funds rate as a contributor to higher intra-period leverage with reference to their conclusion that central bank interventions "can remove the inefficiency deriving from asset price volatility and achieve the same allocation as with complete markets" (pg. 392). We must be careful to distinguish removing volatility from merely shifting it.

Contagion

Allen and Carletti also discuss the fear of contagion as a rationale for central bank intervention, concluding that the main finding from the literature is that contagion is unlikely but that there are reasons for being cautious in accepting this result and that further work in this area should be undertaken (pg. 403-405). I certainly concur on the need for further work, particularly to get beyond consideration of direct exposures between financial firms and to delve further into indirect exposures. Counterparties should have a quite accurate picture of their direct exposures to a firm at risk of being closed. However, indirect exposures caused by parallel and correlated asset positions, as well as proxy hedging strategies, are harder to ascertain, harder as-suage and, thus, more likely to stimulate herding behavior that could give rise to contagion.

A final thought

We need to be careful with the words we use. We have a problem of both too little capital and of too much capital. There is too little loss bearing capacity inside many financial intermediaries in the form of equity; but there is too much capital in the business of financial

intermediation. The easy part of de-levering is the selling of financial assets to shrink balance sheets and the raising of new equity for those firms presumed to be survivors. The harder part will be contraction of the financial services industry.

In the 1990s Japan made two mistakes of consequence. First, in the early 1990s the Bank of Japan ran a too restrictive monetary policy. In the latter part of the decade, the Japanese authorities were too slow in managing the process of consolidating their weakened banks.

I hope we have learned both lessons from the Japanese experience.

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General Discussion: The Role of Liquidity in Financial Crises

Chair: Stanley Fischer

Mr. Makin: I would like to ask the authors and Peter if the liquidity problems they are discussing—and, Peter, your experience in the marketplace over the past 12 months—suggests to you the Fed ought to consider enlarging its balance sheet? More specifically, the Fed is the place where you can go for Treasuries to swap against securities that may be more difficult to turn into liquid assets. In the wake of problems, such as the failure of IndyMac and the incipient failure of other institutions, we see a situation developing where there is a run out of large deposits and into cash and/or Treasuries.

(Personal anecdote: In March of this year when I was very nervous about my deposits in large institutions, I approached a mutual fund and asked them if I could put a substantial amount of money into their Treasury-only fund. And they said, “No, we already have too much of that going on.”)

So, the notion there is going to be in a crisis entailing an excess demand for Treasuries suggests that the Fed ought to start buying more Treasuries in order to be able to supply them to panicky market participants who are running out of bank money. Does that notion follow from your discussion?

Mr. Lacker: The last few decades I've noticed an empirical regularity about financial crises that hasn't gotten as much attention at this conference, but this conference is a good illustration—and it's that financial crises give rise to a significant increase in references to asymmetric information and market frictions and appeals to them as rationales for government intervention of various sorts.

This emerged as a promising line of research in the very early 1980s and was pursued with diligence and industry by many economists—some of them in this room. It has been a very helpful and very useful line of research. It has illuminated very many important phenomena. But it has been disappointing as well because what we found from those research endeavors is that it's fairly difficult—not impossible, but fairly difficult—to build an efficiency-related rationale for government intervention. Obviously, what it requires is some comparative advantage with a government actor, such as superior information, superior technology, or the ability to tax. But the ability to tax implies the intervention is a redistribution rather than an efficiency enhancement.

A fair reading of the literature on financial arrangements under limited information suggests deep humility about the economics of central bank credit market intervention. It occurred to me yesterday in the discussion about how prudential regulators ought to respond to credit cycles. You don't have to stand on your head to build a model in which financial intermediaries varied their credit standards over the cycle in response to varying economic conditions in which that is optimal.

In other words, the cyclical variation in credit standards is an effect and not a cause. It will be difficult to implement an optimal calibration intervening in those credit standard judgments.

This humility suggests we entertain when we consider interventions or consider how we understand financial market crises a range of potential explanations for observable phenomena and check how well they line up against observations. The authors of this paper propose a cash-in-the-market friction as an explanation of last year's phenomenon. I have a hard time buying this because we've heard all these

reports of vast sums sitting on the sidelines waiting for more attractive prices. In fact, the discussant seems to be an instance of that.

So, I would be interested in how they reconciled that observation with their friction. Besides, even if you grant the friction, it would explain the need for unsterilized intervention. Yet, what we have done is sterilized intervention because sterilized intervention doesn't increase the amount of cash in the market. Here, Bordo's distinction is important.

As the authors are surely aware, observationally equivalent models would explain what happened to prices as deteriorating fundamentals. I am not sure how one rejects the notion the large discounts of mortgage-backed securities reflect the sense that, if returns were exceptionally low, it would be a very bad state of the world.

Mr. Alexander: Chairman Bernanke yesterday talked a lot about improving infrastructure and settlement systems for securities markets. I wondered if the authors and Peter could comment on the degree to which (if we expanded those things like having central counterparties or pushing more trading onto exchanges) you think that would mitigate some of these problems?

Mr. Landau: My question is about liquidity holding on the interbank market. A lot of people would agree that this is the reason, rather than counterparty risk, why interbank markets were disrupted in the last year.

It is only fair to say that nobody expected that to happen beforehand. So, I was wondering whether we have some kind of fundamental explanation of this behavior, why liquidity demand can increase so fast up to almost an infinite amount or whether we have to accept that as a fact of life that there are jumps between different kinds of regime shifts where liquidity demand jumps up and down. It seems to me that it is very important to get to a kind of deep understanding and that before you even start thinking about what central banks should be doing in those situations.

Mr. McCulley: I have the same asset or liability as Peter; I am not sure which in being a practitioner. Theory is theory and practice is practice, and I confess that I was a very large liquidity hoarder, even though I was a net lender to the System last fall.

My serious question is actually to the authors of the paper, which is that, while I enjoyed your paper, I felt a huge vacuum in that you did not discuss the framework of Hyman Minsky at all in explaining this phenomenon. My question is, Why?

Mr. Bullard: Since I am not European, I'll comment on UBS. One argument would be that the problems of UBS are well-known—the problems described are well-known—and the markets are well-aware of these problems. What they are doing is anybody who is doing business with UBS is pricing in this information and taking into account the firm might fail. For this reason, should they actually fail, the probability of contagion is not very high. But maybe Professor Allen thinks the markets aren't pricing this in there. Either they are unwilling or unable to do so.

Mr. Allen: Let me first of all thank Peter for his comments. They are very interesting, and I don't think that we disagree with anything he said. So, let me turn to the questions and discuss some of the points raised there.

The first question was about this issue of should the Fed supply more Treasuries and supply collateral to make things easy because there seems to be a shortage? Again, this gets back to this window-dressing issue. Peter was saying this is indeed what is going on; there is window-dressing. But that is a serious problem because one of the ways the market disciplines financial institutions is to see what risks they are taking in order to get the returns they're earning.

If everyone looks pretty good because they're holding these Treasuries while the central banks have the junk stuff they're holding most of the rest of the quarter, that is not a very good way of investors or regulators being able to figure out what is going on.

One way to solve this would be to make it, for example, random, which day you had to declare your holdings of securities. So, instead

of making it a specific day, you would say, “We’re going to draw a number of an urn, and then you have to tell us what you held that day.” It would be different for different things, and we would get rid of these effects. So there are other ways of dealing with these window-dressings.

Jeff Lacker was talking about the electric chair and no convincing rationale for intervention. Let me make a couple of points here. He was talking about the tax argument and there being these redistributions, so it’s redistribution rather than efficiency. One of the key points is that what goes wrong is that if you look at the complete-markets case, what in fact is going on is you are having redistributions. That is what the complete markets are doing. They are allowing risk-sharing, by transferring funds from people. That is what is breaking down, I would argue, in many of these cases. The central bank has a role to play in correcting that problem.

Let me also make a point, which I don’t think I made clearly enough in the talk, which is contagion is a big problem. Because if you go through this sequence of events that Chairman Bernanke described yesterday with a chain of bankruptcies, those are very costly. There are an awful lot of deadweight costs in the bankruptcy of financial institutions. If I were to say what’s the most important reason that we need intervention, I would use the contagion argument because there are real efficiency issues there.

Now, a question about how these actual cash-in-the-market effects work and can we supply liquidity. It is very difficult to get liquidity into the right place. These markets are fairly segmented. For these kinds of fairly exotic securities, there aren’t huge numbers of traders in them, and it’s difficult to get cash in there quickly because they have capital constraints. You have to go back and say, “Look, there is a problem in this market. We need more capital so we can arbitrage and we can make a lot of money.”

That all takes time because of the kinds of agency problems we discussed yesterday. That creates the problem that once you get these links broken, we are into this risky arbitrage. That is so important.

Do people anticipate these changes? We will have periods where prices do deviate from fundamentals. Gary was saying yesterday—

this was kind of unique because of the subprime mortgage-backed securities—these problems can occur with many kinds of securities.

Take the Long-Term Capital Management (LTCM) crisis. LTCM was doing the convergent trade, where they were shorting the low-yield liquid securities and going long in the high-yield illiquid securities. Arguably what happened there—I haven't gone back and looked at the data, but I will do this in the next few months—is we got liquidity pricing in those markets with the default of the Russians. That caused prices to move in the wrong way. Liquidity pricing kicked in, and that caused the problem. We know in the end it worked out.

We didn't discuss Hyman Minsky. I guess I am not a great believer in behavioral kinds of explanations of these kinds of phenomena. I believe in highly rational people driven to make money. I like to look for frictions for why things don't work and rational expectations of that. That would be my justification.

The question with UBS, why isn't everything priced in? There is a lot of inertia. One of the things that has astonished me is that they haven't had more outflows. People in general don't realize that if they were to go down, there wouldn't be anybody to step in. Maybe the Swiss would save the Swiss citizens, but other citizens I'm not sure they would. That is rational expectations because there are costs of discovering this and that is what inertia is. It's cost of discovering the issues. Anyway, I will close there.

Mr. Fisher: We are in agreement on remedies to window-dressing. It somewhat depresses me to realize it was in 1994 I first proposed that with leverage and other risk measures we should get them out of financial firms on an intraperiod basis, where they would disclose the mode, the high, and the low observation over a 90-day period rather than the March 31, so we are certainly in agreement on the direction there. Maybe we can move that idea along in the coming decades.

Should the Fed expand its balance sheets?—John Makin's question. Let me say I guess I would gently urge them not to bother. There will be enough Treasury borrowing coming along soon enough to deal with this. The FDIC fund, Congress, and stimulus in general eventually

will provide enough Treasuries, and so that would be a very brief intervention that might be necessary.

It was Jeffrey Lacker's question on cash in the market and all the money on the sidelines: First, a number of investors are aware of the limits to arbitrage and the downward pressure on prices brought about by collapsing balance sheets. Just as I think a necessary condition for house prices to stabilize in America is stabilizing some measures of debt to income for the household sector, stabilizing the balance sheets of financial intermediaries is going to have something to do with stabilizing their income-to-debt ratios. The revenue aperture coming into their balance sheets will still be contracting because that revenue is contracting and the investors are aware there is a downward cycle yet ahead of them.

But more precisely probably in your vein is that there is inertia in hurdle rates, and these investors are looking for one or two turns of leverage in order to get the hurdle rates they want. They are optimists about central banks' ability to get us back to an economy growing at trend, so they want to get a mid-teens return. They need one or two turns to leverage to do that. They have to go to some intermediary, someone else to provide them the leverage, and that is the connection. The cash in the market is he who is lending. As I meant to make clear in my remarks, the repo market is the cash in the market.

Lew Alexander asked about infrastructure and if I am optimistic about infrastructure improvements making a difference. The answer is yes and no. A number of infrastructure improvements will make a difference. Clearly, 20 years of work on the foreign exchange settlement process reduced our anxieties about foreign exchange settlement mechanisms being the unzipping process for a banking crisis, but it did take decades, not a couple of years.

I forget who yesterday made the comment that improving risk management is all about increasing your ability to take more risk. There are a number of areas where the banks and major dealers' appetite for these improvements is principally because they want to take more risk. They want to be able to do more activities, generate more volume.

I don't know this for a fact but I know it anecdotally, from the people who would be in a position to have an opinion that the credit default swap market is probably already more like \$60 trillion to \$70 trillion, much of that growth since the middle of March. That the major dealers are now wards of the state and, therefore, counterparty risk is down, might be contributing to an acceleration in the writing of this product.

I have a particular anxiety about cleaning up the infrastructure of the CDS market, whether there will be delivery of bonds. There are trillions of dollars of contracts that have been written on the premise—if you read their terms—that a bond will be delivered to the writer of protection. And the writer of protection, then, only covers the difference with that and the original covered price. The dealers don't want to bother with this; that would be a nuisance to have to go buy all those bonds and deliver them—it would cause a big settlement headache, and we couldn't clear up the system. So they'd rather tear up all these contracts. But they've found a polite lawyerlike way to say this: We are going to have a credit event default protocol with an auction with a limited number of participants to determine the value of the collateral.

If that goes through without the authorities coming up with the appropriate capital charge for this insurance industry, it will be a very risky thing. So—yes and no. There are some improvements in infrastructure that make a very big difference, and there are some that give me some pause.

Rethinking Capital Regulation

Anil K. Kashyap, Raghuram G. Rajan and Jeremy C. Stein

I. Introduction

Recent estimates suggest that U.S. banks and investment banks may lose up to \$250 billion from their exposure to residential mortgage securities.¹ The resulting depletion of capital has led to unprecedented disruptions in the market for interbank funds and to sharp contractions in credit supply, with adverse consequences for the larger economy. A number of questions arise immediately. Why were banks so vulnerable to problems in the mortgage market? What does this vulnerability say about the effectiveness of current regulation? How should regulatory objectives and actual regulation change to minimize the risks of future crises? These are the questions we focus on in this paper.

Our brief answers are as follows. The proximate cause of the credit crisis (as distinct from the housing crisis) was the interplay between two choices made by banks. First, substantial amounts of mortgage-backed securities with exposure to subprime risk were kept on bank balance sheets even though the “originate and distribute” model of securitization that many banks ostensibly followed was supposed to transfer risk to those institutions better able to bear it, such as unleveraged pension funds.² Second, across the board, banks financed these and other risky assets with short-term market borrowing.

This combination proved problematic for the system. As the housing market deteriorated, the perceived risk of mortgage-backed securities increased, and it became difficult to roll over short-term loans against these securities. Banks were thus forced to sell the assets they could no longer finance, and the value of these assets plummeted, perhaps even below their fundamental values—i.e., funding problems led to fire sales and depressed prices. And as valuation losses eroded bank capital, banks found it even harder to obtain the necessary short-term financing—i.e., fire sales created further funding problems, a feedback loop that spawned a downward spiral.³ Bank funding difficulties spilled over to bank borrowers, as banks cut back on loans to conserve liquidity, thereby slowing the whole economy.

The natural regulatory reaction to prevent a future recurrence of these spillovers might be to mandate higher bank capital standards, so as to buffer the economy from financial-sector problems. But this would overlook a more fundamental set of problems relating to corporate governance and internal managerial conflicts in banks—broadly termed agency problems in the finance literature. The failure to offload subprime risk may have been the leading symptom of these problems during the current episode, but they are a much more chronic and pervasive issue for banks—one need only to think back to previous banking troubles involving developing country loans, highly-leveraged transactions, and commercial real estate to reinforce this point. In other words, while the specific manifestations may change, the basic challenges of devising appropriate incentive structures and internal controls for bank management have long been present.

These agency problems play an important role in shaping banks' capital structures. Banks perceive equity to be an expensive form of financing and take steps to use as little of it as possible; indeed, a primary challenge for capital regulation is that it amounts to forcing banks to hold more equity than they would like. One reason for this cost-of-capital premium is the high level of discretion that an equity-rich balance sheet grants to bank management. Equity investors in a bank must constantly worry that bad decisions by management will dissipate the value of their shareholdings. By contrast, secured short-term creditors are better

protected against the actions of wayward bank management. Thus, the tendency for banks to finance themselves largely with short-term debt may reflect a privately optimal response to governance problems.

This observation suggests a fundamental dilemma for regulators as they seek to prevent banking problems from spilling over onto the wider economy. More leverage, especially short-term leverage, may be the market's way of containing governance problems at banks; this is reflected in the large spread between the costs to banks of equity and of short-term debt. But when governance problems actually emerge, as they invariably do, bank leverage becomes the mechanism for propagating bank-specific problems onto the economy as a whole. A regulator focused on the proximate causes of the crisis would prefer lower bank leverage, imposed for example through a higher capital requirement. This will reduce the risk of bank defaults. However, the higher capital ratio will also increase the overall cost of funding for banks, especially if higher capital ratios in good times exacerbate agency problems.

Moreover, given that the higher requirement holds in both good times and bad, a bank faced with large losses will still face an equally unyielding tradeoff—either liquidate assets or raise fresh capital. As we have seen during the current crisis, and as we document in more detail below, capital-raising tends to be sluggish. Not only is capital a relatively costly mode of funding at all times, it is particularly costly for a bank to raise new capital during times of great uncertainty. Moreover, at such times many of the benefits of building a stronger balance sheet accrue to other banks and to the broader economy and thus are not properly internalized by the capital-raising bank.

Here is another way of seeing our point. Time-invariant capital requirements are analogous to forcing a homeowner to hold a fixed fraction of his house's value in savings as a hedge against storm damage—and then not letting him spend down these savings when a storm hits. Given this restriction, the homeowner will have no choice but to sell the damaged house and move to a smaller place—i.e., to suffer an economic contraction.

This analogy suggests one possible avenue for improvement. One might raise the capital requirement to, say, 10% of risk-weighted assets in normal times, but with the understanding that it will be relaxed back to 8% in a crisis-like scenario. This amounts to allowing some of the rainy-day fund to be spent when it rains, which clearly makes sense—it will reduce the pressure on banks to liquidate assets and the associated negative spillovers for the rest of the economy. Thus, time-varying capital requirements represent a potentially important improvement over the current time-invariant approach in Basel II.

Still, even time-varying capital requirements continue to be problematic on the cost dimension. If banks are asked to hold significantly more capital during normal times—which, by definition, is most of the time—their expected cost of funds will increase, with adverse consequences for economic activity. This is because the fundamental agency problem described above remains unresolved. Investors will continue to charge a premium for supplying banks with large amounts of equity financing during normal times because they fear that this will leave them vulnerable to the consequences of poor governance and mismanagement.

Pushing our storm analogy a little further, a natural alternative suggests itself, namely disaster insurance. In the case of a homeowner who faces a small probability of a storm that can cause \$500,000 of damage, the most efficient solution is not for the homeowner to keep \$500,000 in a cookie jar as an unconditional buffer stock—especially if, in a crude form of internal agency, the cookie jar is sometimes raided by the homeowner's out-of-control children. Rather, a better approach is for the homeowner to buy an insurance policy that pays off only in the contingency when it is needed, i.e. when the storm hits. Similarly, for a bank, it may be more efficient to arrange for a contingent capital infusion in the event of a crisis, rather than keeping permanent idle (and hence agency-prone) capital sitting on the balance sheet.⁴

To increase flexibility, the choice could be left to the individual banks themselves. A bank with \$500 billion in risk-weighted assets could be given the following option by regulators: it could either

accept a capital requirement that is 2% higher, meaning that the bank would have to raise \$10 billion in new equity. Or, it could acquire an insurance policy that pays off \$10 billion upon the occurrence of a systemic “event”—defined perhaps as a situation in which the aggregate write-offs of major financial institutions in a given period exceed some trigger level. In terms of cushioning the impact of a systemic event on the economy, the insurance option is just as effective as higher capital requirements.

To make the policy default-proof, the insurer (say a sovereign wealth fund, a pension fund, or even market investors) would, at inception, put \$10 billion in Treasuries into a “lock box.” If there is no event over the life of the policy, the \$10 billion would be returned to the insurer, who would also receive the insurance premium from the bank as well as the interest paid by the Treasuries. If there is an event, the \$10 billion would transfer to the balance sheet of the insured bank.

From the bank’s perspective, the premium paid in insuring a systemic event triggered by aggregate bank losses may be substantially smaller than the high cost it has to pay for additional unconditional capital on balance sheet. This reduced cost of additional capital would in turn dampen the bank’s incentive to engage in regulatory arbitrage.

Note that the insurance approach does not strain the aggregate capacity of the market any more than the alternative approach of simply raising capital requirements. In either case, we must come up with \$10 billion when the new regulation goes into effect. Nevertheless, there may be some concern about whether a clientele will emerge to supply the required insurance on reasonable terms. In this regard, it is reassuring to observe that the return characteristics associated with writing such insurance have been much sought after by investors around the world—a higher-than-risk free return most of the time, in exchange for a small probability of a serious loss. Also, given the opt-in feature, if the market is slow to develop or proves to be too expensive, banks will always have the choice of raising more equity instead of relying on insurance.

To be clear, capital insurance is not intended to solve all the problems associated with regulating banks. For example, to the extent that the trigger is only breached when a number of large institutions experience losses at the same time, the issue of dealing with a single failing firm that is very inter-connected to the financial system would remain. The opt-in aspect of our proposal also underscores the fact that one should not view capital insurance as a replacement for traditional capital regulation, but rather, as one additional element of the capital-regulation toolkit. What makes this one particular tool potentially valuable is that it is designed with an eye towards mitigating the underlying frictions that make bank equity expensive—namely the governance and internal agency problems that are pervasive in this industry. The added flexibility associated with the insurance option may therefore help to reduce the externalities associated with bank distress, while at the same time minimizing the potential costs of public bailouts during crises, as well as the drag on intermediation in normal times.

More generally, our proposal reflects some pessimism that regulators can ever make the financial system fail-safe. Rather than placing the bulk of the emphasis on preventative measures, more attention should be paid to reducing the costs of a crisis. Or, using an analogy from Hoenig (2008), instead of attempting to write the most comprehensive fire code possible, we should give some thought to installing more sprinklers.

The rest of the paper is organized as follows. In Section II, we describe the causes of the current financial crisis and its spillover effects onto the real economy. In Section III, we discuss capital regulation, with a particular focus on the limitations of the current system. In Section IV, we use our analysis to draw out some general principles for reform. In Section V, we develop our specific capital-insurance proposal. Section VI concludes.

II. The Credit-Market Crisis: Causes and Consequences

We begin our analysis by asking why so many mortgage-related securities ended up on bank balance sheets and why banks funded these assets with so much short-term borrowing.

II. A. Agency problems and the demand for low-quality assets

Our preferred explanation for why bank balance sheets contained problematic assets, ranging from exotic mortgage-backed securities to covenant-light loans, is that there was a breakdown of incentives and risk-control systems within banks.⁵ A key factor contributing to this breakdown is that, over short periods of time, it is very hard, especially in the case of new products, to tell whether a financial manager is generating true excess returns adjusting for risk, or whether the current returns are simply compensation for a risk that has not yet shown itself but that will eventually materialize. Consider the following specific manifestations of the problem.

Incentives at the top

The performance of CEOs is evaluated based in part on the earnings they generate relative to their peers. To the extent that some leading banks can generate legitimately high returns, this puts pressure on other banks to keep up. Follower-bank bosses may end up taking excessive risks in order to boost various observable measures of performance. Indeed, even if managers recognize that this type of strategy is not truly value-creating, a desire to pump up their stock prices and their personal reputations may nevertheless make it the most attractive option for them (Stein, 1989; Rajan, 1994).

There is anecdotal evidence of such pressure on top management. Perhaps most famously, Citigroup Chairman Chuck Prince, describing why his bank continued financing buyouts despite mounting risks, said:

*“When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to get up and dance. We’re still dancing.”*⁶

Flawed internal compensation and control

Even if top management wants to maximize long-term bank value, it may find it difficult to create incentives and control systems that steer subordinates in this direction. Retaining top traders, given the competition for talent, requires that they be paid generously based on performance. But high-powered pay-for-performance schemes create

an incentive to exploit deficiencies in internal measurement systems. For instance, at UBS, AAA-rated mortgage-backed securities were apparently charged a very low internal cost of capital. Traders holding these securities were allowed to count any spread in excess of this low hurdle rate as income, which then presumably fed into their bonuses.⁷ No wonder that UBS loaded up on mortgage-backed securities.

More generally, traders have an incentive to take risks that are not recognized by the system, so they can generate income that appears to stem from their superior abilities, even though it is in fact only a market risk premium.⁸ The classic case of such behavior is to write insurance on infrequent events, taking on what is termed “tail” risk. If a trader is allowed to boost her bonus by treating the entire insurance premium as income, instead of setting aside a significant fraction as a reserve for an eventual payout, she will have an excessive incentive to engage in this sort of trade.

This is not to say that risk managers in a bank are unaware of such incentives. However, they may be unable to fully control them, because tail risks are by their nature rare, and therefore hard to quantify with precision before they occur. Absent an agreed-on model of the underlying probability distribution, risk managers will be forced to impose crude and subjective-looking limits on the activities of those traders who are seemingly the bank’s most profitable employees. This is something that is unlikely to sit well with a top management that is being pressured for profits.⁹ As a run of good luck continues, risk managers are likely to become increasingly powerless, and indeed may wind up being most ineffective at the point of maximum danger to the bank.

II. B. Agency problems and the (private) appeal of short-term borrowing

We have described specific manifestations of what are broadly known in the finance literature as managerial agency problems. The poor investment decisions that result from these agency problems would not be so systemically threatening if banks were not also highly levered, and if such a large fraction of their borrowing was not short-term in nature.

Why is short-term debt such an important source of finance for banks? One answer is that short-term debt is an equilibrium response to the agency problems described above.¹⁰ If instead banks were largely equity financed, this would leave management with a great deal of unchecked discretion, and shareholders with little ability to either restrain value-destroying behavior or to ensure a return on their investment. Thus, banks find it expensive to raise equity financing, while debt is generally seen as cheaper.¹¹ This is particularly true if the debt can be collateralized against a specific asset, since collateral gives the investor powerful protection against managerial misbehavior.

The idea that collateralized borrowing is a response to agency problems is a common theme in corporate finance (see, e.g., Hart and Moore, 1998), and of course this is how many assets—from real estate to plant and equipment—are financed in operating firms. What distinguishes collateralized borrowing in the banking context is that it tends to be very short-term in nature. This is likely due to the highly liquid and transformable nature of banking firms' assets, a characteristic emphasized by Myers and Rajan (1998). For example, unlike with a plot of land, it would not give a lender much comfort to have a long-term secured interest in a bank's overall trading book, given that the assets making up this book can be completely reshuffled overnight. Rather, any secured interest will have to be in the individual components of the trading book, and given the easy resale of these securities, will tend to short-term in nature.

This line of argument helps to explain why short-term, often secured, borrowing is seen as significantly cheaper by banks than either equity or longer-term (generally unsecured) debt. Of course, short-term borrowing has the potential to create more fragility as well, so there is a tradeoff. However, the costs of this fragility may in large part be borne systemically, during crisis episodes, and hence not fully internalized by individual banks when they pick an optimal capital structure.¹² It is to these externalities that we turn next.

II.C. Externalities during a crisis episode

When banks suffer large losses, they are faced with a basic choice: Either they can shrink their (risk-weighted) asset holdings so that

they continue to satisfy their capital requirements with their now-depleted equity bases, or they can raise fresh equity. For a couple of reasons, equity-raising is likely to be sluggish, leaving a considerable fraction of the near-term adjustment to be taken up by asset liquidations. One friction comes from what is known as the debt overhang problem (Myers, 1977): By bolstering the value of existing risky debt, a new equity issue results in a transfer of value from existing shareholders. A second difficulty is that equity issuance may send a negative signal, suggesting to the market that there are more losses to come (Myers and Majluf, 1984). Thus, banks may be reluctant to raise new equity when under stress. It may also be difficult for them to cut dividends to stem the outflow of capital, for such cuts may signal management's lack of confidence in the firm's future. And a loss of confidence is the last thing a bank needs in the midst of a crisis.

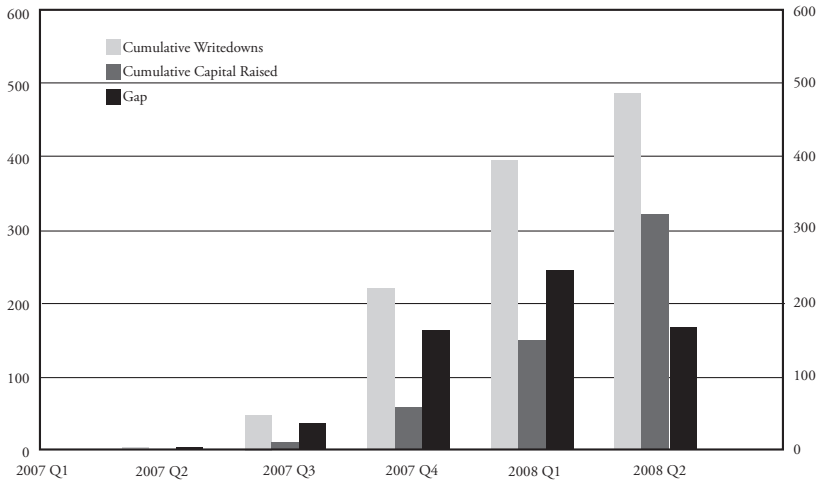
Chart 1 plots both cumulative disclosed losses and new capital raised by global financial institutions (these include banks and brokerage firms) over the last four quarters. As can be seen, while there has been substantial capital raising, it has trailed far behind aggregate losses. The gap was most pronounced in the fourth quarter of 2007 and the first quarter of 2008, when cumulative capital raised was only a fraction of cumulative losses. For example, through 2008Q1, cumulative losses stood at \$394.7 billion, while cumulative capital raised was only \$149.1 billion, leaving a gap of \$245.6 billion. The situation improved in the second quarter of 2008, when reported losses declined, while the pace of capital raising accelerated.

While banks may have good reasons to move slowly on the capital-raising front, this gradual recapitalization process imposes externalities on the rest of the economy.

The fire-sale externality

If a bank does not want to raise capital, the obvious alternative will be to sell assets, particularly those that have become hard to finance on a short-term basis.¹³ This creates what might be termed a fire-sale externality. Elements of this mechanism have been described in theoretical work by Allen and Gale (2005), Brunnermeier and Pedersen (2008), Kyle and Xiong (2001), Gromb and Vayanos (2002), Morris

Chart 1
Progress Towards Recapitalization by Global Financial Firms



Source: Bloomberg, WDCI <GO>, accessed August 6, 2008

and Shin (2004), and Shleifer and Vishny (1992, 1997) among others, and it has occupied a central place in accounts of the demise of Long-Term Capital Management in 1998.

When bank A adjusts by liquidating assets—e.g., it may sell off some of its mortgage-backed securities—it imposes a cost on another bank B who holds the same assets: The mark-to-market price of B’s assets will be pushed down, putting pressure on B’s capital position and in turn forcing it to liquidate some of its positions. Thus, selling by one bank begets selling by others, and so on, creating a vicious circle.

This fire-sale problem is further exacerbated when, on top of capital constraints, banks also face short-term funding constraints. In the example above, even if bank B is relatively well-capitalized, it may be funding its mortgage-backed securities portfolio with short-term secured borrowing. When the mark-to-market value of the portfolio falls, bank B will effectively face a margin call, and may be unable to roll over its loans. This too can force B to unwind some of its holdings. Either way, the end result is that bank A’s initial liquidation—through its effect on market prices and hence its impact on bank B’s

price-dependent financing constraints—forces bank B to engage in a second round of forced selling, and so on.

The credit-crunch externality

What else can banks do to adjust to a capital shortage? Clearly, other more liquid assets (e.g. Treasuries) can be sold, but this will not do much to ease the crunch since these assets do not require much capital in the first place. The weight of the residual adjustment will fall on other assets that use more capital, even those far from the source of the crisis. For instance, banks may cut back on new lending to small businesses. The externality here stems from the fact that a constrained bank does not internalize the lost profits from projects the small businesses terminate or forego, and the bank-dependent enterprises cannot obtain finance elsewhere (see, e.g., Diamond and Rajan, 2005). Adrian and Shin (2008b) provide direct evidence that these balance sheet fluctuations affect various measures of aggregate activity, even controlling for short-term interest rates and other financial market variables.

Recapitalization as a public good

From a social planner's perspective, what is going wrong in both the fire-sale and credit-crunch cases is that bank A should be doing more of the adjustment to its initial shock by trying to replenish its capital base, and less by liquidating assets or curtailing lending. When bank A makes its privately-optimal decision to shrink, it fails to take into account the fact that were it to recapitalize instead, this would spare others in the chain the associated costs. It is presumably for this reason that Federal Reserve officials, among others, have been urging banks to take steps to boost their capital bases, either by issuing new equity or by cutting dividends.¹⁴

A similar market failure occurs when bank A chooses its initial capital structure up front and must decide how much, if any, "dry powder" to keep. In particular, one might hope that bank A would choose to hold excess capital well above the regulatory minimum, and not to have too much of its borrowing be short-term, so that when losses hit, it would not be forced to impose costs on others. Unfortunately, to the extent that a substantial portion of the costs are

social, not private costs, any individual bank's incentives to keep dry powder may be too weak.

II.D. Alternatives for regulatory reform

Since the banking crisis (as distinct from the housing crisis) has roots in both bank governance and capital structure, reforms could be considered in both areas. Start first with governance. Regulators could play a coordinating role in cases where action by individual banks is difficult for competitive reasons—for example, in encouraging the restructuring of employee compensation so that some performance pay is held back until the full consequences of an investment strategy play out, thus reducing incentives to take on tail risk. More difficult, though equally worthwhile, would be to find ways to present a risk-adjusted picture of bank profits, so that CEOs do not have an undue incentive to take risk to boost reported profits.

But many of these problems are primarily for corporate governance, not regulation, to deal with, and given the nature of the modern financial system, impossible to fully resolve. For example, reducing high-powered incentives may curb excessive risk taking but will also diminish the constant search for performance that allows the financial sector to allocate resources and risk. Difficult decisions on tradeoffs are involved, and these are best left to individual bank boards rather than centralized through regulation. At best, supervisors should have a role in monitoring the effectiveness of the decision-making process. This means that the bulk of regulatory efforts to reduce the probability and cost of a recurrence might have to be focused on modifying capital regulation.

III. The Role of Capital Regulation

To address this issue, we begin by describing the “traditional view” of capital regulation—the mindset that appears to inform the current regulatory approach, as in the Basel I and II frameworks. We then discuss what we see to be the main flaws in the traditional view. For reasons of space, our treatment has elements of caricature: It is admittedly simplistic and probably somewhat unfair. Nevertheless,

it serves to highlight what we believe to be the key limitations of the standard paradigm.

III.A. The traditional view

In our reading, the traditional view of capital regulation rests largely on the following four premises.

Protect the deposit insurer (and society) from losses due to bank failures

Given the existence of deposit insurance, when a bank defaults on its obligations, losses are incurred that are not borne by either the bank's shareholders or any of its other financial claimholders. Thus, bank management has no reason to internalize these losses. This observation yields a simple and powerful rationale for capital regulation: A bank should be made to hold a sufficient capital buffer such that, given realistic lags in supervisory intervention, etc., expected losses to the government insurer are minimized.

One can generalize this argument by noting that, beyond just losses imposed on the deposit insurer, there are other social costs that arise when a bank defaults—particularly when the bank in question is large in a systemic sense. For example, a default by a large bank can raise questions about the solvency of its counterparties, which in turn can lead to various forms of gridlock.

In either case, however, the reduced-form principle is this: Bank failures are bad for society, and the overarching goal of capital regulation—and the associated principle of prompt corrective action—is to ensure that such failures are avoided.

Align incentives

A second and related principle is that of incentive alignment. Simply put, by increasing the economic exposure of bank shareholders, capital regulation boosts their incentives to monitor management and to ensure that the bank is not taking excessively risky or otherwise value-destroying actions. A corollary is that any policy action that reduces the losses of shareholders in a bad state is undesirable from an ex ante incentive perspective—this is the usual moral hazard problem.

Higher capital charges for riskier assets

To the extent that banks view equity capital as more expensive than other forms of financing, a regime with “flat” (non-risk-based) capital regulation inevitably brings with it the potential for distortion, because it imposes the same cost-of-capital markup on all types of assets. For example, relatively safe borrowers may be driven out of the banking sector and forced into the bond market, even in cases where a bank would be the economically more efficient provider of finance.

The response to this problem is to tie the capital requirement to some observable proxy for an asset’s risk. Under the so-called IRB (internal-ratings-based) approach of the Basel II accord, the amount of capital that a bank must hold against a given exposure is based in part on an estimated probability of default, with the estimate coming from the bank’s own internal models. These internal models are sometimes tied to those of the rating agencies. In such a case, risk-based capital regulation amounts to giving a bank with a given dollar amount of capital a “risk budget” that can be spent on either AAA-rated assets (at a low price), on A-rated assets (at a higher price), or on B-rated assets (at an even higher price).

Clearly, a system of risk-based capital works well only insofar as the model used by the bank (or its surrogate, the rating agency) yields an accurate and not-easily-manipulated estimate of the underlying economic risks. Conversely, problems are more likely to arise when dealing with innovative new instruments for which there exists little reliable historical data. Here the potential for mischaracterizing risks—either by accident, or on purpose, in a deliberate effort to subvert the capital regulations—is bound to be greater.

License to do business

A final premise behind the traditional view of capital regulation is that it forces troubled banks to seek re-authorization from the capital market in order to continue operating. In other words, if a bank suffers an adverse shock to its capital, and it cannot convince the equity market to contribute new financing, a binding capital requirement will necessarily compel it to shrink. Thus, capital requirements can be said to impose a type of market discipline on banks.

III.B. Problems with the traditional mindset

The limits of incentive alignment

Bear Stearns' CEO Jim Cayne sold his 5,612,992 shares in the company on March 25, 2008, at price of \$10.84, meaning that the value of his personal equity stake fell by over \$425 million during the prior month. Whatever the reasons for Bear's demise, it is hard to imagine that the story would have had a happier ending if only Cayne had had an even bigger stake in the firm, and hence higher-powered incentives to get things right. In other words, ex ante incentive alignment, while surely of some value, is far from a panacea—no matter how well incentives are aligned, disasters can still happen.

Our previous discussion highlights a couple of specific reasons why even very high-powered incentives at the top of a hierarchy may not solve all problems. First, in a complex environment with rapid innovation and short histories on some of the fastest-growing products, even the best-intentioned people are sometimes going to make major mistakes. And second, the entire hierarchy is riddled with agency conflicts that may be difficult for a CEO with limited information to control. A huge bet on a particular product that looks, in retrospect, like a mistake from the perspective of Jim Cayne may have represented a perfectly rational strategy from the perspective of the individual who actually put the bet on—perhaps he had a bonus plan that encouraged risk taking, or his prospects for advancement within the firm were dependent on a high volume of activity in that product.

Fire sales and large social costs outside of default

Perhaps the biggest problem with the traditional capital-regulation mindset is that it places too much emphasis on the narrow objective of averting defaults by individual banks, while paying too little attention to the fire-sale and credit-crunch externalities discussed earlier.¹⁵ Consider a financial institution, which, when faced with large losses, immediately takes action to bring its capital ratio back into line by liquidating a substantial fraction of its asset holdings.¹⁶ On the one hand, this liquidation-based adjustment process can be seen as precisely the kind of “prompt corrective action” envisioned by fans of capital regulation with a traditional mindset. And there is no

doubt that from the perspective of avoiding individual bank defaults, it does the trick.

Unfortunately, as we have described above, it also generates negative spillovers for the economy: Not only is there a reduction in credit to customers of the troubled bank, there is also a fire-sale effect that depresses the value of other institutions' assets, thereby forcing them into a similarly contractionary adjustment. Thus, liquidation-based adjustment may spare individual institutions from violating their capital requirements or going into default, but it creates a suboptimal outcome for the system as a whole.

Regulatory arbitrage and the viral nature of innovation

Any command-and-control regime of regulation creates incentives for getting around the rules, i.e., for regulatory arbitrage. Compared to the first Basel accord, Basel II attempts to be more sophisticated in terms of making capital requirements contingent on fine measures of risk; this is an attempt to cut down on such regulatory arbitrage. Nevertheless, as recent experience suggests, this is a difficult task, no matter how elaborate a risk-measurement system one builds into the regulatory structure.

One complicating factor is the viral nature of financial innovation. For example, one might argue that AAA-rated CDOs were a successful product precisely because they filled a demand on the part of institutions for assets that yielded unusually high returns, given their low regulatory capital requirements.¹⁷ In other words, financial innovation created a set of securities that were highly effective at exploiting skewed incentives and regulatory loopholes. (See, e.g., Coval, Jurek and Stafford, 2008a, b; and Benmelech and Dlugosz, 2008.)

Insufficient attention paid to cost of equity

A final limitation of the traditional capital-regulation mindset is that it simply takes as given that equity capital is more expensive than debt, but does not seek to understand the root causes of this wedge. However, if we had a better sense of why banks viewed equity capital as particularly costly, we might have more success in designing policies that moderated these costs. This in turn would reduce the drag

on economic growth associated with capital regulation, as well as lower the incentives for regulatory arbitrage.

Our discussion above has emphasized the greater potential for governance problems in banks relative to non-financial firms. This logic suggests that equity or long-term debt financing may be much more expensive than short-term debt, not only because long-term debt or equity has little control over governance problems, it is also more exposed to the adverse consequences. If this diagnosis is correct, it suggests that rather than asking banks to carry expensive additional capital all the time, perhaps we should consider a *conditional capital arrangement* that only channels funds to the bank in those bad states of the world where capital is particularly scarce, where the market monitors bank management carefully, and hence where excess capital is least likely to be a concern. We will elaborate on one such idea shortly.

IV. Principles for Reform

Having discussed what we see to be the limitations of the current regulatory framework for capital, we now move on to consider potential reforms. We do so in two parts. First, in this section, we articulate several broad principles for reform. Then, in Section V, we offer one specific, fleshed-out recommendation.

IV.A. Don't just fight the last war

In recent months, a variety of policy measures have been proposed that are motivated by specific aspects of the current crisis. For example, there have been calls to impose new regulations on the rating agencies, given the large role generally attributed to their perceived failures. Much scrutiny has also been given to the questionable incentives underlying the “originate to distribute” model of mortgage securitization (Keys, et al., 2008). And there have been suggestions for modifying aspects of the Basel II risk-weighting formulas, e.g., to increase the capital charges for highly-rated structured securities.

While there may well be important benefits to addressing these sorts of issues, such an approach is inherently limited in terms of its ability to prevent future crises. Even without any new regulation, the one thing we can be almost certain of is that when the next

crisis comes, it won't involve AAA-rated subprime mortgage CDOs. Rather, it will most likely involve the interplay of some new investment vehicles and institutional arrangements that cannot be fully envisioned at this time. This is the most fundamental message that emerges from taking a viral view of the process of financial innovation—the problem one is trying to fight is always mutating. Indeed, a somewhat more ominous implication of this view is that the seeds of the next crisis may be unwittingly planted by the regulatory responses to the current one: Whatever new rules are written in the coming months will spawn a new set of mutations whose properties are hard to anticipate.

IV.B. Recognize the costs of excessive reliance on ex ante capital

Another widely discussed approach to reform is to simply raise the level of capital requirements. We see several possible limitations to this strategy. In addition to the fact that it would chill intermediation activity generally by increasing banks' cost of funding, it would also increase the incentives for regulatory arbitrage.

While any system of capital regulation inevitably creates some tendency towards regulatory arbitrage, basic economics suggests that the volume of this activity is likely to be responsive to incentives—the higher the payoff to getting around the rules, the more creative energy will be devoted to doing so. In the case of capital regulation, the payoff to getting around the rules is a function of two things: i) the level of the capital requirement; and ii) the wedge between the cost of equity capital (or whatever else is used to satisfy the requirement) and banks' otherwise preferred form of financing. Simply put, given the wedge, capital regulation will be seen as more cumbersome and will elicit a more intense evasive response when the required level of capital is raised.

A higher capital requirement also does not eliminate the fire-sale and credit-crunch externalities identified above. If a bank faces a binding capital requirement—with its assets being a fixed multiple of its capital base—then when a crisis depletes a large chunk of its capital, it must either liquidate a corresponding fraction of its assets or raise new capital. This is true whether the initial capital requirement is 8% or 10%.¹⁸

A more sophisticated variant involves raising the ex-ante capital requirement, but at the same time pre-committing to relax it in a bad state of the world.¹⁹ For example, the capital requirement might be raised to 10% with a provision that it would be reduced to 8% conditional on some publicly observable crisis indicator.²⁰ Leaving aside details of implementation, this design has the appeal that it helps to mitigate the fire-sale and credit-crunch effects: Because banks face a lower capital requirement in bad times, there is less pressure on them to shrink their balance sheets at such times (provided, of course, that the market does not hold them to a higher standard than regulators). In light of our analysis above, this is clearly a helpful feature.

At the same time, since crises are by definition rare, this approach has roughly the same impact on the expected cost of funding to banks as one of simply raising capital requirements in an un-contingent fashion. In particular, if a crisis only occurs once every ten years, then in the other nine years this looks indistinguishable from a regime with higher un-contingent capital requirements. Consequently, any adverse effects on the general level of intermediation activity, or on incentives for regulatory arbitrage, are likely to be similar.

Thus if one is interested in striking a balance between: i) improving outcomes in crisis states, and ii) fostering a vibrant and non-distortionary financial sector in normal times, then even time-varying capital requirements are an imperfect tool. If one raises the requirement in good times high enough, this will lead to progress on the first objective, but only at the cost of doing worse on the second.

IV.C. Anticipate ex post cleanups; encourage private-sector recapitalization

Many of the considerations that we have been discussing throughout this paper lead to one fundamental conclusion: It is very difficult—probably impossible—to design a regulatory approach that reduces the probability of financial crises to zero without imposing intolerably large costs on the process of intermediation in normal times. First of all, the viral nature of financial innovation will tend to frustrate attempts to simply ban whatever “bad” activity was the proximate cause of the previous crisis. Second, given the complexity

of both the instruments and the organizations involved, it is probably naïve to hope that governance reforms will be fully effective. And finally, while one could in principle force banks to hold very large buffer stocks of capital in good times, this has the potential to sharply curtail intermediation activity, as well as to lead to increased distortions in the form of regulatory arbitrage.

It follows that an optimal regulatory system will necessarily allow for some non-zero probability of major adverse events, and focus on reducing the costs of these events. At some level this is an obvious point. The more difficult question is what the policy response should then be once an event hits. On the one hand, the presence of systemic externalities suggests a role for government intervention in crisis states. We have noted that, in a crisis, private actors do too much liquidation and too little recapitalization relative to what is socially desirable. Based on this observation, one might be tempted to argue that the government ought to help engineer a recapitalization of the banking system or of individual large players. This could be done directly, through fiscal means, or more indirectly, e.g., via extremely accommodative monetary policy that effectively subsidizes the profits of the banking industry.

Of course, ad hoc government intervention of this sort is likely to leave many profoundly uncomfortable, and for good reason, even in the presence of a well-defined externality. Beyond the usual moral hazard objections, there are a variety of political-economy concerns. If, for example, there are to be meaningful fiscal transfers in an effort to recapitalize a banking system in crisis, there will inevitably be some level of discretion in the hands of government officials regarding how to allocate these transfers. And such discretion is, at a minimum, potentially problematic.

In our view, a better approach is to recognize up front that there will be a need for recapitalization during certain crisis states, and to “pre-wire” things so that the private sector—rather than the government—is forced to do the recapitalization. In other words, if the fundamental market failure is insufficiently aggressive recapitalization during crises, then regulation should seek to speed up the process of private-sector recapitalization. This is distinct from both: i) the

government being directly involved in recapitalization via transfers; ii) requiring private firms to hold more capital ex ante.

V. A Specific Proposal: Capital Insurance

V.A. *The basic idea*

As an illustration of some of our general principles and building on the logic we have developed throughout the paper, we now offer a specific proposal. The basic idea is to have banks buy capital insurance policies that would pay off in states of the world when the overall banking sector is in sufficiently bad shape.²¹ In other words, these policies would be set up so as to transfer more capital onto the balance sheets of banking firms in those states when aggregate bank capital is, from a social point of view, particularly scarce.

Before saying anything further about this proposal, we want to make it clear that it is only meant to be one element in what we anticipate will be a broader reform of capital regulation in the coming years. For example, the scope of capital regulation is likely to be expanded to include investment banks. And it may well make sense to control liquidity ratios more carefully going forward—i.e., to require, for example, banks' ratio of short-term borrowings to total liabilities not to exceed some target level (though clearly, any new rules of this sort will be subject to the kind of concerns we have raised about higher capital requirements). Our insurance proposal is in no way intended to be a substitute for these other reforms. Instead, we see it as a complement—as a way to give an extra degree of flexibility to the system so that the overall costs of capital regulation are less burdensome.

More specifically, we envision that capital insurance would be implemented on an opt-in basis in conjunction with other reforms as follows. A bank with \$500 billion in risk-weighted assets could be given the following choice by regulators: It could either accept an upfront capital requirement that is, say, 2% higher, meaning that the bank would have to raise \$10 billion in new equity. Or it could acquire an insurance policy that pays off \$10 billion upon the occurrence of a systemic "event"—defined perhaps as a situation in which

the aggregate write-offs of major financial institutions in a given period exceed some trigger level.

To make the policy default-proof, the insurer (we have in mind a pension fund or a sovereign wealth fund) would at inception put \$10 billion in Treasuries into a custodial account, i.e., a “lock box.” If there is no event over the life of the policy, the \$10 billion would be returned to the insurer, who would also receive the insurance premium from the bank as well as the interest paid by the Treasuries. If there is an event, the \$10 billion would transfer to the balance sheet of the insured bank. Thus from the perspective of the insurer, the policy would resemble an investment in a defaultable “catastrophe” bond.

V.B. The economic logic

This proposal obviously raises a number of issues of design and implementation, and we will attempt to address some of these momentarily. Before doing so, however, let us describe the underlying economic logic.

One way to motivate our insurance idea is as a form of “recapitalization requirement.” As discussed above, the central market failure is that, in a crisis, individual financial institutions are prone to do too much liquidation and too little new capital raising relative to the social optimum. In principle, this externality could be addressed by having the government inject capital into the banking sector, but this is clearly problematic along a number of dimensions. The insurance approach that we advocate can be thought of as a mechanism for committing the private sector to come up with the fresh capital injection on its own, without resorting to government transfers.

An important question is how this differs from simply imposing a higher capital requirement *ex ante*—albeit one that might be relaxed at the time of a crisis. In the context of the example above, one might ask: What is the difference between asking a pension fund to invest \$10 billion in what amounts to a catastrophe bond, versus asking it to invest \$10 billion in the bank’s equity, so that the bank can satisfy an increased regulatory capital requirement? Either way, the pension fund has put \$10 billion of its money at risk, and either way, the

bank will have access to \$10 billion more in the event of an adverse shock that triggers the insurance policy.

The key distinction has to do with the state-contingent nature of the insurance policy. In the case of the straight equity issue, the \$10 billion goes directly onto the bank's balance sheet right away, giving the bank full access to these funds immediately, independent of how the financial sector subsequently performs. In a world where banks are prone to governance problems, the bank will have to pay a cost-of-capital premium for the unconditional discretion that additional capital brings.²²

By contrast, with the insurance policy, the \$10 billion goes into a custodial account. It is only taken out of the account, and made available to the bank, in a crisis state. And crucially, in such states, the bank's marginal investments are much more likely to be value-creating, especially when evaluated from a social perspective. In particular, a bank that has an extra \$10 billion available in a crisis will be able to get by with less in the way of socially-costly asset liquidations.²³

This line of argument is an application of a general principle of corporate risk management, developed in Froot, Scharfstein and Stein (1993). A firm can in principle always manage risk via a simple non-contingent "war chest" strategy of having a less leveraged capital structure and more cash on hand. But this is typically not as efficient as a state-contingent strategy that also uses insurance and/or derivatives to more precisely align resources with investment opportunities on a state-by-state basis, so that, to the extent possible, the firm never has "excess" capital at any point in time.

In emphasizing the importance of a state-contingent mechanism, we share a key common element with Flannery's (2005) proposal for banks to use reverse-convertible securities in their capital structure.²⁴ However, we differ substantially from Flannery on a number of specific design issues. We sketch some of the salient features of our proposal below, acknowledging that many details will have to be filled in after more analysis.

V.C. Design

We first review some basic logistical issues and then offer an example to illustrate how capital insurance might work.

Who participates?

Capital insurance is primarily intended for entities that are big enough to inflict systemic externalities during a crisis. It may, however, be unwise for regulatory authorities to identify ahead of time those whom they deem to be of systemic importance. Moreover, even smaller banks could contribute to the credit-crunch and the fire-sale externalities. Thus we recommend that any entity facing capital requirements be given the option to satisfy some fraction of the requirement using insurance.

Suppliers

Although the natural providers of capital insurance may include institutions such as pension funds and sovereign wealth funds, the securitized design we propose means that policies can be supplied by any investor who is willing to receive a higher-than-risk-free return in exchange for a small probability of a large loss.²⁵ The experience of the last several years suggests that such a risk profile can be attractive to a range of investors.

While the market should be allowed to develop freely, one category of investor should be excluded, namely those that are themselves subject to capital requirements. It makes no sense for banks to simultaneously purchase protection with capital insurance, only to suffer losses from writing similar policies. Of course, banks should be allowed to design and broker such insurance so long as they do not take positions.

Trigger

The trigger for capital insurance to start paying out should be based on losses that affect aggregate bank capital (where the term “bank” should be understood to mean any institution facing capital requirements). In this regard, a key question is the level of geographic aggregation. There are two concerns here. First, banks could suffer

losses in one country and withdraw from another.²⁶ Second, international banks may have some leeway in transferring operations to unregulated territories.²⁷

These considerations suggest two design features: First, each major country or region should have its own contingent capital regime meeting uniform international standards so that if, say, losses in the U.S. are severe, multinational banks with significant operations in the U.S. do not spread the pain to other countries. Second, multinational banks should satisfy their primary regulator that a significant proportion of their global operations (say 90 percent) are covered by capital insurance.

With these provisos, the trigger for capital insurance could be that the sum of losses of covered entities in the domestic economy (which would include domestic banks and local operations of foreign banks) exceeds some significant amount. To avoid concerns of manipulation, especially in the case of large banks, the insurance trigger for a specific bank should be based on losses of all other banks *except* the covered bank.

The trigger should be based on aggregate bank losses over a certain number of quarters.²⁸ This horizon needs to be long enough for substantial losses to emerge, but short enough to reflect a relatively sudden deterioration in performance, rather than a long, slow downturn. In our example below, we consider a four-quarter benchmark, which means that if there were two periods of large losses that were separated by more than a year, the insurance might not be triggered.

An alternative to basing the trigger on aggregate bank losses would be to base it on an index of bank stock prices, in which case the insurance policy would be no more than a put option on a basket of banking stocks. However, this alternative raises a number of further complications. For example, with so many global institutions, creating the appropriate country-level options would be difficult, since there are no share prices for many of their local subsidiaries. Perhaps more importantly, the endogenous nature of stock prices—the fact that stock prices would depend on insurance payouts and vice-versa—could create various problems with indeterminacy or multiple

equilibria. For these reasons, it is better to link insurance payouts to a more exogenous measure of aggregate bank health.

Payout profile

A structure that offers large discrete payouts when a threshold level of losses is hit might create incentives for insured banks to artificially inflate their reported losses when they find themselves near the threshold. To deter such behavior, the payout on a policy should increase continuously in aggregate losses once the threshold is reached. Below, we give a concrete example of a policy with this kind of payout profile.

Staggered maturities

An important question is how long a term the insurance policies would run for. Clearly, the longer the term, the harder it would be to price a policy and the more unanticipated risk the insurer would be subject to, while the shorter the term, the higher the transactions costs of repeated renewal. Perhaps a five-year term might be a reasonable compromise.

However, with any finite term length, there is the issue of renewal under stress: What if a policy is expiring at a time when large losses are anticipated, but have not yet been realized? In this case, the bank will find it difficult to renew the policy on attractive terms. To partially mitigate this problem, it may be helpful for each bank to have in place a set of policies with staggered maturities, so that each year only a fraction of the insurance needs to be replaced. Another point to note is that if renewal ever becomes prohibitively expensive, there is always the option to switch back to raising capital in a conventional manner, i.e., via equity issues.

An example

To illustrate these ideas, Table 1 provides a detailed example of how the proposal might work for a bank seeking \$10 billion in capital insurance. We assume that protection is purchased via five policies of \$2 billion each that expire at year end for each of the next five

Table 1
Hypothetical Capital Insurance Payout Structure

In this example, Bank X purchases \$10 billion in total coverage. It does so by buying five policies of \$2 billion each, with expiration dates of 12/31/2009, 12/31/2010, 12/31/2011, 12/31/2012, and 12/31/2013. The payout on each policy is given by:

$$\text{Payout} = \begin{cases} \frac{4 \text{ quarter loss} - \max(\text{high water}_{t-1}, \text{trigger})}{\text{Full Payout} - \text{trigger}} * (\text{Policy face}) & \text{if } 4 \text{ quarter loss} > \text{high water}_{t-1} \\ 0 & \text{otherwise} \end{cases}$$

The trigger on each policy is \$100 billion in aggregate losses for all banks other than X, and full payout is reached when losses by all banks other than X reach \$200 billion.

	Dollars (billions)				
	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4
Current quarter loss	50	40	20	0	140
Cumulative 4 quarter loss	80	120	140	110	200
High water mark on losses	80	120	140	140	200
Payout per policy	0	0.4	0.4	0	1.2
Payout total	0	2	2	0	6
Cumulative payout	0	2	4	4	10

years. There are three factors that shape the payouts on the policies: the trigger points for both the initiation of payouts and the capping of payouts, the pattern of bank losses, and the function that governs how losses are translated into payouts.

In the example, the trigger for initiating payouts is hit once cumulative bank losses over the last four quarters reach \$100 billion. And payouts are capped once cumulative losses reach \$200 billion. In between, payouts are linear in cumulative losses. This helps to ensure that, aside from the time value of earlier payments, banks have no collective benefit to pulling forward large loss announcements.

The payout function also embeds a “high-water” test, so that—given the four-quarter rolling window for computing losses—only incremental losses in a given quarter lead to further payouts. In the example, this feature comes into play in the third quarter of 2009, when current losses are zero. Because of the high-water feature, payouts in this quarter are zero also, even though cumulative losses over the prior four

quarters continue to be high. Put simply, the high-water feature allows us to base payouts on a four-quarter window, while at the same time avoiding double-counting of losses.

These and other details of contract design are important, and we offer the example simply as a starting point for further discussion. However, given that the purpose of the insurance is to guarantee relatively rapid recapitalization of the banking sector, one property of the example that we believe should carry over to any real-world structure is that it be made to pay off promptly.

V.D. Comparisons with alternatives

An important precursor to our proposal, and indeed the starting point for our thinking on this, is Flannery (2005). Flannery proposes that banks issue reverse convertible debentures, which convert to equity when a bank's share price falls below a threshold. Such an instrument can be thought of as a type of firm-specific capital insurance.

One benefit of a firm-specific trigger is that it provides the bank with additional capital in any state of the world when it is in trouble—unlike our proposal where a bank gets an insurance payout only when the system as a whole is severely stressed. In the spirit of the traditional approach to capital regulation, the firm-specific approach does a more complete job of reducing the probability of distress for each individual institution. The firm-specific trigger also should create monitoring incentives for the bond holders, which could be useful. Finally, to the extent that one firm's failure could be systemically relevant, this proposal resolves that problem, whereas ours does not.

However, a firm-specific trigger also has disadvantages. First, given that a reverse convertible effectively provides a bank with debt forgiveness if it performs poorly enough, it could exacerbate problems of governance and moral hazard. Moreover, the fact that the trigger is based on the bank's stock price may be particularly problematic here. One can imagine that once a bank begins to get into trouble, there may be the ingredients in place for a self-fulfilling downwards spiral: As existing shareholders anticipate having their stakes diluted via the

conversion of the debentures, stock prices decline further, making the prospect of conversion even more likely, and so on.²⁹

Our capital insurance structure arguably does better than reverse convertibles on bank-specific moral hazard, given that payouts are triggered by aggregate losses rather than by poor individual performance. With capital insurance, not only is a bank not rewarded for doing badly, it gets a payout in precisely those states of the world when access to capital is most valuable, i.e., when assets are cheap and profitable lending opportunities abound. Therefore, banks' incentives to preserve their own profits are unlikely to be diminished by capital insurance.

Finally, ownership of the banking system brings with it important political-economy considerations. Regulators may be unwilling to allow certain investors to accumulate large control stakes in a banking firm. To the extent that holders of reverse convertibles get a significant equity stake upon conversion, regulators may want to restrict investment in these securities to those who are fit and proper, or alternatively, remove their voting rights. Either choice would further limit the attractiveness of the reverse convertible. By contrast, our proposal does not raise any knotty ownership issues: When the trigger is hit, the insured bank simply gets a cash payout with no change in the existing structure of shareholdings.

The important common element of the Flannery (2005) proposal and ours is the contingent nature of the financing. There are other contingent schemes that could also be considered; Culp (2002) offers an introductory overview of these types of securities and a description of some that have been issued.

Security design could take care of a variety of concerns. For example, if investors do not like the possibility of losing everything on rare occasions, the insurance policies could be over-collateralized: The insurer would put \$10 billion into the lock box, but only a maximum of \$5 billion could be transferred to the insured policy in the event the trigger is breached. This is a transparent change that might get around problems arising because some buyers (such as pension funds or insurance companies) face restrictions on buying securities with low ratings.

A security that has some features of Flannery's proposal (it is tied to firm-specific events) and some of ours (it is tied to losses, not stock prices) is the hybrid security issued in 2000 by the Royal Bank of Canada (RBC). RBC sold a privately placed bond to Swiss RE that, upon a trigger event, converted into preferred shares with a given dividend yield. The conversion price was negotiated at date of the bond issue, and the trigger for conversion was tied to a large drop in RBC's general reserves. The size of the issue (C\$200 million) was set to deliver an equity infusion of roughly one percent of RBC's tier capital requirement.

Of particular interest is the rationale RBC had for this transaction. Culp (2002, p. 51) quotes RBC executive David McKay as follows: "It costs the same to fund your reserves whether they're geared for the first amount of credit loss or the last amount of loss... What is different is the probability of using the first loss amounts versus the last loss amounts. Keeping capital on the balance sheet for a last loss amount is not very efficient."

The fact that this firm-specific security could be priced and sold suggests the industry-linked one that we are proposing need not present insurmountable practical difficulties.

Before concluding, let us turn to a final concern about our insurance proposal that it might create the potential for a different kind of moral hazard. Even though banks do not get reimbursed for their own losses, the fact that they get a cash infusion in a crisis might reduce their incentives to hedge against the crisis, to the extent that they are concerned about not only expected returns, but also the overall variance of their portfolios. In other words, banks might negate some of the benefits of the insurance by taking on more systematic risk. To see the logic most transparently, consider a simple case where a bank sets a fixed target on the net amount of money it is willing to lose in the bad state (i.e., it implements a value-at-risk criterion). If it knows that it will receive a \$10 billion payoff from an insurance policy in the crisis, it may be willing to tolerate \$10 billion more of pre-insurance losses in the crisis. If all banks behave in this way, they may wind up with more highly correlated portfolios than they would absent capital insurance.

This concern is clearly an important one. However, there are a couple of potentially mitigating factors. First, what is relevant is not whether our insurance proposal creates any moral hazard, but whether it creates more or less than the alternative of raising capital requirements. One could equally well argue that, in an effort to attain a desired level of return on equity, banks target the amount of systematic risk borne by their stockholders, i.e., their equity betas. If so, when the capital requirement is raised, banks would offset this by simply raising the systematic risk of their asset portfolios, so as to keep constant the amount of systematic risk borne per unit of equity capital. In this sense, any form of capital regulation faces a similar problem.

Second, the magnitude of the moral hazard problem associated with capital insurance is likely to depend on how the trigger is set, i.e. on the likelihood that the policy will pay off. Suppose that the policy only pays off in an extremely bad state which occurs with very low probability a true financial crisis. Then a bank that sets out to take advantage of the system by holding more highly correlated assets faces a tradeoff: This strategy makes sense to the extent that the crisis state occurs and the insurance is triggered, but will be regretted in the much more likely scenario that things go badly, but not sufficiently badly to trigger a payout. This logic suggests that with an intelligently designed trigger, the magnitude of the moral hazard problem need not be prohibitively large.

This latter point is reinforced by the observation that, because of the agency and performance-measurement problems described above, bank managers likely underweight very low probability tail events when making portfolio decisions. On the one hand, this means that they do not take sufficient care to avoid assets that have disastrous returns with very low probability, hence the current crisis. At the same time, it also means that they do not go out of their way to target any specific pattern of cashflows in such crisis states. Rather, they effectively just ignore the potential for such states *ex ante* and focus on optimizing their portfolios over the more normal parts of the distribution. If this is the case, insurance with a sufficiently low-probability trigger will not have as much of an adverse effect on behavior.

VI. Conclusions

Our analysis of the current crisis suggests that governance problems in banks and excessive short-term leverage were at its core. These two causes are related. Any attempt at preventing a recurrence should recognize that it is difficult to resolve governance problems, and, consequently, to wean banks from leverage. Direct regulatory interventions, such as mandating more capital, could simply exacerbate private sector attempts to get around them, as well as chill intermediation and economic growth. At the same time, it is extremely costly for society to either continue rescuing the banking system or to leave the economy to be dragged into the messes that banking crises create.

If despite their best efforts, regulators cannot prevent systemic problems, they should focus on minimizing their costs to society without dampening financial intermediation in the process. We have offered one specific proposal, capital insurance, which aims to reduce the adverse consequences of a crisis, while making sure the private sector picks up the bill. While we have sketched the broad outlines of how a capital insurance scheme might work, there is undoubtedly much more work to be done before it can be implemented. We hope that other academics, policymakers and practitioners will take up this challenge.

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Endnotes

¹See Bank for International Settlements (2008, chapter 6), Bank of England (2008), Bernanke (2008), Borio (2008), Brunnermeier (2008), Dudley (2007, 2008), Greenlaw et al (2008), IMF (2008), and Knight (2008) for comprehensive descriptions of the crisis.

²Throughout this paper, we use the word “bank” to refer to both commercial and investment banks. We say “commercial bank” when we refer to only the former.

³See Brunnermeier and Pedersen (2008) for a detailed analysis of these kinds of spirals and Adrian and Shin (2008b) for empirical evidence on the spillovers.

⁴The state-contingent nature of such an insurance scheme makes it similar in some ways to Flannery’s (2005) proposal for the use of reverse convertible securities in banks’ capital structures. We discuss the relationship between the two ideas in more detail below.

⁵See Hoenig (2008) and Rajan (2005) for a similar diagnosis.

⁶*Financial Times*, July 9, 2007.

⁷*Shareholder Report on UBS Writedowns*, April 18, 2008, <http://www.ubs.com/1/e/investors/agm.html>.

⁸Another example of the effects of uncharged risk is described in the Shareholder Report on UBS Writedowns on page 13: “The CDO desk received structuring fees on the notional value of the deal, and focused on Mezzanine (“Mezz”) CDOs, which generated fees of approximately 125 to 150 bp (compared with high-grade CDOs, which generated fees of approximately 30 to 50 bp).” The greater fee income from originating riskier, lower quality mortgages fed directly to the originating unit’s bottom line, even though this fee income was, in part, compensation for the greater risk that UBS would be stuck with unsold securities in the event that market conditions turned.

⁹As the *Wall Street Journal* (April 16, 2008) reports, “Risk controls at [Merrill Lynch], then run by CEO Stan O’Neal, were beginning to loosen. A senior risk manager, John Breit, was ignored when he objected to certain risks...Merrill lowered the status of Mr. Breit’s job...Some managers seen as impediments to the mortgage-securities strategy were pushed out. An example, some former Merrill executives say, is Jeffrey Kronthal, who had imposed informal limits on the amount of CDO exposure the firm could keep on its books (\$3 billion to \$4 billion) and on its risk of possible CDO losses (about \$75 million a day). Merrill dismissed him and two other bond managers in mid-2006, a time when housing was still strong but was peaking. To oversee the job of taking CDOs onto Merrill’s own books, the firm tapped ...a senior trader but one without much experience in mortgage securities. CDO holdings on Merrill’s books were soon piling up at a rate of \$5 billion to \$6 billion per quarter.” Bloomberg (July 22, 2008, “Lehman Fault-Finding

Points to Last Man Fuld as Shares Languish”) reports a similar pattern at Lehman Brothers whereby “at least two executives who urged caution were pushed aside.” The story quotes Walter Gerasimowicz, who worked at Lehman from 1995 to 2003, as saying “Lehman at one time had very good risk management in place. They strayed in search of incremental profit and market share.”

¹⁰The insight that agency problems lead banks to be highly levered goes back to Diamond’s (1984) classic paper.

¹¹By analogy, it appears that the equity market penalizes too much financial slack in operating firms with poor governance. For example, Dittmar and Mahrt-Smith (2007) estimate that \$1.00 of cash holdings in a poorly-governed firm is only valued by the market at between \$0.42 and \$0.88.

¹²A more subtle argument is that the fragile nature of short-term debt financing is actually part of its appeal to banks: Precisely because it amplifies the negative consequences of mismanagement, short-term debt acts as a valuable *ex ante* commitment mechanism for banks. See Calomiris and Kahn (1991). However, when thinking about capital regulation, the critical issue is whether short-term debt has some social costs that are not fully internalized by individual banks.

¹³In a Basel II regime, the pressure to liquidate assets is intensified in crisis periods because measured risk levels—and hence risk-weighted capital requirements—go up. One can get a sense of magnitudes from investment banks, who disclose firm-wide “value at risk” (VaR) numbers. Greenlaw et al (2008) calculate a simple average of the reported VaR for Morgan Stanley, Goldman Sachs, Lehman Brothers and Bear Stearns, and find that it rose 34% between August 2007 and February 2008.

¹⁴For instance, Bernanke (2008) says: “I strongly urge financial institutions to remain proactive in their capital-raising efforts. Doing so not only helps the broader economy but positions firms to take advantage of new profit opportunities as conditions in the financial markets and the economy improve.”

¹⁵Kashyap and Stein (2004) point out that the Basel II approach can be thought of as reflecting the preferences of a social planner who cares only about avoiding bank defaults, and who attaches no weight to other considerations, such as the volume of credit creation.

¹⁶See Adrian and Shin (2008a) for systematic evidence on this phenomenon.

¹⁷Subprime mortgage originations seemed to take off to supply this market. For instance, Greenlaw et al show that subprime plus Alt-A loans combine represented fewer than 10% of all mortgage originations in 2001, 2002 and 2003, but then jumped to 24% in 2004 and further to 33% in 2005 and 2006; by the end of 2007 they were back to 9%. As Mian and Sufi (2008) and Keys et al (2008) suggest, the quality of underlying mortgages deteriorated considerably with increased demand for mortgaged-backed securities. See European Central Bank (2008) for a detailed description of the role of structured finance products in propagating the initial subprime shock.

¹⁸It should be noted, however, that higher ex ante capital requirements do have one potentially important benefit. If a bank starts out with a high level of capital, it will find it easier to recapitalize once a shock hits, because the lower is its post-shock leverage ratio, the less of a debt overhang problem it faces, and hence the easier it is issue more equity. Hence the bank will do more recapitalization, and less liquidation, which is a good thing.

¹⁹See Tucker (2008) for further thoughts on this. For instance, capital standards could also be progressively increased during a boom to discourage risk-taking.

²⁰Starting in 2000 Spain has run a system based on “dynamic provisioning” whereby provisions are built up during times of low reported losses that are to be applied when losses rise. According to Fernández-Ordóñez (2008), Spanish banks “had sound loan loss provisions (1.3% of total assets at the end of 2007, and this despite bad loans being at historically low levels).” In 2008 the Spanish economy has slowed, and loan losses are expected to rise, so time will tell whether this policy changes credit dynamics.

²¹Our proposal is similar in the spirit to Caballero’s (2001) contingent insurance plan for emerging market economies.

²²There may be a related cosmetic benefit of the insurance policy. Since the bank takes less equity onto its balance sheet, it has fewer shares outstanding, and various measures of performance, such as earnings per share and return on equity, may be less adversely impacted than by an increase in the ex ante capital requirement. Of course, this will also depend on how the bank is allowed to amortize the cost of the policy.

²³To illustrate, suppose a bank has 100 in book value of loans today; these will yield a payoff of either 90 or 110 next period, with a probability $\frac{1}{2}$ of either outcome. One way for the bank to insure against default would be to finance itself with 90 of debt and 10 of equity. But this approach leaves the bank with 20 of free cash in the good state. If investors worry that this cash in good times will lead to mismanagement and waste, they will discount the bank’s stock. Now suppose instead that the bank seeks contingent capital. It could raise 105, with 100 of this in debt and 5 in equity, and use the extra 5 to finance, in addition to the 100 of loans, the purchase of an insurance policy that pays off 10 only in the bad state. From a regulator’s perspective, the bank should be viewed as just as well-capitalized as before, since it is still guaranteed not to default in either state. At the same time, the agency problem is attenuated, because after paying off its debt, the bank now has less cash to be squandered in the good state (10, rather than 20).

²⁴See also Stein (2004) for a discussion of state-contingent securities in a banking context.

²⁵There may be some benefit to having the insurance provided by passive investors. Not only do they have pools of assets that are idle and can profitably serve as collateral (in contrast to an insurance company that might be reluctant to see

its assets tied up in a lock box), they also have the capacity to bear losses without attempting to hedge them (again, unlike a more active financial institution). Individual investors, pension funds, and sovereign wealth funds would be important providers. See Organization for Economic Cooperation and Development (2008) for a list of major investments, totaling over \$40 billion, made by sovereign wealth funds in the financial sector from 2007 through early 2008.

²⁶Indeed, Peek and Rosengren (2000) document the withdrawal of Japanese banks from lending in California in response to severe losses in Japan.

²⁷The trigger might also be stated in terms of the size of the domestic market so that firms entering a market do not mechanically change the likelihood of a payment.

²⁸Because this insurance pays off only in systemically bad states of nature, it will be expensive, but not relative to pure equity financing. For example, suppose that there are 100 different future states of the world for each bank and that the trigger is breached only in 1 of the 100 scenarios. Because equity returns are low both in the trigger state and in many others (with either poor bank-specific outcomes or bad but not disastrous aggregate outcomes), the cost of equity must be higher than the cost of the insurance.

²⁹Relatedly, such structures can create incentives for speculators to manipulate bank stock prices. For example, it may pay for a large trader to take a long position in reverse convertibles, then try to push down the price of the stock via short-selling in order to force conversion and thereby acquire an equity stake on favorable terms.

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Commentary: Rethinking Capital Regulation

Jean-Charles Rochet

It is a privilege to be here today to discuss this stimulating article of my distinguished colleagues Kashyap, Rajan and Stein, and to participate in this very interesting conference on how to maintain financial stability after the current credit crisis.

Many influential commentators¹ have advocated for fundamental reforms of financial regulatory/supervisory systems as a necessary response to the crisis. Capital regulations are clearly a crucial element of these systems, and the article by Kashyap, Rajan and Stein offers several important insights and a specific proposal on how to improve these regulations. This article is therefore particularly timely.

I will organize my comments in three parts:

1. The objectives of capital regulation.
2. The regulatory treatment of capital insurance.
3. Reorganizing the financial infrastructure.

1. The objectives of capital regulation

Capital regulation is a fundamental component of the financial safety net, together with deposit insurance, supervisory intervention, liquidity support by central banks and in some cases capital

injections by the Treasury. This financial safety net has officially two objectives:

- To protect small depositors against the failure of their bank (micro-prudential objective),
- And to protect the financial system as a whole against aggregate shocks (macro-prudential objective).

As pointed out by Kashyap, Rajan and Stein, individual bank failures and systemic crises cannot be eliminated altogether, which raises two questions:

- What should be their “optimal” frequency?
- How should we manage individual failures and, more importantly, systemic crises when they occur?

Existing capital regulations, notably Basel 2, have only offered a relatively precise answer to the first question, at least for individual bank failures. In particular, the IRB approach to credit risk in the pillar one of Basel 2 implies more or less explicitly a quantitative target for the maximum probability of default of commercial banks (0.1% over one year). This focus on the probability of default is consistent with traditional actuarial methods in insurance, with the practice of rating agencies and with the VaR approach to risk management developed by large banks (see also Gordy, 2003).

However, I want to suggest that focusing on an exogenously given probability of default is largely arbitrary and has many undesirable consequences. For example, Kashyap and Stein (2003), among others, argue that it would make more sense to implement a flexible approach where the maximum probability of failure would not be constant but would instead vary along the business cycle (concretely, to allow banks to take more risks during recessions and less during booms). This is obviously related to the procyclicality debate.

Moreover, the VaR approach can be easily manipulated and has led to many forms of regulatory arbitrage. In particular, it gives incentives for banks to shift their risks towards the upper tails of loss distributions, which increases systemic risk. In fact, VaR measures

may be appropriate from the perspective of a bank shareholder (who is protected by limited liability) but certainly not from that of public authorities (who will ultimately bear the costs of extreme losses).

From a conceptual viewpoint, capital requirements should be seen as a component of an insurance contract between regulators and banks, whereby banks have access to the financial safety net, provided they satisfy certain conditions. The capital of the bank can be interpreted as the “deductible” in this insurance contract, namely the size of the first tranche of losses, that will be entirely borne by shareholders. The failure of the bank occurs exactly when incurred losses exceed this amount.

In property casualty insurance, the level of deductibles on an insurance contract is **not** determined by a hypothetical target probability of claims (here bank failures), but instead by a trade-off between the expected cost of these claims (including transaction costs), the cost of self-financing the deductible (here the cost of equity for banks) and the benefit of insurance for customers that includes being able to increase the level of their risky activities (here the volume of lending).

By analogy, the capital requirement (CR) for banks should not be computed as a “VaR” but as an expected shortfall (or Tail VaR), which takes fully into account the tail distribution of losses, and thus does not give perverse incentives to shift risks to the upper tail of the loss distributions. Moreover, this “economic” approach to CR is much more flexible than the dominant “actuarial” approach. As in the case of insurance (see Plantin and Rochet, 2008), optimal CRs can in this way be determined by trading off the social cost of bank failures against the social benefit of bank lending, which are both likely to vary across the business cycle. They can also incorporate incentive considerations, on which I will comment below.

2. The regulatory treatment of capital insurance

As shown by Kashyap, Rajan and Stein (2008), the macro-prudential component of financial regulation is not sufficiently taken into account in existing capital regulations. They rightly point at the aggregate effects of the behavior of banks (especially large ones) during

crises. When these large banks face binding solvency constraints, they tend to react by reducing too much (from a social welfare perspective) their volume of assets (lending less and selling securities, even at a depressed price), rather than by issuing the amount of new equity that would allow them to keep the same volume of assets. This is because banks do not internalize the negative impact of their fire sales on the prices of these assets, which may itself force other banks to liquidate some of their assets, provoking a credit crunch and a downward spiral for asset prices (Brunnermeier, 2008; Adrian and Shin, 2008).

Kashyap, Rajan and Stein (2008) put forward a specific proposal for improving capital regulation: encouraging banks (on a voluntary basis) to purchase capital insurance contracts that would pay off in states of the world where the overall banking system is in bad shape. The idea behind this proposal is that whereas banks' preferred form of financing during tranquil times is short-term debt (because it is a better disciplining tool than equity or long-term debt, given the complexity of banking activities), equity capital becomes too scarce during recessions and banking crises. Banks tend to respond to these negative shocks by reducing the size of their balance sheets rather than by issuing new equity, both because investors are reluctant to provide it during stress periods and because banks do not internalize the negative impact on the economy.

In the capital insurance contracts proposed by Kashyap, Rajan and Stein, the insurer would commit to provide a given amount of cash when some aggregate measure of banks' performance falls below a pre-specified threshold. Banks would be less inclined to sell assets, and the need for public authorities to step in would be reduced. This proposal (which resembles an earlier proposal put forward by Flannery, 2005) is a particular form of the new Alternative Risk Transfer (ART) methods that provide hybrid instruments (with both insurance and financing components) to large firms, not exclusively in the financial sector. These ART instruments (such as contingent capital, catastrophe bonds and options) have been promoted by several re-insurers (notably Swiss Re) but have not so far been used extensively in practice.

The proposal of Kashyap, Rajan and Stein is a good idea, but several questions have to be answered more precisely. For example, isn't it too demanding to impose that the insurer post a 100% collateral deposit in a custodial account, considering that the probability of a claim is (hopefully) very small and the duration of the contract presumably quite long? On the other hand, how can regulators guarantee that the insurer will always fulfill its obligations, unless the insurer's capital itself is also regulated? Also, the pricing of these capital insurance contracts is likely to be difficult, given that claims will have a low probability of occurrence, but will occur exactly when the overall economic situation is very bad. Finally, the authors should clarify whether they think the main reason why banks do not issue more capital during crises is that they cannot or that they do not want to. In the first case, capital insurance contracts make a lot of sense, but then why is it that the banks themselves have not already come up with the idea? In the second case (i.e. if banks do not want to issue more capital during crises), capital insurance can still be good from a regulatory perspective (if not from a private perspective), but regulators have to be given the power to prevent the banks from distributing dividends with the money collected from the capital insurance contract.

I would like to put forward a similar proposal, inspired by Holmström and Tirole (1998), which could be viewed as a complement to the capital insurance proposal of Kashyap, Rajan and Stein. Suppose indeed that the Treasury issues a new type of security, namely a contingent bond that would pay off only conditionally on some trigger (that could be related to aggregate bank losses like in the proposal of Kashyap, Rajan and Stein, or more generally to other indicators of macroeconomic stress). The insurance properties of this security would be exactly the same as the one suggested by Kashyap, Rajan and Stein, but it would be provided by the Treasury and not by private investors such as sovereign funds or pension funds. The advantages would be that the solvency of the issuer would not have to be monitored and that liquidity would only be issued *ex post* (in the states of the world where it is needed) and would not be "wasted" in the states of the world where it is not needed. The superiority of the government over the market in providing *ex-post* liquidity comes from its unique ability to tax households and firms in the future.

Let me address now the questions of incentives. There seems to be a consensus that agency problems have been prevalent at all stages of the securitization process. A recent study by Ashcraft and Schuermann (2008) gives a splendid illustration of this prevalence. An important empirical question is whether capital requirements can be really efficient for aligning incentives between bank managers and public authorities. Kashyap, Rajan and Stein argue that short-term finance may be a better tool for disciplining bankers, essentially because banks are too complex entities to be monitored by shareholders. They observe that even if managers have very large stakes in their banks, they are inclined to take huge risks. This may explain why equity financing is so expensive for banks.

I believe this view is more appropriate for investment banks rather than commercial banks. In fact, since the implementation of Basel 1, commercial banks have traditionally held way more equity than the regulatory minimum, in response to market discipline. This seems to suggest that financial analysts and rating agencies consider that commercial banks need a sufficient amount of equity capital, above regulatory minimums. In fact, economic capital for a well-managed bank is often evaluated to a given multiple of regulatory capital. Therefore, regulation has to be designed in such a way that banks can save on their minimum capital charges (and thus on their economic capital, which allows them to increase return on equity) when they make investment decisions that are socially beneficial.

More generally, if one believes that capital regulation may have a sizable impact on bankers' incentives, it is particularly important to design capital charges for securitization and other credit risk transfer operations in such a way that they align the incentives of bank shareholders with the regulator's objective: encourage the transfer of "exogenous" risks (those that are not under the control of the bankers), limit the transfer of "endogenous" risks (the risks that are partially affected by bankers' actions) to the maximum amount that preserves incentives. The current implications of securitization in terms of regulatory capital requirements (especially Basel 2) do not necessarily encourage banks to adopt this strategy.

3. Reorganizing the financial infrastructure

As was clearly advocated by Tim Geithner, the president and CEO of the New York Fed, in a recent article (*Financial Times*, June 8, 2008), the important changes in the industrial organization of the financial industry that have been observed in the last decade make it necessary to “adapt the regulatory system to address the vulnerabilities exposed by the financial crisis.” In particular, he argues that “supervision has to ensure that counterparty risk management in the supervised institutions limits the risk of a rise in overall leverage outside the regulated institutions that could threaten the stability of the whole financial system.”

The guiding principle here should be the absence of a “regulatory free lunch”: If investment banks want to have access to the liquidity provision facilities put in place by central banks, they should be required to satisfy more stringent conditions in terms of capital, liquidity and risk management. Similarly, if supervised institutions want to benefit from reductions in capital charges when they use new, complex credit risk transfer instruments, they should accept a certain degree of standardization and centralization in the issuance, clearing and settlement of these instruments. The management of systemic risk is obviously easier at the level of a central platform (exchange, clearing house or central depository) than when there exists a complex nexus of opaque, over the counter (OTC) transactions. An interesting innovation in this direction is the development by the Deposit Trust and Clearing Corporation of a new facility that provides central settlement to major OTC derivatives dealers.

In the same vein, why not use central clearing and settlement platforms for reforming the industrial organization of the credit rating industry? Many commentators have indeed accused the credit rating agencies (CRAs) of bearing a strong responsibility in the current credit crisis. They argue that CRAs may have deliberately underestimated the risks of some mortgage backed securities pools or collateralized debt obligations. They criticize the “issuer pays” model as creating the possibility of conflicts of interest. Since the bulk of CRAs’ revenues come from issuers and arrangers, it is not inconceivable that CRAs could have temporarily run the risk of jeopardizing their reputation by

inflating credit ratings in order to earn more structuring fees. Increasing regulatory scrutiny on the ratings process itself would probably be difficult, and in the end, largely inefficient. Returning to the “investors pay” model of the past is likely to be impossible. Brian Clarkson, the president of Moody’s, is pessimistic: “Whoever pays, there will be a conflict” (*The Economist*, February 7, 2008).

I would like to put forward an alternative solution that could solve these conflicts of interest. It is based on the following analogy. People who want to sell valuable paintings often use the services of an auction house like Sotheby’s, who organizes the auctioning of the paintings. Typically the seller requires the assistance of experts, who certify the authenticity of the paintings. For obvious reasons, these experts are almost always hired and remunerated by the auction house and never by the seller itself. The same is true if the seller wants to exhibit his paintings into an art gallery, in order to facilitate the sales. It is the gallery that organizes the certification, not the seller.

By analogy, suppose that an arranger wants to issue some asset backed securities and wants to apply for credit ratings by a Nationally Recognized Statistical Rating Organization (NRSRO). The proposal would be that this potential issuer is required to contact a “central platform” that could be a central depository, a clearing house or an exchange. This platform would be completely in control of the rating process and could also provide record keeping services to the different parties in the securitization operation. The idea would be to cut any direct commercial links between issuers and CRAs. The potential issuer would pay a (pre-issue fee) to the central platform, who would then organize the rating of the securities by one or several NRSROs. The rating fees would be paid by the central platform to the NRSROs. These fees would obviously be independent of the outcome of the rating process and of the fact that the issue finally takes place or not. This would eliminate any perverse incentives for a lax behavior by CRAs. This would also solve the conflict of interest between issuers and investors,² since the central platform’s profit maximization depends on appropriately aggregating the interests of the two sides of the market.

Summary and conclusion

Let me conclude by briefly summarizing the main points of my comments on this very interesting paper:

- Rethinking capital regulation is indeed important: The current crisis has clearly shown how ill-designed regulation could distort incentives in ways that increase systemic risk. In particular, the VaR approach to credit risk has encouraged banks to shift risks towards the upper tail of the loss distributions. I believe it should be reconsidered. Value at Risk may be a good metric for banks, since they are protected by limited liability, but it is certainly not a good risk measure for public authorities, who ultimately bear the costs of large losses.
- Other sources of financing for banks, such as the capital insurance contracts suggested by Kashyap, Rajan and Stein, could indeed improve things, but only if regulators make sure that this does not lead to regulatory arbitrage by banks and ultimately increase aggregate risk in the financial sector.
- Centralized trading, clearing or depository facilities can also provide a solution to the conflict of interest in the credit rating industry. If the rating process is left entirely to the control of these platforms in such a way that all commercial links between CRAs and issuers are cut, this would reduce perverse incentives for these CRAs to inflate ratings in order to increase their revenues.

Endnotes

¹For example, Tom Hoenig, president and CEO of the Kansas City Fed, has recently argued (in his speech “Perspectives on the Recent Financial Turmoil” for the IIF membership meeting, Rio de Janeiro, March 5, 2008) that “the response to this crisis should be fundamental reform, not Band-Aids and tourniquets” and that “both the private sector and the government will have key roles to play in articulating needed reforms and ensuring that they are implemented.”

²As rightly pointed out by Charles Calomiris (2008), rating inflation could also be demand driven if there are conflicts of interest between asset managers and investors. Solving the other conflicts of interest would necessitate additional policy measures.

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General Discussion: Rethinking Capital Regulation

Chair: Stanley Fischer

Mr. Liikanen: Thank you very much for a very innovative paper. First a comment and then a question.

This comment comes actually from Raghu's paper delivered here three years ago in 2005 titled, "Has Financial Development Made the World Riskier?" His reply was "Yes." All the critics here said, "No."

So I don't dare to criticize your paper, Raghu. That's all. But I want to put a question on the present paper. We are discussing very much in Europe and other areas about multinational banking institutions. How would this apply in the multinational case, where banks operate, let's say, in four to five countries? Why is it such a concrete question? We have now in Europe banks, for instance, which are not systemically important in the home country, but are systemically important in the host country. The cross-border solution is quite critical to us. Have you had any thoughts on that issue?

Mr. Calomiris: I want to applaud the paper and say that I think it may be a good idea. I just want to offer three quick comments to get your reactions about possible refinements or problems you may want to address.

First, it is interesting to ask, How is the financial system going to react if this becomes a reality? I can think of two obvious reactions

that are undesirable. The first reaction is a substantial increase in the correlation of risk in the banking system. Why? Because now all banks have a very strong incentive to write deeply out of the money S&P 500 puts. So the amount of systemic risk goes up when you insure systemic risk. That is an important potential problem.

The second problem is that we are collateralizing this insurance—mono-line insurance companies might provide this insurance—and we are going to collateralize it with Treasury bonds. That will encourage them to provide other kinds of credit enhancement to the banks more aggressively on an uncollateralized basis, so they can asset strip to get back to where they wanted to get to in the combined exposure they have to the banks. So you collateralize this exposure, but then you create more uncollateralized exposure that basically undoes it.

Third, as I read your paper, you seem to be saying that we might as well give up on the ability to enforce traditional capital regulation based on accounting concepts. This seems to require further discussion.

Mr. Blinder: I liked this proposal very much ... I think. That is what is leading to my question.

The first point I want to make takes up right where Charlie left off. In the presentation of the paper, there is a lot of prose that sounds like and says raising capital has a lot of downsides and is not such a good idea. But the proposal does raise capital requirements. That is just a stylistic question. I don't think you are wrong about that. I think you are right about that, but there is a bit of a tone, as Charlie said, that raising capital is not a good idea. The paper is really about raising capital in a somewhat different way.

Now here is the question. A recent year's piece of Wall Street wisdom you all know is that in a crisis all correlations go to one. So this is what I am wondering about. This is an insurance policy that will pay off only in very bad states of the world when the portfolios of just about everybody are taking a hit. This is part of the question. Can you find a class of people who are actually enjoying these bad times? Because if you can't, and I don't think you can, it seems to me the insurance premium on this is going to be extremely high because you are making people pay at times when they don't want to pay. I

am wondering about that vice as against, for example, the ingenious suggestion we just heard from Mr. Rochet or Flannery's idea of these convertible bonds, which are basically forcing people to acquire stock when it's cheap.

Mr. Sperling: My question is for the authors, and it is about the insurers. My question is—as you are thinking about your proposal actually succeeding—whether you are at all worried you might create a new class of too-big-to-fail, too-interrelated-to-fail institutions? You talk about will people do this? Now you're immediate answer will be, “Yes, but we have this lockbox”—but that lockbox is highly essential to your model that you are not creating too-big-to-fail insurers. Even if you do have this lockbox, presumably there would be a couple of institutions—Fannie Capital Reinsurance whatever—and they would become very good at this, and they would rely on being paid to roll over. I wonder whether you think, if this developed, if the companies insuring the capital requirements were to go under, whether you would find yourself in another different too-big-to-fail regulatory issue?

Mr. Holmström: Yes, two comments. One going back to the incentive problem that you talked about: It's fairly easy to blame because incentives are always in a tautological sense the cause.

There is some anecdotal evidence on headquarters of institutions being liable rather than their traders. Allegedly the UBS board and top management kicked off a campaign to get traders into lucrative by risky derivatives. In the Scandinavian crisis, it is interesting that banks that were decentralized and let their loan managers decide on the loans largely on their own, those banks actually did pretty well, whereas banks where the center decided on the loan-to-value ratio as a way of controlling lending, those banks really got into trouble. That is true both in Finland and Sweden. So that indicates that the problem is not the rogue traders necessarily. I am not saying there isn't that problem, too, but I would urge people to look carefully at the incentives before they jump to conclusions about the underlying problem.

Then a comment on your insurance scheme: It may be a good scheme if the problem is to redistribute a fixed amount of

collateral or Treasuries within the private sector. But what if there aren't enough Treasuries? Then government has a role in supplying additional Treasuries.

Government and private sector insurance are not competing schemes; they are complementary.

I also want to emphasize that the government's ability to inject Treasuries ex post saves a lot on the deadweight cost of taxation. The lockbox of Treasuries that you need in your scheme incurs needlessly high deadweight costs of taxation. With private insurance, you have to determine contingencies in advance, but you can't forecast what contingencies will happen. You may think it's some crisis of the sort we see now, but if it is a very different crisis, we need ex post judgment and intervention, and only government can provide that.

Mr. Carney: I join the others in complimenting the paper and the idea. I want to address this, though, by picking up on Peter Fisher's point on consolidation in the industry and think about how your proposal might influence consolidation. One of the things, certainly at the margin, is capital is going to flow to the relatively stronger institutions. Or, to put it another way, strong institutions will also get capital with this scheme.

That raises a couple of issues that always can be addressed. On the one hand—for the stronger institutions right now—part of the reason why their share prices are holding up is because they are not going to issue additional capital. So there is this dilution issue with the proposal. Do you have to add to this idea an ability to have the option to flow through the capital proceeds to the shareholders on a tax-efficient basis, so you don't get an overhang for stronger institutions? Point one.

Point two: You mentioned consolidation, but obviously when there is consolidation in the industry, it is almost exclusively done on an equity basis—to achieve a tax-free rollover. Here you would have to do consolidation for cash.

The last point: One thing we haven't had a chance to address is there are some real accounting issues right now that are preventing

consolidation in the sector. As we think going forward, some of these issues may need to be addressed in order to get us out of it.

Mr. Lindsey: I would like to inject an ideological heterodox note here. When I hear all your talk about the various agency problems and also the difference between endogenous and exogenous risk, why don't we default to what we've historically always defaulted to, which is some combination of nationalization and monetization? After all, who has better information than the government and regulator? When we think about endogenous versus exogenous risk, let's face it, all the exogenous risk, as you described, or much of it has to do with public policy. I hate to ask the question I've just asked, but you haven't convinced me yet that we shouldn't default back to good old Uncle Sam.

Mr. Meltzer: Like everyone else, I think this is a very interesting paper. It's one of several papers here like the paper by Charles Calomiris and many others that at least try to think about the problem of the incentives that are created by the regulation. That is something very different from what lawyers usually do. They don't think about the incentives, and therefore set up what I call the first law of regulation. They regulate, and the markets circumvent.

We have a system where we're always going to be subject to problems because financial institutions borrow short and lend long—and they're subject to unforeseen permanent shocks, which are hard or impossible to anticipate in most cases. So we've gone from a system which worked very well—I am going to talk about that—to a system which in my opinion cannot survive. We neglect in our discussion, of course, one of the reasons why we've shifted from that system. It is called the Congress, or more generally, the members who are much more interested in redistribution than in efficiency.

We had a system which was relatively efficient and worked for a hundred years, and that was the British system that became famous as Bagehot's rule. But Bagehot didn't criticize the Bank of England for not using his rule. He criticized them for not announcing it in advance. He was an early rational expectationist. He said the Bank of England should announce the rule and, if they did, there would

be fewer crises. That rule worked very well in Britain for a hundred years. The reason we don't have it is because today Congress and regulators are much more concerned about redistribution than they are about efficiency. Bagehot's rule said, "Let them fail."

Failure in the modern world would mean that we wipe out the equity owners and we wipe out the management, as we did on a couple of occasions—for example, Continental Illinois Bank—and lend freely to those people who have a problem. Anna Schwartz showed, as they say, that this worked very well in the U.K. for over a hundred years. That was certainly a system which was a multinational system. They were lending all over the world. They got into the famous Bering crisis because of Argentina's default and so on. But they managed to survive through those crises without great problems of the kind that we now have.

Who will claim the current system is doing better? Not I. I close with this reminder, especially for the authors. In the 1920s, if you went to a bank, the thing that stood out for you most was on the window. It said "capital and surplus" and it listed what those were. By the 1950s, those were gone, and what it said was "member of FDIC."

Franklin Roosevelt recognized that FDIC would create a moral hazard problem. That is why he opposed it. Of course, these rules—like the FDIC and others—may have very good properties, but they have created many of the risks we have. In order to respond to those risks, the best thing we can do is go back to Bagehot's rule—that is, let them fail, but clean up the secondary consequences.

Mr. Redrado: I have been thinking about the implementation capacity of your insurance proposal. In particular, how to make it operational in the international arena, especially when you look at international banks that could suffer losses in one country and shift it to another or move operations from regulated to less-regulated places. What I wonder is: What kind of counterparty have you thought about? When I think about how to implement such a proposal, it seems to me you could give a role to multilateral entities, in particular, the BIS, where most of the central banks have a portion of their own reserves. It could be a conduit to be a counterparty for an

international situation. Moreover, in rethinking the role of the IMF—let me recall that you and I have talked about the possibility of irrelevance of the IMF. I wonder if you have thought that international financial institutions could have a role in being the counterparty of this insurance scheme.

Mr. Crockett: I like the insurance proposal quite a lot, but as you recognize, of course, there are lots of details that need to be looked at. One of them that I don't think has been mentioned yet is the valuation of the claims the insurer would get in the event it was activated. It is very difficult to value a franchise in the circumstances of a financial crisis, if the insurer is constrained automatically to put in the amount, which of course is in the lockbox and then transferred.

Mr. Rosengren: The idea of contingent capital is very interesting, and it is a good idea. You framed the proposal in terms of insurance. It would seem like a simpler structure would be using options, so that if you had long-dated, out-of-the-money puts on a portfolio of financial stocks, it would seem to be much easier to implement. It would eliminate some of the counterparty concerns and implementation concerns that people raised. You could set the capital relative to the strike price, rather than the premium you paid at initiation. You could imagine a situation where it would have many of the characteristics that you want, but get around some of the implementation problems that people have discussed.

Mr. Bullard: I liked this paper. There are many nice market-oriented ideas. I think the idea of fire-sale asset prices is not so good. The idea of rationalizing government intervention based on the existence of times of large classes of assets trading below fundamentals somehow does not strike me as sound. It links up to this idea of, How is this trigger going to work when, as previous speakers have said, it is very difficult to value the firm in the middle of a crisis? What is the role of market to market in this scheme?

Mr. Stein: Thanks very much. There are a lot of terrific comments and we'll try to get to a subset of them. First to Jean-Charles, who raised this question of, Do you want to have the private sector do

this, in which case you rely on the lockbox as opposed to having the government do it?

A couple of issues. I don't think the 100 percent lockboxing is expensive or socially costly, if there is not a general equilibrium shortage of Treasury securities. Now you can earn the interest on them. There is nothing dissipative happening. It is only if there is some kind of a general equilibrium shortage. So that is one reason. If you thought there was an equilibrium shortage, you might be drawn to having the government do it.

The other reason, as Bengt alluded to, to have the government do it, would be, Our thing relies on defining a trigger *ex ante*. We have to specify what the bad state looks like. It is bank losses greater than \$200 billion.

The government can do it like pornography. They can just recognize it when they see it, which is an advantage. They can condition on more information.

The reason we are drawn to the private option is in direct response to this question. We think there is a downside of having the government do it, which is with this discretion comes political economy concerns of all sorts. It's not that this might not be complementary, but to the extent you can go as far as you can with the private sector, that is a good thing.

Charlie Calomiris asked about herding. Will everybody want to take the same kind of risk? There is a logical argument here. It is a little more subtle than maybe people realize. It is not the standard moral hazard problem. You don't get paid back based on your own losses. So there is no expected return rationale for herding. There is only a second-moment rationale for herding that it might lower the variance of your portfolio. Something like that. Some of this is addressed with the trigger. If this option is sufficiently far out of the money and you do the same stupid thing as everybody—and instead of hitting a crisis—we just hit a very bad state, such that the trigger is not passed. You will bear all the burden of this. One virtue of this option structure is, if you set it sufficiently far out of the money,

there is a big deductible on the herding strategy as well. Just wanted to make that one point.

A point that both Charlie and Alan Blinder raised is, Are we giving up on capital regulation? No. If we said that, we've misspoke. The way I think about it is, We recognize there is going to be capital regulation. In fact, there is going to be a push to raise capital, and we want to make a form of capital that is cheaper. The specific mechanism is, What makes capital expensive is giving guys discretion in all states of the world raises agency costs. We want to give them cash only in a specific, smaller number of states of the world where the agency costs are lower because the social value of having banks do a lot of investment is higher.

To Alan's second point, the CAPM risk premium. You said, "Well, the insurer is on the wrong side of a contract which pays out in a very adverse state of the world."

That's going to have not only an unexpected return component to the pricing, but it should have a beta component. That absolutely must be right. Of course, this is true when you give somebody equity as well. There are those bad states. They are going to lose money in those bad states with unconditional capital.

You asked about the Flannery proposal. The Flannery proposal is similar to ours—for those of you who don't know it—but it is insurance that is firm-specific, so it will pay off whenever the individual bank does badly as opposed to the whole system doing badly.

That just pays off in more states of world. It pays off in the very bad systemic states of the world and it pays off in the firm-specific states. Since it's paying off in more states, it has to be more expensive. There is certainly an equilibrium cost to be borne here. I don't know if you get around it.

Last one I'll speak to—put options. Our thing is a put option. The strike price is, as we have envisioned it, bank earnings, rather than stock prices. There is a potential real problem with striking the option on stock prices because they are endogenous, and you worry about all kinds of feedback effects—manipulation and things. If

people think the banking sector is not going to be paid off, that will affect the prices. You like these things to be hooked to something that is hopefully a little bit more exogenous.

Mr. Kashyap: Let me start with Allan Meltzer's point. The Bagehot advice in these illiquid markets is very difficult to implement because there are multiple equilibria. Let's suppose we are not sure what the price is because a security is not trading and everybody is unsure what the price is going to be. If you don't lend, that removes buyers, pushes down the price, and something that could start out as a liquidity problem quickly becomes a solvency problem. In figuring out whether or not you want to mark to market and just make these decisions is much more difficult in practice than it was a hundred years ago. So as a practical matter, it is very difficult to decide how to apply Bagehot when you are looking at actual entities.

On the multinational question that came up several times, we struggled with a way to do that. The way we would imagine this is you will have a principal regulator. You will have to go to your principal regulator and convince them your operations across all markets are substantially insured. Whether the BIS would be the place the reporting goes to, so everybody knows what the operations are across markets, is a detail that is quite important to work out.

We are worried about this tradeoff between a bank getting in trouble in Vietnam and then exporting its problems into the United States. We would like to make sure the Vietnam stuff is insured there, the U.S. part is insured in the United States, and there is enough collective insurance.

Let me just close with saying two broad things. First of all, we view this as a complement to lots of other good existing proposals. Secondly, even if you don't buy into the proposal, we hope to change the discussion about capital regulation from simply trying to keep forcing them to hold capital and never thinking about why they don't want to hold it, to recognizing there are good reasons why they view capital as expensive. Attempting to design regulation so that you address those underlying frictions—whether using our solution or not—we think that is the single biggest point.

Central Banks and Financial Crises

Willem H. Buiter

Introduction

In this paper I draw lessons from the experience of the past year for the conduct of central banks in the pursuit of macroeconomic and financial stability. Modern central banks have three main tasks: (1) the pursuit of macroeconomic stability; (2) maintaining financial stability and (3) ensuring the proper functioning of the “plumbing” of a monetary economy, that is, the payment, clearing and settlement systems. I focus on the first two of these, and on the degree to which they can be separated and compartmentalised, conceptually and institutionally. My thesis is that both monetary theory and the practice of central banking have failed to keep up with key developments in the financial systems of advanced market economies, and that as a result of this, many central banks were to varying degrees ill-prepared for the financial crisis that erupted on August 9, 2007.

The empirical illustrations will be drawn mainly from the experience of three central banks, the Federal Reserve System (Fed), the Eurosystem (ECB) and the Bank of England (BoE), with occasional digressions into the experience of other central banks. Discussion of mainly Fed-related issues will account for well over one third of the paper, partly in deference to the location of the Jackson Hole Symposium, but mainly because I consider the performance of the Fed to have been

by some significant margin the worst of the three central banks, as regards both macroeconomic stability and financial stability.

In many ways, August 2008 is far too early for a *post mortem*. Both the financial crisis and dysfunctional macroeconomic performance are still with us and are likely to remain with us well into 2009: Inflation and inflation expectations are above-target and rising (see Chart 1 and Charts 2a,b), output is falling further below potential (see Charts 3a,b) and there is a material risk of recession in the US, the UK and the euro area.^{1,2} Nevertheless, I believe that, although a final verdict may have to wait another couple of generations, there are some lessons that can and should be learnt right now, because they are highly relevant to policy choices the monetary authorities will face in the months and years immediately ahead. Such, in any case, have been the justifications for even earlier crisis post-mortems written by myself and others (see e.g. Buiter, 2007f, 2008b, and Cecchetti, 2008).

Possibly because truly systemic financial crises have been few and far between in the advanced industrial countries since the Great Depression (the Nordic financial crisis of 1992/1993 is a notable exception (see Ingves and Lind, (1996), and Bäckström, (1997))), most central banks in the North Atlantic region—the region where the crisis started and has done the most damage—were not prepared for the storm that hit them. It is therefore not surprising that mistakes were made. The incidence and severity of the mistakes were not the same, however, for the three central banks. I find that the Fed performed worst as regards macroeconomic stability and as regards one of the two time dimensions of financial stability—minimising the likelihood and severity of *future* financial crises. As regards the other time dimension of financial stability, dealing with the *immediate* crisis, the BoE gets the wooden spoon, because of its failure to act appropriately in the early days of the crisis.

I argue that three factors contribute to the Fed's underachievement as regards macroeconomic stability. The first is institutional: The Fed is the least independent of the three central banks and, unlike the ECB and the BoE, has a regulatory and supervisory role; fear of political encroachment on what limited independence it has and

cognitive regulatory capture by the financial sector make the Fed prone to over-react to signs of weakness in the real economy and to financial sector concerns.

The second is a sextet of technical and analytical errors: (1) misapplication of the “Precautionary Principle”; (2) overestimation of the effect of house prices on economic activity; (3) mistaken focus on “core” inflation; (4) failure to appreciate the magnitude of the macroeconomic and financial correction/adjustment required to achieve a sustainable external equilibrium and adequate national saving rate in the US following past excesses; (5) overestimation of the likely impact on the real economy of deleveraging in the financial sector; and (6) too little attention paid (especially during the asset market and credit boom that preceded the current crisis) to the behaviour of broad monetary and credit aggregates.

All three central banks have been too eager to blame repeated and persistent upwards inflation surprises on “external factors beyond their control,” specifically food, fuel and other commodity prices.

The third cause of the Fed’s macroeconomic underachievement has been its proclivity to use the main macroeconomic stability instrument, the federal funds target rate, to address financial stability problems. This was an error both because the official policy rate is a rather ineffective tool for addressing liquidity and insolvency issues and because more effective tools were available, or ought to have been. The ECB, and to some extent the BoE, have assigned the official policy rate to their respective price stability objectives and have addressed the financial crisis with the liquidity management tools available to the lender of last resort and market maker of last resort.

The BoE made the worst job of handling the immediate financial crisis during the early months (until about November 2007). The ECB, partly as the result of an accident of history, did best as regards putting out fires.

The most difficult part of financial stability management is to handle the inherent tension between the two key dimensions of financial stability: The urgent short-term task of “putting out fires,” that is, managing the immediate crisis, and the vital long-run task of

minimizing the likelihood and severity of future financial crises. Through their pricing of illiquid collateral, all three central banks *may* have engaged in behaviour that created unnecessary moral hazard, thus laying the foundations for future reckless lending and borrowing. In the case of the Fed this is all but certain, in the case of the ECB quite likely and in the case of the BoE merely possible.

As regards the Fed, the nature of the arrangements for pricing illiquid collateral offered by primary dealers invites abuse. In the case of the BoE and the ECB, the secrecy surrounding their pricing methodology and models, and their unwillingness to provide information about the pricing of specific types and items of illiquid collateral make one suspect the worst. These distorted arrangements (in the case of the Fed) and lack of transparency as regards actual pricing (for all three central banks) continue. The reason the Fed did worst in this area also is probably again due to the fact that, unlike the ECB and the BoE, the Fed is a financial regulator and supervisor for the banking sector. Cognitive regulatory capture of the Fed by Wall Street resulted in excess sensitivity of the Fed not just to asset prices (the “Greenspan-Bernanke put”) but also to the concerns and fears of Wall Street more generally.

All three central banks have gone well beyond the provision of emergency liquidity to solvent but temporarily illiquid banks. All three have allowed themselves to be used in varying degrees as quasi-fiscal agents of the state, either by providing implicit subsidies to banks and other highly leveraged institutions, and/or by assisting in the recapitalisation of insolvent institutions, while keeping the resulting contingent exposure off the budget and balance sheet of the fiscal authorities. Such subservience to the fiscal authorities undermines the independence of the central banks even in the area of monetary policy. The unwillingness of the three central banks to reveal their valuation models for and actual valuations of illiquid collateral and, more generally, their unwillingness to provide the information required to calculate the magnitude of all their quasi-fiscal interventions, make a mockery of their accountability for the use of public resources.

In Section I, I discuss the principles of macroeconomic stability and in Section II the principles of financial stability. Section III reviews the

records of the three central banks during the past year, first as regards macroeconomic stability and then as regards financial stability. Section IV concludes.

I. Macroeconomic stability

I.1 Objectives

The macroeconomic stability objectives of the three central banks are not the same. Both the ECB and the BoE have a lexicographic or hierarchical preference ordering with price stability in pole position. Only *subject to* the price stability objective being met (for the BoE) or *without prejudice to* the price stability objective (for the ECB) can these central banks pursue other objectives, including growth and employment. In the UK, the operationalization of the price stability objective is the responsibility of the Chancellor of the Exchequer. It takes the form of a 2 percent annual target inflation rate for the headline consumer price index or CPI. The ECB sets its own operational inflation target, an annual rate of inflation for the CPI that is below but close to 2 percent in the medium term.

The Fed formally has a triple mandate: maximum employment, stable prices and moderate long-term interest rates.³ The third of these is habitually ignored, leaving the Fed in practice with a dual mandate: maximum employment and stable prices. Unlike the lexicographic ordering of ECB and BoE objectives, the Fed's objective function can be interpreted as *symmetric* between price stability and real economic activity, in the sense that, in the central bank's objective function, the one can be traded off for the other. This is captured well by the traditional flexible inflation targeting loss function Λ shown in equations (1) and (2). Here E_t is the conditional expectation operator at time t , π is the rate of inflation, π^* the (constant) target rate of inflation, y real GDP (or minus the unemployment rate) and y^* the target level of output, which could be potential output (or minus the natural rate of unemployment) or, where this differs from potential output, the efficient level of output (the efficient rate of unemployment).

$$\Lambda_t = E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+\delta} \right)^i L_{t+i} \quad (1)$$

$$\delta > 0$$

$$L_{t+i} = (\pi_{t+i} - \pi^*)^2 + \omega (y_{t+i} - y_{t+i}^*)^2 \quad (2)$$

$$\omega > 0$$

With a lexicographic ordering, the central bank can be viewed as first minimizing the loss function in (1) and (2) with the weight on the squared output gap, ω , set equal to zero. If there is a unique policy rule that solves this problem, this is the optimal policy rule. If there is more than one solution, the policy authority chooses among these the one that minimizes something like $\Lambda_t^y = E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+\delta} \right)^i (y_{t+i} - y_{t+i}^*)^2$.

“Maximum employment” is not a well-defined concept. Recent Fed chairmen have interpreted it as something close to the natural rate of unemployment or the NAIRU (the non-accelerating inflation rate of unemployment). In employment space this translates into the maximum *sustainable* level or rate of employment. In output space it becomes the maximum *sustainable* output gap (excess of actual over potential GDP) or the maximum *sustainable* growth rate of GDP.

Price stability has not been given explicit numerical content by the Fed, the US Congress or any other authority. Since the Greenspan years, the Fed appears to have targeted a stable, low rate of inflation for the core personal consumption expenditure (PCE) deflator index. It has not always been clear whether the Fed actually targets core inflation or whether it targets headline inflation in the medium term and treats core inflation as the best predictor of medium-term headline inflation. As late as March 2005, the current Chairman of the Fed admitted to a “comfort zone” for the core PCE deflator of 1 to 2 percent (Bernanke, 2005). This is also consistent with the FOMC members’ inflation forecasts at a three-year horizon. In what follows, I will treat the Fed’s implicit inflation target as 1.5 percent for the headline PCE deflator or just below 2.0 percent for the headline CPI, given the usual wedge between PCE and CPI inflation rates.

The recent performance of the CPI inflation rates, of survey-based measures of 1-year and long-term inflation expectations and of real GDP growth rates for the US, the euro area and the UK are shown in Charts 1, 2a,b and 3a,b.

1.2 Instruments

The key instrument of monetary policy for macroeconomic stabilisation policy is the short risk-free nominal rate of interest on non-monetary financial instruments, henceforth the official policy rate, denoted i . This is the federal funds target rate in the US, the inelegantly named Main Refinancing Operations Minimum Bid Rate of the ECB and Bank Rate in the UK. In principle, the nominal exchange rate (either a bilateral exchange rate or a multilateral index) could be used as the instrument of monetary policy instead of the official policy rate. In practice, all three countries have market-determined exchange rates.⁴ I don't consider sterilised foreign exchange market intervention (unilateral or internationally co-ordinated) to be a significant additional instrument of policy, unless foreign exchange markets were to become disorderly and illiquid—something that hasn't happened yet.

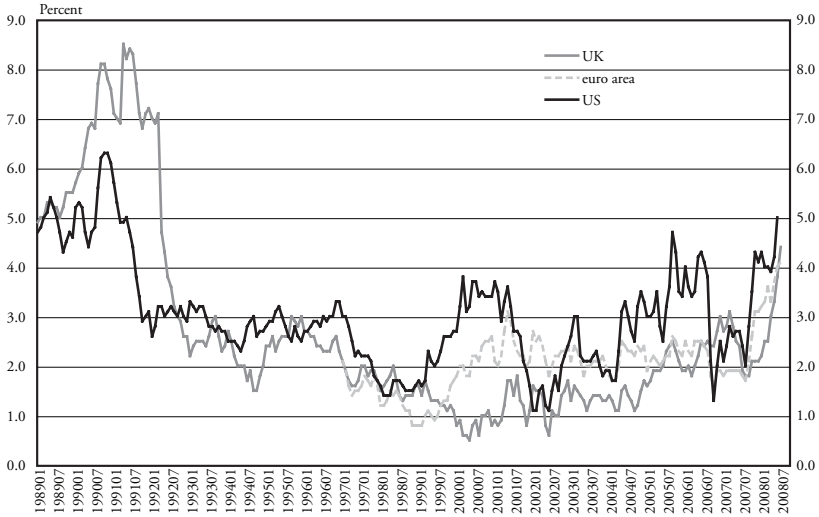
Reserve requirements on eligible deposits, when they are unremunerated, are best thought of as a quasi-fiscal tax. When remunerated, they can be viewed as part of a set of capital and liquidity requirements that can be used as financial stability instruments (see Section II below), but not as significant macroeconomic stabilisation instruments.

The non-negativity constraint on the official policy rate has not been an issue so far in the current crisis. With the federal funds target rate at 2.00 percent, it is by no means inconceivable that $i \geq 0$ could become a binding constraint on the Fed's interest rate policy before this crisis and cyclical downturn are over.⁵

In what follows, the official policy rate will be the only macroeconomic stabilisation instrument of the central bank I consider in detail.

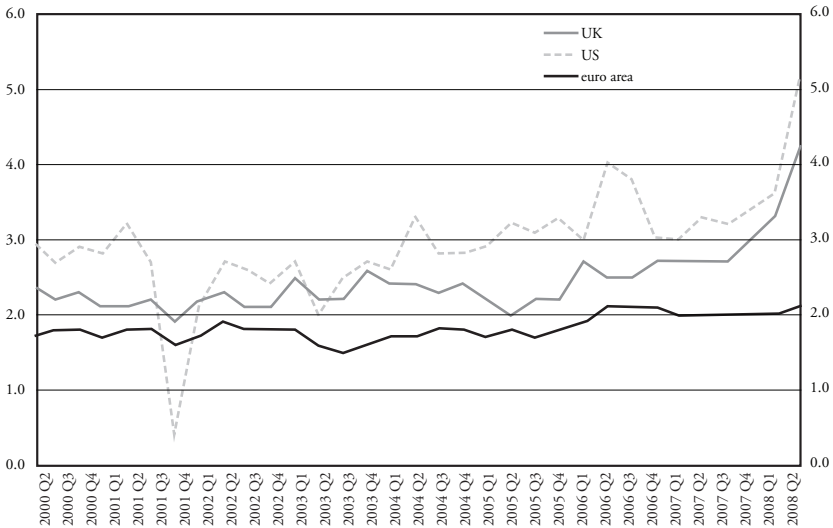
Because economic behaviour (consumption, portfolio demand, investment, employment, production, price setting) is strongly influenced by expectations of the future, both directly and through the

Chart 1
Headline CPI inflation rates, 1989M1-2008M7 (percent)



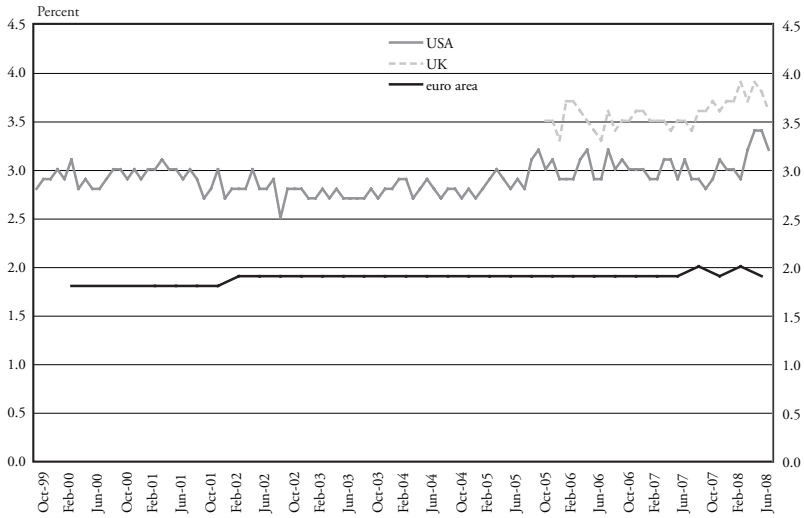
Percent change month on same month one year earlier
 Source: UK: ONS; euro area: Eurostat; US: BEA.

Chart 2a
One-year ahead inflation expectations, 2000Q2-2008Q2 (percent)



Source: UK: Bank of England/GfK NOP Inflation Attitudes Survey (median); US: University of Michigan Survey (median); Euro area: ECB survey of professional forecasters (mean).

Chart 2b
Long-term inflation expectations



Sources: USA: The University of Michigan 5-10 Yr Expectations: Annual Chg in Prices: Median Increase (%).
 UK: YouGov/CitiGroup Inflation expectations 5-10 years ahead. Median Increase (%)
 Euro area: ECB Survey of Professional Forecasters five years ahead forecast. Mean Increase (%)

Chart 3a
Real GDP Growth Rates USA, Euro Area and UK
1956Q1 - 2008Q2

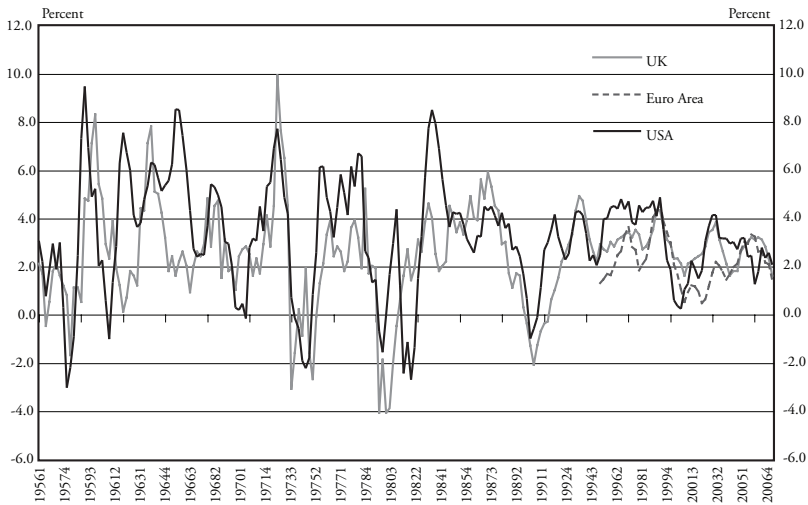
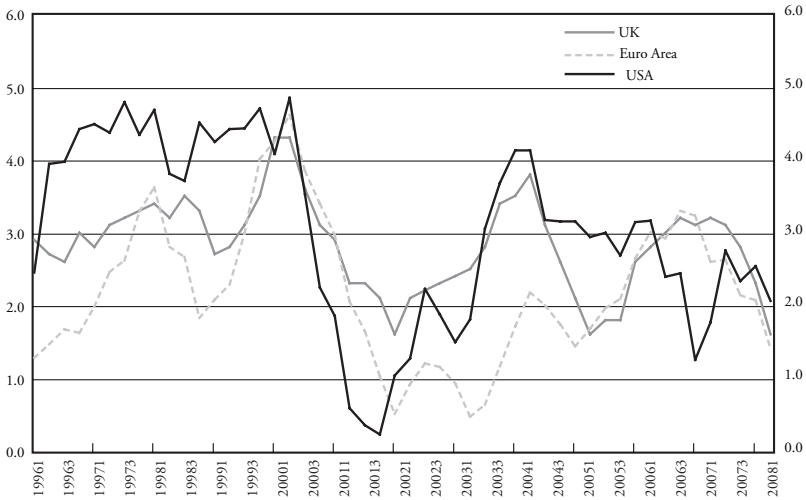


Chart 3b
Real GDP growth rates US, Euro Area and UK
1996Q1 - 2008Q2*



Source: UK and euro area: Eurostat; US: Bureau of Economic Analysis.

Notes: quarter on same quarter one year earlier; * for euro area, data end in 2008Q1.

effect of these expectations on long-duration asset prices, it is not just past and current realisations of the official policy rate that drive outcomes, but the entire distribution of the contingent future sequence of official policy rates. The effect of a change in the current official policy rate is therefore the sum of the direct effect (holding constant expectations of future rates) and the indirect effect of a change in the current official policy rate on the distribution of the sequence of future contingent official policy rates. This leveraging of future expectations effectively permits future interest rates to be used as instruments multiple times (provided announcements are credible): Once at the date the actual official policy rate is set, $i(t_1)$, say, and through announcements or expectations of that official policy rate at dates before t_1 . By abuse of certainty equivalence, I will summarise this announcement effect as $\{A_{t_1-j, t_1}(i_{t_1}); j \geq 1\}$, where $A_{t_1-j, t_1}(i_{t_1})$ is the announcement of the period t_1 policy rate in period t_1-j . “Announcement” should be interpreted broadly to include all the hints, nudges,

winks and other forms of verbal and non-verbal communication engaged in by the authorities.

This means that an opportunistic policy authority (one incapable of credible commitment to a specific contingent future policy rule) will be tempted, if it has any credibility at all, to use announcements of future policy rates as independent instruments of policy, unconstrained by the commitment or consistency constraint that the announcement of the future official policy rate, or of the future rule for setting the official policy rate, be equal to the best available current guess about what the authorities will actually do at that future date, which can be expressed as $A_{t_1-j}(i_{t_1}) = E_{t_1-j}(i_{t_1})$.

II. Financial stability

I adopt a narrow view of financial stability. Sometimes financial instability is defined so broadly that it encompasses any inefficiency or imbalance in the financial system. In what follows, financial stability means (1) the absence of asset price bubbles; (2) the absence of illiquidity of financial institutions and financial markets that may threaten systemic stability; and (3) the absence of insolvency of financial institutions that may threaten systemic stability. I deal with the three in turn.

II.1 Should central banks use the official policy rate to try to influence asset price bubbles?

The original Greenspan-Bernanke position that the official policy rate should not be used to tackle asset booms/bubbles is convincing (Greenspan, 2002; Bernanke, 2002; Bernanke and Gertler, 2001). To the extent that asset booms influence or help predict the distribution of future outcomes for the macroeconomic stability objectives (price stability or price stability and sustainable economic growth), they will, of course, already have been allowed for under the existing approaches to maintaining macroeconomic stability in the US, the euro area and the UK.

But the official policy rate should not be used to “lean against the wind” of asset booms and bubbles beyond addressing their effect on

or informational content about the objectives of macroeconomic stabilisation policy, that is, asset prices should not be targeted with the official policy rate “in their own right.” First, this would “overburden” the official policy rate, which is already fully engaged in the pursuit of price stability and, in the case of the US, in the pursuit of price stability and sustainable growth. Second, asset price bubbles are, by definition, driven by non-fundamental factors. Going after an asset bubble with the official policy rate—a fundamental determinant of asset prices—may well turn out to be like going after a rogue elephant with a pea shooter. It could require a very large peashooter (a very large increase in the official policy rate) to have a material effect on an asset price bubble.

The collateral damage to the macroeconomic stability objectives caused by interest rate increases capable of subduing asset price bubbles would make hunting bubbles with the official policy rate an unattractive policy choice. Mundell’s principle of effective market classification (Mundell, 1962) suggests that the official policy rate not be assigned to asset bubbles in their own right.

That, however, leaves a major asymmetry in the macroeconomic policy and financial stability framework. This asymmetry is not that the official policy rate responds more sharply to asset market price declines than to asset market price increases. Even if there were no “Greenspan-Bernanke put,” such asymmetry should be expected because asset price booms and busts are not symmetric. Asset price busts are sudden and involve sharp, extremely rapid asset price falls. Even the most extravagant asset price boom tends to be gradual in comparison. So an asymmetric response to an asymmetric phenomenon is justified. This does not mean that there has been no evidence of a “Greenspan-Bernanke” put during the current crisis. I believe that phenomenon—excess sensitivity of the federal funds target rate to sudden declines in asset prices, and especially US stock prices—to be real, and will address the issue in Section III.2a below.

Operationally, the asymmetry is that there exists a panoply of liquidity-enhancing, credit-enhancing and capital-enhancing measures

that can be activated during an asset market bust or a credit crunch, to enhance the availability of credit and capital and to lower its cost, but no corresponding liquidity- and credit-restraining and capital-diminishing instruments during a boom. When financial markets are disorderly, illiquid or have seized up completely, the lender of last resort and market maker of last resort (discussed in Section II.3) can spring into action.

Examples abound. Sensible proposals from the SEC in the US that require putting a range of off-balance sheet vehicles back on the balance sheets of commercial banks are waived or postponed for the duration of the financial crisis because implementation now would further squeeze the available capital of the banks. Given where we are, this makes sense, but where was the matching regulatory insistence on increasing capital and liquidity ratios during the good times?

We even have proposals now that mark-to-market accounting rules be suspended during periods of market illiquidity (see e.g. IIF, 2008). The argument is that illiquid asset markets undervalue assets compared to their fundamental value in orderly markets, and that because of this fair value accounting and reporting rules are procyclical. The observation that mark-to-market behaviour is procyclical is correct, but suspending mark-to-market when markets are disorderly would introduce a further asymmetry, because orderly and technically efficient asset markets can produce valuations that depart from the fundamental valuation because of the presence of a bubble. There have been no calls for mark-to-market accounting and reporting standards to be suspended during asset price booms and bubbles.

Fundamentally, what drives this operational asymmetry is the fact that the authorities are unable or unwilling to let large highly leveraged financial institutions collapse. There is no matching inclination to expropriate, to subject to windfall taxes, to penalise financially or to restrain in other ways extraordinarily profitable financial institutions. This asymmetry creates incentives for excessive risk taking by the financial institutions concerned and has undesirable distributional consequences. It needs to be corrected. I believe a regulatory response is the only sensible one.

II.2 *Regulatory measures for restraining asset booms*

I propose that any large and highly leveraged financial institution (commercial bank, investment bank, hedge fund, private equity fund, SIV, conduit, other SPV or off-balance sheet entity, currently in existence or yet to be created—whatever it calls itself, whatever it does and whatever its legal form—be regulated according to the same set of principles aimed at restraining excessive credit growth and leverage during financial booms. Again, this regulation should apply to *all* institutions deemed too systemically important (too large or too interconnected) to fail.

Therefore, while I agree with the traditional Greenspan-Bernanke view that the official policy rate not be used to target asset market bubbles, or even to lean against the wind of asset booms, I do not agree that the best that can be done is for the authorities to clean up the mess after the bubble bursts.

II.2a *Leverage is the key*

The asymmetries have to be corrected through regulatory measures, effectively by across-the-board credit (growth) controls, probably in the form of enhanced capital and liquidity requirements. Every asset and credit boom in history has been characterised by rising, and ultimately excessive *leverage*, and by rising and ultimately excessive *mismatch*. Mismatch here means asset-liability mismatch or resources-exposure mismatch as regards maturity, liquidity, currency denomination, credit risk and other risk characteristics. The crisis we are now suffering the consequences of is no exception. Because mismatch only becomes a systemic issue if there is excessive leverage, and because increased leverage is largely motivated by the desire of the leveraged entity for increased mismatch, I will focus on leverage in what follows.

Leverage is a simple concept which may be very difficult to measure, as those struggling to quantify the concept of *embedded leverage* will know. In the words of the Counterparty Risk Management

Group II (2005), “...leverage exists whenever an entity is exposed to changes in the value of an asset over time without having first disbursed cash equal to the value of that asset at the beginning of the period.” And: “...the impact of leverage can only be understood by relating the underlying risk in a portfolio to the economic and funding structure of the portfolio as a whole.”

Traditional sources of leverage include borrowing, initial margin (some money up front—used in futures contracts) and no initial margin (no money up front—when exposure is achieved through derivatives).

I propose using simple measures of leverage, say a measure of gross exposure to book equity, as a metric for constraining *capital insolvency* risk (liabilities exceeding assets) of all large, highly leveraged institutions. Common risk-adjusted Basel II-type capital adequacy requirements and reporting requirements would be imposed on all large institutions whose leverage, according to this simple metric, exceeds a given value. These capital adequacy requirements would be varied (or vary automatically) in countercyclical fashion.

To address the second way financial entities can fail, what the CRMG calls *liquidity insolvency* (meaning they cannot meet their obligations as they become due because they run out of cash and are unable to raise new funds), I propose that minimal funding liquidity and market or asset liquidity requirements be imposed on, respectively, the liability side and the asset side of the balance sheets of all large highly leveraged financial institutions. These liquidity requirements would also be tightened and loosened in countercyclical fashion.

The regular Basel II capital requirements would provide a floor for the capital requirements imposed on all highly leveraged financial institutions above a certain threshold size. It is possible that Basel II will be revised soon to include minimum funding liquidity and asset liquidity requirements for banks and other highly leveraged financial institutions. If not, national regulators should impose such minimum funding liquidity and asset liquidity requirements on all highly leveraged financial institutions above a threshold size.

Countercyclical variations in capital and liquidity requirements could either be imposed in a discretionary manner by the central bank or be built into the rule defining the capital or liquidity requirement itself. An example of such an *automatic financial stabiliser* is the proposal by Charles Goodhart and Avinash Persaud (Goodhart and Persaud, 2008a,b), to make the supplementary capital requirement for any given institution (over and above the Basel II requirement, which would set a common floor) an increasing function of the growth rate of that institution's balance sheet.

My wrinkle on this proposal (which Goodhart and Persaud propose for banks only) is that the same formula would apply to all highly leveraged financial institutions above a given threshold size. The Goodhart-Persaud proposal makes the supplementary-capital-requirement-defining growth rate a weighted average (with declining weights) of the growth rate of the institution's assets over the past three years. The details don't matter much, however, as long as the criterion is easily monitored and penalises rapid expansion of balance sheets. A similar Goodhart-Persaud approach could be taken to liquidity requirements for highly leveraged institutions. If the assets whose growth rate is taxed or penalised under this proposal are valued at their fair value (that is, marked-to-market where possible), its stabilising properties would be enhanced.

Finally, I would propose that all large leveraged institutions that are deemed too large, too interconnected, or simply too well-connected to fail, be made subject to a Special Resolution Regime along the lines that exist today for federally insured deposit-taking institutions through the FDIC. A concept of *regulatory insolvency*, which could bite before either capital insolvency or liquidity insolvency kick in, must be developed that allows an official administrator to take control of any large, leveraged financial institution and/or to engage in Prompt Corrective Action. The intervention of the administrator would be expected to impose serious penalties on existing shareholders, incumbent board and management and possibly on the creditors as well. The intervention should aim to save the institution, not its owners, managers or board, nor should it aim to "make whole," that is, compensate in full, its creditors.

II.3 Liquidity management: From lender of last resort to market maker of last resort

Liquidity management is central to the financial stability role of the central bank. Liquidity can be a property of economic agents and institutions or of financial instruments. *Funding liquidity* is the capacity of an economic agent or institution to attract external finance at short notice, subject to low transaction costs and at a financial cost that reflects the fundamental solvency of the agent or institution. It concerns the liability side of the balance sheet. *Market liquidity* is the capacity to sell a financial instrument at short notice, subject to low transaction costs and at a price close to its fundamental value. It concerns the asset side of the balance sheet. Both funding liquidity and market liquidity are continuous rather than binary concepts, that is, there can be varying degrees of liquidity.

Funding liquidity (a property of institutions) and market liquidity (a property of financial instruments or the markets they are traded in) are distinct but interdependent. This is immediately apparent when one recognises that access to external funds often requires collateral (secured lending); the cost of external funds certainly depends on the availability and quality of the collateral offered. The value of the assets offered as collateral depends on the market liquidity of the assets.

The central bank is unique because it can never encounter domestic-currency liquidity problems (domestic-currency funding illiquidity). This is because the monetary liabilities it issues, as agent of the state—the sovereign—provide unquestioned, ultimate domestic-currency liquidity. Often this finds legal expression through legal tender status for the central bank's monetary liabilities. Central banks can, of course, encounter foreign-currency liquidity problems. The recent experience of Iceland is an example.

There is no such thing as a perfectly liquid private financial instrument or a private entity with perfect funding liquidity, since the liquidity of private entities and instruments is ultimately dependent on confidence and trust. Liquidity, both funding liquidity and market liquidity, is very much a fair weather friend: It is there when you don't need it, absent when you urgently need it. Although private

agents may also lose confidence in the real value of the financial obligations of the state, including those of the central bank, the state is in the unique position of having the legitimate use of force at its disposal to back up its promises. The power to declare certain of your liabilities to be legal tender, the power to tax and the power to regulate (that is, to prescribe and proscribe behaviour) are unique to the state and its agents. The quality of private sector liquidity therefore cannot exceed that of central bank liquidity.

Funding illiquidity and market illiquidity interact in ways that can create a vicious downward spiral, well described in Adrian and Shin (2007a,b) and Spaventa (2008). Faced with the disappearance of normal sources of funding, banks or other financial institutions sell assets to raise liquidity to meet their maturing obligations. With illiquid asset markets, these assets sales can trigger a sharp decline in asset prices. Mark-to-market valuation, accounting and reporting requirements can cause capital ratios to fall below critical levels in other institutions, or may prompt margin calls. This prompts further asset sales that can turn the asset price decline into a collapse. Although these vicious circles can occur even in the absence of mark-to-market or fair value accounting and reporting, the adoption of such rules undoubtedly exacerbates the problem. The procyclicality of the Basel requirements (and especially of Basel II) (which began to be introduced just around the time the crisis erupted) had, of course, been noted before (see e.g. Borio, Furfine and Lowe, 2001; Goodhart, 2004; Kashyap and Stein, 2004; and Gordy and Howells, 2004).

II.3a Funding liquidity, the relationships-oriented model of intermediation and the lender of last resort

Funding liquidity is central to the traditional “relationships-oriented” model (ROM) of financial capitalism and the traditional lender of last resort (LLR) role of the central bank. In the traditional banking model, banks fund themselves through deposits (fixed market value claims withdrawable on demand and subject to a sequential service constraint—first come, first served). On the asset side of the balance sheet the traditional bank holds a small amount of liquid reserves, but mainly illiquid assets—loans to households or to businesses, partly

secured (mortgages), partly unsecured. In the ideal-type ROM bank, loans are held to maturity (e.g. the “originate to hold model” of mortgage finance). Even when loans mature, the borrowers tend to stay with the same bank for their future financial needs. Although deposits can be withdrawn on demand, depositors too tend to stick with the same bank, with which they often have a variety of other financial relations. The long-term relationships mitigate asymmetric information problems and permit the parties to invest in reputations and to build on trust. It inhibits risk-trading and makes entry difficult.

This combination of very short-maturity liabilities and long-maturity, illiquid assets is vulnerable to speculative attacks—bank runs. Such runs can occur, and be individually rational, even though the bank is solvent, in the sense that the value of the assets, if held to maturity, would be sufficient to pay off the depositors (and any other creditors). If the assets have to be liquidated prior to maturity, they would, however, be worthless (in milder versions the assets would be sold at a hefty discount on their fair value) and not all depositors would be made whole. This has been known since deposit-taking banks were first created. It has been formalised for instance in Diamond and Dybvig’s famous paper (Diamond and Dybvig, 1983, see also Diamond, 2007).

There are typically two equilibria. One equilibrium has no run on the bank. No depositor withdraws his deposits; this is because he believes that total withdrawals will not exceed the liquid reserves of the banks. This is confirmed in equilibrium. The other equilibrium has a run on the bank. Each depositor tries to withdraw his deposit because he believes that the withdrawals by other depositors will exceed the bank’s liquid reserves. The bank fails.

Solutions to this problem take the form of deposit insurance, standstills (mandatory bank holidays until the run subsides) and lender of last resort (LLR) intervention. All three require state intervention. Private deposit insurance can only cope with runs on individual banks or on a subset of the banks. It cannot handle a run on all banks. A creditor (depositor) standstill—making it impossible to withdraw deposits—could be part of the deposit contract, to be invoked at the discretion of the bank. This would, however, create

rather serious moral hazard and adverse selection problems, so a bank regulator/supervisor would be a more plausible party to which to delegate the authority to suspend the right to withdraw deposits. Lending to a single troubled bank can be and has been provided by other banks. Again this cannot work if a sufficiently large number of banks are faced with a run.

Individually rational bank runs don't require that bank's liabilities be deposits. They are possible whenever funding sources are short-term and assets are of longer maturity and illiquid. When creditors to a bank refuse to renew maturing loans or credit lines, this is economically equivalent to a withdrawal of deposits. This applies to credit obtained in the interbank market or funds obtained by issuing debt instruments in the capital markets.

Lending to a solvent but illiquid bank to prevent a socially costly bank failure should satisfy Bagehot's dictum, which can be paraphrased as: Lend freely, against collateral that will be good in the long run (even if it is not good today), and at a penalty rate (Bagehot, 1873). Taking collateral and charging a penalty rate is part of the LLR rule book to avoid skewing incentives towards future excessive risk taking in lending and funding by the banks, that is, to avoid moral hazard.

The discount window is an example of a LLR facility (in the case of the Fed I will mean by this the primary discount window, in the case of the ECB the marginal lending facility and in the case of the BoE the standing lending facility).

The effective operation of LLR facility requires that the central bank determine all of the following:

1. The maturities of the loans and the total quantity of liquidity to be made available at each maturity.
2. The nature of the liquidity provided (e.g. central bank reserves or Treasury bills).
3. The interest rates charged on the loans and the other financial terms of the loan contract.

4. The set of eligible counterparties (who has access to the LLR facility?).
5. The regulatory requirements imposed on the eligible counterparties.
6. Whether the loan is collateralised or unsecured.
7. The set of financial instruments eligible as collateral.
8. The valuation of the collateral when there is no appropriate market price (when the collateral is illiquid).
9. Any further haircut (discount) applied to the valuation of the collateral and any other fees or financial charges imposed on the collateral.

Items (3), (5), (8) and (9) jointly determine the cost to the borrower of access to the LLR facility, and thus the moral hazard created by the arrangement.

In the case of the discount window (which can be described as an LLR facility “lite”), once points (1) to (9) have been determined, access to the facility is at the discretion of the borrower, that is, discount window borrowing is demand-driven. Strangely, and rather unfortunately, use of discount window facilities has become stigmatised in both the US and the UK. I assume the same applies to use of the discount window facilities of the Eurosystem, but I have less directly relevant information for this case. This stigmatisation of the use of the discount window may be individually rational, because a would-be discount window borrower could reasonably fear that future access to private sources of funding might be compromised if use of the discount window were seen as a signal that the borrower is in trouble. While this would be an unfortunate equilibrium, it is unlikely to be a fatal problem for a fearful discount window borrower: As long as the illiquid institution has a sufficient quantity of good collateral to be able to survive by using discount window funding (or through access to market-maker-of-last-resort facilities, discussed below in Section II.3b), discount window stigmatisation should not be a matter of corporate life or death.

LLR facilities other than the discount window tend not to be “on demand.” They often involve borrowers whose solvency the central

bank is not fully confident of. Such ad-hoc LLR facilities typically accept a wider range of collateral than the discount window, and the use of the facility is subject to bilateral negotiation between the would-be borrower(s) and the central bank. The Treasury and the regulator, if this is not the central bank, may also be involved (this was the case with the LLR facility arranged by the BoE for Northern Rock in September 2007—the Liquidity Support Facility). Such ad-hoc LLR arrangements are often arranged in secret and kept confidential as long as possible. Even after the fact, when commercial confidentiality concerns no longer apply, the information needed to determine whether the LLR (and the Treasury) made proper use of public funds in rescue operations are often not made public. The terms on which deposit insurance was made available to Northern Rock by the UK Treasury and the terms on which Northern Rock could access the Liquidity Support Facility created by the BoE are still not in the public domain. There is no justification for such secrecy.

The LLR facilities (including the discount window) are only there to address liquidity issues, not solvency problems. Of course, future solvency is a probabilistic concept, not a binary one. When continued solvency is in question (discussed below in Section II.6), the central bank may be a party to a public-sector rescue and recapitalisation. The arrangement through which public resources are made available may well look like an LLR facility “on steroids.” The key difference with the regular LLR facility is that the resources made available through a normal LLR facility are not meant to be provided on terms that involve a subsidy to the borrower, its owners or its creditors. The risk-adjusted rate of return to the central bank on its LLR loans should cover its funding cost, essentially the interest rate on sovereign debt instruments of the relevant maturity. In a funding liquidity crisis, there is likely to be a wedge between the risk-adjusted cost of funds to the central bank and the (prohibitive) cost of obtaining funding from private sources. Under these conditions the central bank can provide liquidity to a borrower on terms that make it both subsidy-free (or even profitable *ex-ante* for the central bank) and cheaper than what the liquidity-constrained borrower could obtain elsewhere. Such actions correct a market failure.

In the case of the UK, the discount window (the standing lending facility) is highly restrictive in the maturity of its loans (overnight only) and in the collateral it accepts (only sovereign and supranational securities, issued by an issuer rated Aa3 [on Moody's scale] or higher by two or more of the ratings agencies [Moody's, Standard and Poor's, and Fitch]).⁶ The UK discount window therefore does not provide liquidity in any meaningful sense. It provides overnight liquidity in exchange for longer-term liquidity. It is of use only to banks that are caught short at the end of the trading day because of some technical glitch.

Because the BoE has no discount window in the normal sense of the word, it had to create one when Northern Rock, a private commercial bank engaged mainly in home lending, found itself faced with both market liquidity and funding liquidity problems in September 2007. The resulting construct, the Liquidity Support Facility, is just what a normal discount window ought to have been, and is in the US and the euro area.

Most central banks make, under special circumstances, unsecured loans to eligible counterparties as part of their LLR role, but these tend to be separate from the discount window. Also, as regards (2), discount window loans tend to be in exchange for central bank liquidity (reserves) rather than some other highly liquid instrument like Treasury bills. With the longer-maturity (up to 3 months) discount window loans that are now available in the US (for eligible deposit-taking banks), there is, in principle, no reason why the Fed should not make TBs or Federal Reserve Bills (non-monetary liabilities of the Fed) available at the discount window. It certainly could make such non-reserve liquidity available at LLR facilities other than the discount window.

If a central bank engages in LLR loans to a solvent but illiquid bank, the central bank should expect to end up making a profit. It can extract this rent because the central bank is the only entity that is never illiquid (as regards domestic-currency obligations). It can always afford to hold good but illiquid assets till maturity. If the collateral offered is risky (specifically, subject to credit or default risk), the central bank can *ex post* make a loss even if it *ex ante* prices risky assets

to properly reflect the risk of both the borrowing bank defaulting and the issuer of the collateral defaulting. I believe it is essential for a clear division of responsibilities between the central bank and the Treasury, and for proper public accountability for the use of public funds (to Congress/Parliament and to the electorate), that any such losses be made good immediately by the Treasury. Ideally, all collateral offered to the central bank other than sovereign instruments should be exchanged immediately with the Treasury for sovereign debt instruments, at the valuation put on that collateral in the LLR transaction. This removes the risk that the central bank is (ab)used as a quasi-fiscal agent of the government.

To avoid regulatory arbitrage, any institutions eligible to access the discount window or any of the other LLR facilities of the central bank should be subject to a uniform regulatory regime. A special and key feature of such a common regulatory regime ought to be that access to LLR facilities only be granted to financial institutions for which there is a Special Resolution Regime which provides for Prompt Corrective Action and which establishes criteria under which the central bank, or a public agency working closely with the central bank like the FDIC, can declare a financial institution to be regulatorily insolvent before balance sheet insolvency or funding/liquidity insolvency can be established.

The SRR managed by the FDIC for federally insured deposit-taking banks is a model. The SRR would allow a public administrator to be appointed who can take over the management of the institution, dismiss the board and the management, suspend the voting rights of the shareholders, place the shareholders at the back of the queue of claimants to the value that can be realised by the administrator, transfer (part of) its assets or liabilities to other parties etc. Outright nationalisation would also have to be an option.

The need for such an SRR for all institutions eligible to access LLR facilities follows from the fact that it is impossible for the central bank to determine whether a would-be user of the LLR facility is merely illiquid or both illiquid and insolvent. Without the SRR, the existence of the LLR facility would encourage quasi-fiscal abuse of

the central bank and would become a source of adverse selection and moral hazard.

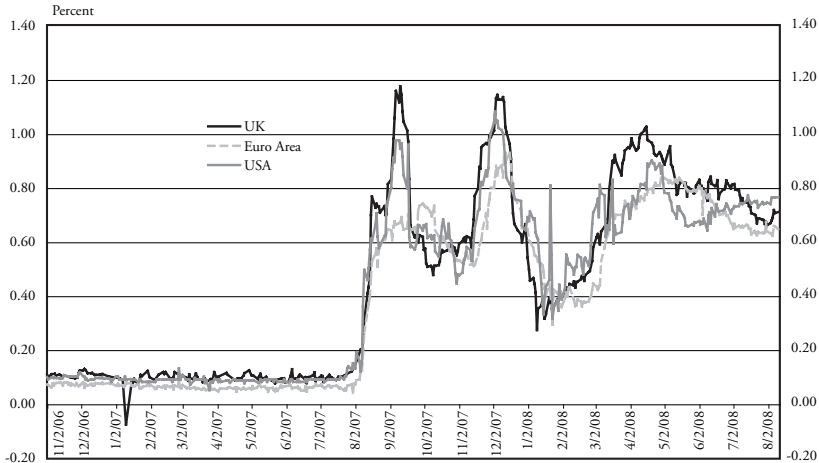
II.3b Market liquidity, the transactions-oriented model of intermediation and the market maker of last resort

The defining feature of the financial crisis that started on August 9, 2007 was not runs on banks or other financial institutions. A few of these did occur. Ignoring smaller regional and local banks, a classic depositors' bank run brought down Northern Rock in the UK (a mortgage lending bank that funded itself 75 percent in the wholesale markets), and non-deposit creditor runs were instrumental in killing off Bear Stearns, a US investment bank and primary dealer, and IndyMac, a large US mortgage lending bank. These, however, were exceptional events.

The new and defining feature of the crisis was the sudden and comprehensive closure of a whole range of financial wholesale markets, including the asset-backed commercial paper (ABCP) markets, the auction-rate securities (ARS) market, other asset-backed securities (ABS) markets, including the markets for residential mortgage-backed securities (RMBS), and many other collateralised debt obligations (CDO) and collateralised loan obligations (CLO) markets (see Buiters, 2007b, 2008b). The unsecured interbank market became illiquid to the point that Libor now is the rate at which banks won't engage in unsecured lending to each other. The sudden increase in Libor rates at the beginning of August 2007 and the continuation of spreads over the overnight indexed swap (OIS) rate is shown for three-month Libor, historically an important benchmark, in Chart 4.⁷

The fact that the Libor-OIS spreads look rather similar for the three monetary authorities (with the obvious exception of a few idiosyncratic early spikes upwards in the sterling spread, reflecting the BoE's late and belated conversion to the market-maker-of-last-resort cause) does not mean that all three did equally well in addressing the liquidity crunch in their jurisdiction. First, the magnitude of the challenge faced by each of the three may not have been the same. Second, the spreads are rather less interesting than the volumes of lending and borrowing that actually take place at these spreads. A 90-basis points

Chart 4
Three-Month Libor-OIS spreads
11/02/2006-08/02/2008



spread with an active market is much less of a problem than a 90-basis points spread at which no one transacts. Unfortunately, turnover data for the interbank markets are not in the public domain.

Third and most important, international financial integration ensures that liquidity can leak on a large scale between the jurisdictions of the national central banks, as long as the foreign exchange markets remain liquid, as they did for the major currencies. Unlike foreign branches, foreign subsidiaries of internationally active banks tend to have full access to the discount windows of their host central banks and they often also are eligible counterparties in the repos and other open market operations of their host central banks.

Subsidiaries of UK banks made use of Eurosystem and Fed liquidity facilities. Indeed UK parents used their euro area subsidiaries to obtain liquidity for themselves. At least one subsidiary of a Swiss bank accessed the Fed's discount window. Icelandic banks used their euro area subsidiaries to obtain euro liquidity, etc. In August 2008, Nationwide, a UK mortgage lender, announced it was setting up an Irish subsidiary. Gaining access to Eurosystem liquidity, both at the discount window and as a counterparty in repos, was a key motivating factor in this decision.

The *de facto* closure of many systemically important wholesale markets continues even now, a year since the start of the crisis. Over-the-counter credit default swap (CDS) markets and exchange-traded CDS derivatives markets became disorderly, with spreads far exceeding any reasonable estimate of default risk; key players in the insurance of credit risk, the so-called Monolines, lost their triple-A ratings and became irrelevant to the functioning of these markets. The rating agencies, which had moved aggressively from rating sovereigns and large corporates into the much more lucrative business of rating complex structured products (as well as advising on the design of such instruments), lost all credibility in these new product lines. This underlines the fact that the minimum shared understanding and information required for organised markets to function no longer existed for many structured products. One example: In the year since August 2007 there have been just two new issues of RMBS in the UK (one by HBOS for £500 million in May 2008, one by Alliance & Leicester for £400 million in August 2008).⁸

Central banks (outside the UK), in principle had the tools to address failing systemically important institutions—the LLR facilities. They did not have the tools to address failing, disorderly and illiquid markets. Central banks had developed and honed their skills during the era of traditional relationships-oriented financial intermediation centred on deposit-taking banks. Most were not prepared, institutionally and in mindset, to deal with the increasingly transactions-oriented financial intermediation that characterises modern financial sectors, especially in the US and the UK.

Fortunately, all that was required to meet the new reality were a number of extensions to and developments of existing open market operations, specifically in relation to the sale and repurchase operations (repos) used by central banks to engage in collateralised lending. The main extensions were: larger transactions volumes, longer maturities, a broader range of counterparties and a wider set of eligible collateral, including illiquid private securities. Increased scale and scope for outright purchases of securities by central banks, which could have been part of the new model, have not (yet) been used.

Central banks learnt fast to increase the scale and scope of their market-supporting operations. Unfortunately, the Fed did not sufficiently heed Bagehot's admonition to provide liquidity only at a penalty rate. The ECB is also likely to have created, through its acceptance of illiquid collateral at excessively generous valuations, adverse incentives for excessive future risk-taking. The ECB has not provided the information required to confirm or deny the suspicions about its collateral facilities. The BoE, on the basis of the limited available information, is the least likely of the three central banks to have over-priced the illiquid collateral it has been offered. Even here, however, the hard information required for proper accountability has not been provided.

Not designing the financial incentives faced by their counterparties in these new facilities to minimize moral hazard has turned out to be the central banks' Achilles heel in the current crisis. It will come back to haunt us in the next crisis.

Modern financial systems tend to be a convex combination of the traditional ROM and the transactions-oriented model of financial capitalism (TOM). The TOM (also called arms-length model or capital markets model) commoditises financial interactions and relationships and trades the resulting financial instruments in OTC markets or in organised exchanges. Securitisation of mortgages is an example. This makes the illiquid liquid and the non-tradable tradable. Scope for risk-trading is greatly enhanced. This is, potentially, good news.

It also destroys information. In the "originate-and-hold" model, the originator of the illiquid individual loan works for the Principal; he works as Agent of the Principal in the "originate-to-distribute" model. This reduces the incentive to collect information on the creditworthiness of the ultimate borrower and to monitor the performance of the borrower over the life of the loan. Securitisation and resale then misplace whatever information is collected: After a couple of transactions in [RMBS], neither the buyer nor the seller has any idea about the creditworthiness of the underlying assets. This is the bad news. Inappropriate securitisation permitted, indeed encouraged, the subversion of ordinary bank lending standards that was an essential input in the subprime disaster in the US.

The TOM affects banks in two ways. First, it provides competition for banks as intermediaries, since non-financial corporates can issue securities in the capital markets instead of borrowing from the banks, thus potentially bypassing banks completely. Savers can buy these securities as alternatives to deposits or other forms of credit to banks. Second, banks turn their illiquid assets into liquid assets which they either sell on (to special purpose vehicles [SPVs] set up to warehouse RMBS, or to investors) or hold on their balance sheet in the expectation that they can be sold at short notice and at a predictable price close to fair value, i.e. that they are liquid.

It may seem that this commoditisation and marketisation of financial relationships that are the essence of the TOM would solve the banks' liquidity problem and would make even bank runs non-threatening. If the bank's assets can be sold in liquid markets, the cost of a deposit run or a "strike" by other creditors need not be a fatal blow. Unfortunately, the liquidity of markets is not a deep, structural characteristic, but the endogenous outcome of the interaction of many partially and poorly informed would-be buyers and sellers. Market liquidity can vanish at short notice, just like funding liquidity.

Bank runs have their analogue in the TOM world in the form of a market freeze, run, strike, seizure or paralysis (the terminology is not settled yet). A potential buyer of a security who has liquid resources available today, may refuse to buy the security (or accept it as collateral), even though he believes that the security has been issued by a solvent entity and will earn an appropriate risk-adjusted rate of return if held to maturity. This socially excessive hoarding of scarce liquid assets can be individually rational because the potential buyer believes that he may be illiquid in the next trading period (and may therefore have to sell the security next period), and that other potential buyers of the security may likewise be illiquid in the future or may strategically refuse to buy the security, to gain a competitive advantage or even to put him out of business. If the transaction is a repo, he would have to believe also that the party trying to sell the security to him today, may be illiquid in the future and unable to make good on his commitment.

It remains an open question whether this approach to market and funding illiquidity today as a result of fear of market and funding illiquidity tomorrow either needs to be iterated *ad infinitum* or requires a fear of insolvency at some future date to support a full-fledged individually rational but socially inefficient equilibrium. Charles Goodhart (2002) believes that without the threat of insolvency there can be no illiquidity (see also the excellent collection of readings in Goodhart and Illing, 2002). Strategic behaviour, Knightian uncertainty, bounded rationality and other behavioural economics approaches to modelling the transactions flows in financial markets, including the rules-of-thumb that lead to information cascades and herding behaviour, may offer a better chance of understanding, predicting and correcting the market pathologies that lead to socially destructive hoarding of liquidity than relentlessly optimising models. The jury is still out on this one.⁹

Market illiquidity addresses the phenomenon that a financial instrument that is traded abundantly one day suddenly finds no buyers the next day at any price, or only at a price that represents a massive discount relative to its fundamental or fair value. That is, illiquidity is an endogenous outcome, a dysfunctional equilibrium in a market or game for which alternative liquid equilibria also exist, but have not materialised (or have not been coordinated on).

Market illiquidity is a form of market failure. Liquidity can be provided privately, by banks and other economic agents holding large amounts of inherently liquid assets (like central bank reserves or TBs). That would, however, be socially and privately inefficient. Maturity transformation and liquidity transformation are essential functions of financial intermediaries. A private financial entity should hold (or have access to, through credit lines, swaps, etc.) enough liquidity to manage its business during normal times, that is, when markets are liquid and orderly. It should not be expected to hoard enough liquid assets (or arrange liquid stand-by funding) during normal times to be able to survive on its own during abnormal times, when markets are disorderly and illiquid. That is what central banks are for.

Central banks can create any amount of domestic currency liquidity at little or no notice and at effectively zero marginal cost.

It would be inefficient to privatise and decentralise the provision of emergency liquidity when there is an abundant source of free liquidity readily available.

Anne Sibert and I (Buiter and Sibert, 2007a,b, see also Buiter, 2007a,b,c,d) have called the role of the central bank as provider of market liquidity during times when systemically important financial markets have become disorderly and illiquid, that of the *market maker of last resort* (MMLR).

The central bank as market maker of last resort either buys outright (through open market purchases) or accepts as collateral in repos and similar secured transactions, systemically important financial instruments that have become illiquid.¹⁰ If no market price exists to value the illiquid securities, the central bank organises reverse auctions that act as value discovery mechanisms. There is no need for the central bank to know more about the value of the securities than the sellers, or indeed for the central bank to know anything at all.

The central bank should organise the auction because it has the liquid “deep pockets.” A reverse Dutch auction, for instance, would be likely to be particularly punitive for the sellers of the illiquid securities. A second-lowest price (sealed bid) reverse auction would have other attractive properties. With so many Nobel-prizes and Nobel-prize calibre economists specialised in mechanism design, I don’t think the expertise to design and run these auctions would be hard to find. The auctions to value the illiquid securities could be organised jointly by the central bank and the Treasury if, as I advocate, the Treasury would immediately take onto its balance sheet any illiquid assets acquired in the auctions, either outright or as part of a repo or swap.

For the MMLR to function effectively, the central bank has to clarify all of the following:

1. The list of eligible instruments for outright purchase or for use in collateralised transactions like repos.
2. The nature of the liquidity provided (e.g. central bank reserves or Treasury bills).
3. The set of eligible counterparties.

4. The regulatory requirements imposed on the eligible counterparties.
5. The valuation of the securities offered for outright purchase or as collateral, when there is no appropriate market price (when the collateral is illiquid).
6. Any haircut (discount) applied to the valuation of the securities and any other fees or financial charges imposed.

Items (4), (5) and (6) determine the effective penalty imposed by the MMLR for use of its facilities, and thus the severity of the moral hazard created by its existence. Unlike discount window access, which is at the initiative of the borrower, MMLR finance is not available on demand, even if (1) through (6) above have been determined. The policy authority (in practice the central bank) decides when to inject liquidity, on what scale and at what maturity.

Injecting large amounts of liquidity against illiquid collateral is easy. The key challenge for the central bank as market maker of last resort is the same as that faced by the central bank as lender of last resort. It is to make the effective performance of the MMLR function during abnormal times, that is, when markets are disorderly and illiquid, compatible with providing the right incentives for risk taking when markets are orderly and liquid. This requires liquidity to be made available only on terms that are punitive. It is here that all three central banks appear to have failed so far, albeit in varying degrees.

II.4 The lender of last resort and market maker of last resort when foreign currency liquidity is the problem

So far, the argument has proceeded on the assumption that the central bank can provide the necessary liquidity effectively costlessly and at little or no notice. That, however, is true only for domestic-currency liquidity. For countries that have banks and other financial institutions that are internationally active and have significant amounts of foreign-currency-denominated exposure, a domestic-currency LLR and MMLR may not be sufficient. This is especially likely to be an

issue if the country's banks or other systemically significant financial businesses have large short-maturity foreign currency liabilities and illiquid foreign currency assets. The example of Iceland comes to mind as do, to a lesser extent, Switzerland and the UK.

If the country in question has a domestic currency that is also a serious global reserve currency, the central bank is likely to be able to arrange swaps or credit lines with other central banks on a scale sufficient to enable it to act as a foreign-currency LLR and MMLR for its banking sector. At the moment there are only two serious global reserve currencies, the US dollar, with 63.3 percent of estimated global official foreign exchange reserves at the end of 2007, and the euro, with 26.5 percent (see Table 1).

Sterling is a minor-league legacy global reserve currency with 4.7 percent, the yen is fading fast at 2.9 percent and Switzerland is a minute 0.2 percent.¹¹

The Fed, the ECB and the Swiss National Bank have created swap lines of US dollars for euro and Swiss francs respectively since the crisis started. These swap arrangements have recently been extended to cover the 2008 year-end period. The Central Bank of Iceland arranged, in May 2008, swap lines for €500mn each with the central banks of Norway, Denmark and Sweden. In the case of Iceland, one can see how such currency swaps could be useful in the discharge of the Central Bank of Iceland's LLR and MMLR function vis-à-vis a banking system with a large stock of short-maturity foreign currency liabilities and illiquid foreign currency assets.

The swaps between the Fed, the ECB and the SNB are less easily rationalised. Both the euro area- and the Switzerland-domiciled banks experienced a shortfall of liquidity of any and all kinds, not a specific shortage of US dollar liquidity. The foreign exchange markets had not seized up and become illiquid. Certainly, it was expensive for euro-area resident banks with maturing US dollar obligations to obtain US dollar liquidity through the swap markets, but that is no reason for official intervention (or ought not to be): Expensive is not the same as illiquid. I therefore interpret these currency swap

Table 1
Currency composition of official foreign exchange reserves

	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07
US dollar	59.00%	62.10%	65.20%	69.30%	70.90%	70.50%	70.70%	66.50%	65.80%	65.90%	66.40%	65.70%	63.30%
Euro					17.90%	18.80%	19.80%	24.20%	25.30%	24.90%	24.30%	25.20%	26.50%
German mark	15.80%	14.70%	14.50%	13.80%									
Pound sterling	2.10%	2.70%	2.60%	2.70%	2.90%	2.80%	2.70%	2.90%	2.60%	3.30%	3.60%	4.20%	4.70%
Japanese yen	6.80%	6.70%	5.80%	6.20%	6.40%	6.30%	5.20%	4.50%	4.10%	3.90%	3.70%	3.20%	2.90%
French franc	2.40%	1.80%	1.40%	1.60%									
Swiss franc	0.30%	0.20%	0.40%	0.30%	0.20%	0.30%	0.30%	0.40%	0.20%	0.20%	0.10%	0.20%	0.20%
Other	13.60%	11.70%	10.20%	6.10%	1.60%	1.40%	1.20%	1.40%	1.90%	1.80%	1.90%	1.50%	1.80%

Sources: 1995-1999, 2006-2007 IMF; Currency Composition of Official Foreign Exchange Reserves; 1999-2005, ECB; The Accumulation of Foreign Reserves

Source: Wikipedia

arrangements (unlike the swap arrangements put in place following 9/11) either as symbolic tokens of international cooperation (and more motion than action) or as unwarranted subsidies to euro area- and Switzerland-based banks needing US dollar liquidity.

II.5 Macroeconomic stabilisation and liquidity management: Interdependence and institutional arrangements

Macroeconomic stabilisation policy and liquidity management (including the LLR and MMLR arrangements and policies) cannot be logically or analytically separated or disentangled completely. Changes in the official policy rate affect output, employment and inflation, but also have an effect on funding liquidity and market liquidity. An artificially low official policy rate can boost bank profitability and help banks to recapitalise themselves. The current level of the federal funds target rate certainly has this effect. Discount window operations, repos, other open market purchases and indeed the whole panoply of LLR and MMLR arrangements and interventions strengthen the financial system, even for a given contingent sequence of current and future official policy rates. This boosts aggregate demand and thus influences growth and inflation.

Nevertheless, I believe that the official policy rate has a clear comparative advantage as a macroeconomic stabilisation tool while liquidity management has a corresponding comparative advantage as a financial stabilisation tool. Mundell's principle of effective market classification (policies should be paired with the objectives on which they have the most influence) therefore suggests that, should we wish to assign each of these instruments to a particular target, the official policy rate be assigned to macroeconomic stability and liquidity management to financial stability (see Mundell, 1962).

Both the ECB and the BoE advocate the view that the official policy rate be assigned to the macroeconomic stability objective (for both central banks this is the price stability objective) and that it not be used to pursue financial stability objectives. Any impact of the official policy rate on financial stability will, in that view, have to be reflected in an appropriate adjustment in the scale and scope of

liquidity management policies. Likewise, liquidity management policies (that is, LLR and MMLR actions) should be targeted at financial stability without undue concern for the impact they may have on price stability and economic activity. If these effects (which are highly uncertain) turn out to be material, there will have to be an appropriate response in the contingent sequence of official policy rates.

Undoubtedly, to the unbridled dynamic stochastic optimiser, the joint pursuit of all objectives with all instruments has to dominate the assignment of the official policy rate to macroeconomic stability and of liquidity management to financial stability. I am with Mundell on this issue, partly because it makes both communication with the markets and accountability to Parliament/Congress and the electorate easier.

A case can even be made for taking the setting of the official policy rate out of the central bank completely. Obviously, as the source of ultimate domestic-currency liquidity, the central bank is the only agency that can manage liquidity. It will also have to *implement* the official policy rate decision, through appropriate money market actions. But it does not have to make the official policy rate *decision*. The knowledge, skills and personal qualities for setting the official policy rate would seem to be sufficiently different from those required for effective liquidity management, that assigning both tasks to the same body or housing them in the same institution is not at all self-evident.

In the UK, the institutional setting is ready-made for taking the Monetary Policy Committee out of the BoE. The Governor of the BoE could be a member, or even the chair of the MPC, but need not be either. The existing institutional arrangements in the US and the euro area would have to be modified significantly if the official policy rate decision were to be moved outside the central bank.

Through its liquidity management role and more generally through its LLR and MMLR functions, the central bank will inevitably play something of a *de facto* supervisory and regulatory role vis-à-vis banks and other counterparties. Regulatory capture is therefore a constant threat and a frequent reality, as the case of the Fed, discussed

below in Section III.2a(xii) makes clear. Moving the official policy rate decision out of the central bank would make it less likely that the official policy rate would display the kind of excess sensitivity to financial sector concerns displayed by the federal funds target rate since Chairman Greenspan.¹²

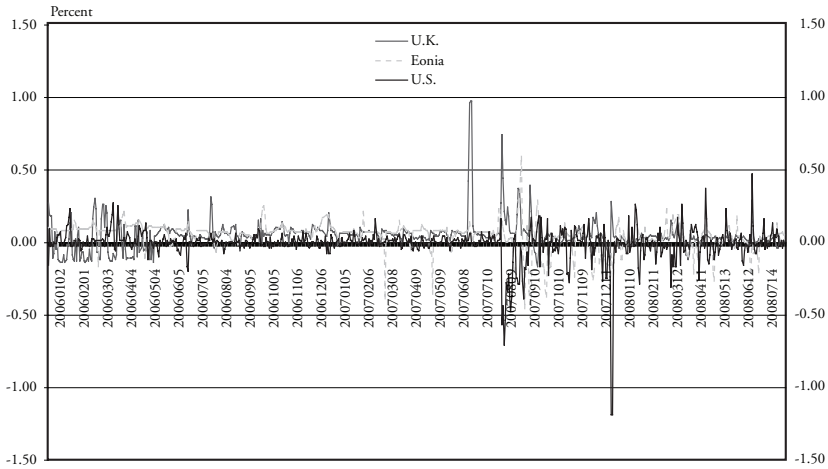
Regardless of whether the official policy rate-setting decision is taken out of the central bank, I consider it desirable that all three central banks change their procedures for setting the overnight rate. Chart 5 shows the spread between overnight Libor (an unsecured rate) and the official policy rate for the three central banks.

Similar pictures could be shown for the spread between the effective federal funds rate and the federal funds target rate and for spreads between the sterling and euro secured overnight rates and official policy rates.

The fact that the central banks are incapable of keeping the overnight rate close to the official policy rate is a direct result of the operating procedures in the overnight money markets (see Bank of England, 2008a, and Clews, 2005; European Central Bank, 2006; and Federal Reserve System, 2002). Setting the official policy rate (like fixing any price or rate) ought to mean that the central bank is willing to lend reserves (against suitable collateral) on demand in any amount and at any time *at that rate*, and that it is willing to accept deposits in any amount and at any time *at that rate*. This would effectively peg the secured overnight lending and borrowing rate at the official policy rate. The overnight interbank rate could still depart from the official policy rate because of bank default risk on overnight unsecured loans, but that spread should be trivial almost always. Ideally, there would be a 24/7 fixed rate tender at the official policy rate during a maintenance period, and a 24/7 unlimited deposit facility at the official policy rate.

The deviations between the official policy rate and the overnight interbank rate that we observe for the Fed, the ECB and the BoE are the result of bizarre operating procedures—the vain pursuit by the central bank of the pipe dream of setting the price (the official policy rate)

Chart 5
Spreads between effective overnight money market rates
and official policy rates (percent)
01/02/2006 - 07/14/2008



while imposing certain restrictions on the quantity (the reserves of the banking system and/or the amount of overnight liquidity provided).¹³

In the case of the UK, for instance, the commercial banks and other deposit-taking institutions that are eligible counterparties in repos specify their planned reserve holdings just prior to a new reserve maintenance period (roughly the period between two successive scheduled MPC meetings). Those reserves earn the official policy rate. If actual reserves (averaged over the maintenance period) exceed the planned amount, the interest rate received by the banks on the excess is at the standing deposit facility rate, 100 basis points below the official policy rate. If banks' estimated reserves turn out to be insufficient and the banks have to borrow from the BoE to meet their liquidity needs, they have to do so at the standing lending facility rate, 100 basis points above the official policy rate, except on the last day of the maintenance period, when the penalty falls to 25 basis points. Compared to simply pegging the rate, the BoE's operating procedure is an example of making complicated something that really is very simple: Setting a rate means supplying any amount demanded at that rate and accepting any amount offered at that rate. The Bank of Canada's

operating procedures for setting the overnight rate are closer to my ideal rate-setting mechanism (Bank of Canada, 2008).

If the central banks were to fix the overnight rate in the way I suggest, this would probably kill off the secured overnight interbank market, although not necessarily the unsecured overnight interbank market (overnight Libor), and certainly not the longer-maturity interbank markets, secured and unsecured. The loss of the secured overnight market would not represent a social loss: It is redundant. Those who used to operate in it, now can engage in more socially productive labour. There is no right to life for redundant markets. If the prospect of killing the secured overnight market is too frightening, central banks could adjust the proposed procedure by lending any amount overnight (against good collateral) at the official policy rate plus a small margin, and accepting overnight deposits in any amount at the official policy rate minus a small margin; twice the margin would just exceed the normal bid-ask spread in the secured private overnight interbank markets.

It does not help communication with the markets, or the division of a labour between interest rate policy and liquidity policy, if the monetary authority sets an official policy rate but there is no actual market rate, that is, no rate at which transactions actually take place, that corresponds to the official policy rate. Fortunately, the remedy is simple.

II.6 Central banks as quasi-fiscal agents: Recapitalising insolvent banks

Whatever its legal or *de facto* degree of operational and goal independence, the central bank is part of the state and subject to the authority of the sovereign. Specifically, the state (through the Treasury) can tax the central bank, even if these taxes may have unusual names. In many countries, the Treasury owns the central bank. This is the case, for instance, in the UK, but not in the US or the euro area. As an agent and agency of the state, the central bank can engage in quasi-fiscal actions, that is, actions that are economically equivalent to levying taxes, paying subsidies or engaging in redistribution. Examples are non-remunerated reserve requirements (a quasi-fiscal tax

on banks), loans to the private sector at an interest rate that does not at least cover the central bank's risk-adjusted cost of non-monetary borrowing (a quasi-fiscal subsidy), accepting overvalued collateral (a quasi-fiscal subsidy) or outright purchases of securities at prices above fair value (a quasi-fiscal subsidy).

To determine how the use of the central bank as a quasi-fiscal agent of the state affects its ability to pursue its macroeconomic stability objectives, a little accounting is in order. In what follows, I disaggregate the familiar "government budget constraint" into separate budget constraints for the central bank and the Treasury. I then derive the *intertemporal budget constraints* for the central bank and the Treasury, or their "comprehensive balance sheets." I then contrast the familiar conventional balance sheet of the central bank with its comprehensive balance sheet.

My stylised central bank has two financial liabilities: the non-interest-bearing and irredeemable monetary base $M \geq 0$ and its interest-bearing non-monetary liabilities (central bank Bills), $N \geq 0$, paying the risk-free one-period domestic nominal interest rate i .¹⁴ On the asset side it has the stock of international foreign exchange reserves, R^f , earning a risk-free nominal interest rate in terms of foreign currency, i^f , and the stock of domestic credit, which consists of central bank holdings of nominal, interest-bearing Treasury bills, $D \geq 0$, earning a risk-free domestic-currency nominal interest rate i , and central bank claims on the private sector, $L \geq 0$, with domestic-currency nominal interest rate i^l . The stock of Treasury debt (all assumed to be denominated in domestic currency) held outside the central bank is B ; it pays the risk-free nominal interest rate i ; T^p is the real value of the tax payments by the domestic private sector to the Treasury; it is a choice variable of the Treasury and can be positive or negative; T^b is the real value of taxes paid by the central bank to the Treasury; it is a choice variable of the Treasury and can be positive or negative; a negative value for T^b is a transfer from the Treasury to the central bank: The Treasury recapitalises the central bank; $T = T^p + T^b$ is the real value of total Treasury tax receipts; P is the domestic general price level; e is the value of the spot nominal exchange rate (the domestic currency price of foreign exchange); $C^g \geq 0$ is the real value of Treasury

spending on goods and services and $C^b \geq 0$ the real value of central bank spending on goods and services. Public spending on goods and services is assumed to be for consumption only.

Equation (3) is the period budget identity of the Treasury and equation (4) that of the central bank.

$$\frac{B_t + D_t}{P_t} \equiv C_t^g - T_t^p - T_t^b + (1+i_t) \left(\frac{B_{t-1} + D_{t-1}}{P_t} \right) \quad (3)$$

$$\begin{aligned} \frac{M_t + N_t - D_t - L_t - e_t R_t^f}{P_t} \equiv & C_t^b + T_t^b \\ & + \frac{M_{t-1} - (1+i_t)(D_{t-1} - N_{t-1}) - (1+i_t^f)L_{t-1} - (1+i_t^f)e_t R_{t-1}^f}{P_t} \end{aligned} \quad (4)$$

The solvency constraints of, respectively, the Treasury and central bank are given in equations (5) and (6):

$$\lim_{N \rightarrow \infty} E_t I_{N,t-1} (B_N + D_N) \leq 0 \quad (5)$$

$$\lim_{N \rightarrow \infty} E_t I_{N,t-1} (D_N + L_N + e_N R_N^f - N_N) \geq 0 \quad (6)$$

where I_{t_1, t_0} is the appropriate nominal stochastic discount factor between periods t_0 and t_1 .

These solvency constraints, which rule out Ponzi finance by both the Treasury and the central bank, imply the following intertemporal budget constraints for the Treasury (equation 7) and for the central bank (equation 8).

$$B_{t-1} + D_{t-1} \leq E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j (T_j^p + T_j^b - C_j^g) \quad (7)^{15}$$

$$D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f - N_{t-1} \leq E_t \sum_{j=t}^{\infty} I_{j,t-1} (P_j (C_j^b + T_j^b + Q_j) - \Delta M_j) \quad (8)$$

where

$$P_j Q_j \triangleq (i_j - i_j^L) L_{j-1} + \left(1 + i_j - (1 + i_j^f) \frac{e_j}{e_{j-1}} \right) e_{j-1} R_{j-1}^f \quad (9)$$

The expression Q in equation (9) stands for the real value of the quasi-fiscal implicit interest subsidies paid by the central bank. If the rate of return on government debt exceeds that on loans to the private sector, there is an implicit subsidy to the private sector equal in period t to $(i_t - i_t^L) L_{t-1}$. If the rate of return on foreign exchange reserves is less than what would be implied by Uncovered Interest Parity (UIP), there is an implicit subsidy to the issuers of these reserves, given in period t by $\left(1 + i_t - (1 + i_t^f) \frac{e_t}{e_{t-1}} \right) e_{t-1} R_{t-1}^f$.

When comparing the conventional balance sheet of the central bank to its comprehensive balance sheet or intertemporal budget constraint, it is helpful to rewrite (8) in the following equivalent form:

$$\begin{aligned} & \frac{M_{t-1}}{1+i_t} - (D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f - N_{t-1}) \\ & \leq E_t \sum_{j=t}^{\infty} I_{j,j-1} \left[P_j (-C_j^b - T_j^b - Q_j) + \left(\frac{i_{j+1}}{1+i_{j+1}} \right) M_j \right] \end{aligned} \quad (10)$$

Summing (3) and (4) gives the period budget identity of the government (the consolidated Treasury and central bank), in equation (11); summing (5) and (6) gives the solvency constraint of the government in equation (12) and summing (7) and (8) gives the intertemporal budget constraint of the government in equation (13).

$$\begin{aligned} M_t + N_t + B_t - L_t - e_t R_t^f & \equiv P_t (C_t^g + C_t^b - T_t) \\ & + M_{t-1} + (1+i_t)(B_{t-1} + N_{t-1}) - (1+i_t^L)L_{t-1} - e_t(1+i_t^f)R_{t-1}^f \end{aligned} \quad (11)$$

$$\lim_{N \rightarrow \infty} E_t I_{N,t-1} (B_N + N_N - L_N - e_N R_N^f) \leq 0 \quad (12)$$

$$B_{t-1} + N_{t-1} - L_{t-1} - e_{t-1} R_{t-1}^f \leq E_t \sum_{j=t}^{\infty} I_{j,j-1} \left(P_j (T_j - Q_j - (C_j^g + C_j^b)) + \Delta M_j \right) \quad (13)$$

Table 2
Central bank conventional financial balance sheet

Assets	Liabilities
D	$\frac{M}{1+i}$
L	N
eR^f	
	W^b

Consider the conventional financial balance sheet of the Central Bank in Table 2.

The Central Bank’s conventional financial net worth or equity, $W^b \triangleq D + L + eR^f - N - \frac{M}{1+i}$, is the excess of the value of its financial assets (Treasury debt, D , loans to the private sector, L and foreign exchange reserves, eR^f) over its non-monetary liabilities N and its monetary liabilities $M/(1+i)$.

On the left-hand side of (10) we have (minus) the conventionally measured equity of the central bank. On the right-hand side of (10) we can distinguish two terms. The first is

$$-E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j (C_j^b + T_j^b + Q_j)$$

—the present discounted value of current and future primary (non-interest) surpluses of the central bank. Important for what follows, this contains both the present value of the sequence of current and future transfer payments made by the Treasury to the central bank ($\{-T_j^b; j \geq t\}$ and (with a negative sign) the present value of the sequence of quasi-fiscal subsidies paid by the central bank $\{Q_j; j \geq t\}$.

The second terms is $E_t \sum_{j=t}^{\infty} I_{j,t-1} \left(\frac{i_{j+1}}{1+i_{j+1}} \right) M_j$, one of the measures of central bank “seigniorage”—the present discounted value of the future interest payments saved by the central bank through its ability to

issue non-interest-bearing monetary liabilities. The other conventional measure of seigniorage, motivated by equation (8), is the present discounted value of future base money issuance: $E_t \sum_{j=t}^{\infty} I_{j,t-1} \Delta M_j$.

Even if the conventionally defined net worth or equity of the central bank is negative, that is, if $W_{t-1}^b \triangleq D_{t-1} + L_{t-1} + e_{t-1} R_{t-1}^f - N_{t-1} - \frac{M_{t-1}}{1+i_t} < 0$, the central bank can be solvent provided

$$W_{t-1}^b + E_t \sum_{j=t}^{\infty} I_{j,t-1} \left(\frac{i_{j+1}}{1+i_{j+1}} \right) M_j \geq E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j (C_j^b + T_j^b + Q_j) \quad (14)$$

Conventionally defined financial net worth or equity excludes the present value of anticipated or planned future non-contractual outlays and revenues (the right-hand side of equation 10). It is therefore perfectly possible for the central bank to survive and thrive with negative financial net worth. If there is a seigniorage Laffer curve, however, there always exists a sufficient negative value for central bank conventional net worth, that would require the central bank to raise

so much seigniorage in real terms, $\left\{ \frac{\Delta M_j}{P_j}; j \geq t \right\}$, or $\left\{ \left(\frac{i_{j+1}}{1+i_{j+1}} \right) M_j; j \geq t \right\}$ through current and future nominal base money issuance, that, given the demand function for real base money, unacceptable rates of inflation would result (see Buiter, 2007e, 2008a). While the central bank can never go broke (that is, equation 14 will not be violated) as long as the financial obligations imposed on the central bank are domestic-currency denominated and not index-linked, it could go broke if either foreign currency obligations or index-linked obligations were excessive. I will ignore the possibility of central bank default in what follows, but not the risk of excessive inflation being necessary to secure solvency without recapitalisation by the Treasury, if the central bank's conventional balance sheet were to take a sufficiently large hit.

This situation can arise, for instance, if the central bank is used as a quasi-fiscal agent to such an extent that the present discounted value

of the quasi-fiscal subsidies it provides, $E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j Q_j$, is so large, that its ability to achieve its inflation objectives is impaired. In that case (if we rule out default of the central bank on its own non-monetary obligations, N_{t-1}), the only way to reconcile central bank solvency and the achievement of the inflation objectives would be a recapitalisation of the central bank by the Treasury, that is, a sufficient large increase in $-E_t \sum_{j=t}^{\infty} I_{j,t-1} P_j T_j^b$.¹⁶

There are therefore in my view two reasons why the Fed, or any other central bank, should not act as a quasi-fiscal agent of the government, other than paying to the Treasury in taxes, T^b , the profits it makes in the pursuit of its macroeconomic stability objectives and its *appropriate* financial stability objectives. The appropriate financial stability objectives are those that involve providing liquidity, at a cost covering the central bank's opportunity cost of non-monetary financing, to illiquid but solvent financial institutions.

The two reasons are, first, that acting as a quasi-fiscal agent may impair the central bank's ability to fulfil its macroeconomic stability mandate and, second, that it obscures responsibility and impedes accountability for what are in substance fiscal transfers. If the central bank allows itself to be used as an off-budget and off-balance-sheet special purpose vehicle of the Treasury, to hide contingent commitments and to disguise de facto fiscal subsidies, it undermines its independence and legitimacy and impairs political accountability for the use of public funds—"tax payers' money."

II.6a Some interesting central bank balance sheets

What do the conventional balance sheets look like in the case of the Fed, the BoE and the ECB/Eurosystem?

The data for the Fed are summarised in Table 3, those for the BoE in Table 4, for the ECB in Table 5 and for the Eurosystem in Table 6.

The data for the Fed are updated weekly in the Consolidated Statement of Condition of All Federal Reserve Banks. In Table 3, I have

Table 3
Conventional financial balance sheet
of the Federal Reserve System

March 12, 2008, US\$ billion

Assets	Liabilities
<i>D</i> : 703.4	<i>M</i> : 811.9
<i>L</i> : 182.2	<i>N</i> : 47.4
<i>R</i> : 13.0	
	<i>W</i> : 39.7

Table 4
Conventional balance sheet of the Bank of England (£ billion)

		Jun 1, 2006	Dec 24, 2007	Mar 12, 2008
	Liabilities	82	102	97
<i>M</i> :	Notes in circulation	38	45	41
	Reserves balances	22	26	21
<i>N</i> :	Other	20	30	33
<i>W^b</i> :	Equity	2	2	2
	Assets	82	102	97
<i>D</i> :	Advances to HM Government	13	13	7
<i>L&D</i> :	Securities acquired via market transactions	8	7	9
<i>L</i> :	Short-term market operations & reverse repos with BoE counterparties	12	44	43
	Other assets	33	38	38

Source: *Financial Statistics*

Table 5
Conventional balance sheet of the European Central Bank
(€ billion)

		December 31, 2006	December 31, 2007
	Liabilities	106	126
<i>M:</i>	Notes in circulation	50	54
<i>N:</i>	Other	56	72
<i>W⁶:</i>	Equity	4	4
	Assets	106	126
<i>D:</i>		54	71
<i>L:</i>	Other Assets	10	11
	Claims on euro-area residents in forex	3	4
<i>R:</i>	Gold and forex reserves	40	39

Source: European Central Bank (2008a)

Table 6
Conventional balance sheet of the Eurosystem (€ billion)

		December 22, 2006	February 29, 2008
	Liabilities	1142	1379
<i>M:</i>		805	887
<i>N:</i>	Other	273	421
<i>W⁶:</i>	Equity	64	71
	Assets	1142	1379
<i>D:</i>	Euro-denominated government debt	40	39
<i>L:</i>	Euro-denominated claims on euro-area credit institutions	452	519
	Other Assets	330	480
<i>R:</i>	Gold and forex reserves	321	340

Source: European Central Bank (2008b)

for simplicity lumped \$2.1 billion worth of buildings and \$40 billion worth of other assets together with claims on the private sector, *L*. The Federal Reserve System holds but small amounts of assets in the gold certificate account and SDR account as foreign exchange reserves, *R*. The foreign exchange reserves of the US are on the balance sheet of the Treasury rather than the Fed. As of February 2008, US Official Reserve Assets stood at \$73.5 billion.¹⁷ US gold reserves (8133.8 tonnes) were valued at around \$261.5 billion in March 2008.

Table 3 shows that, as regards the size of its balance sheet, the Fed would be a medium-sized bank in the universe of internationally active US commercial banks, with assets of around \$900 billion and capital (which corresponds roughly to financial net worth or conventional equity) of about \$40 billion. By comparison, at the time of the run on the investment bank Bear Stearns (March 2008), that bank's assets were around \$340 billion. Citigroup's assets as of 31 December 2007 were just under \$2,188 billion (Citigroup is a universal bank, combining commercial banking and investment banking activities). With 2007 US GDP at around \$14 trillion, the assets of the Fed are about 6.4% of annual US GDP.

At the end of January 2008, seasonally adjusted assets of domestically chartered commercial banks in the US stood at \$9.6 trillion (more than ten times the assets of the Fed). Of that total, credit market assets were around \$7.5 trillion. Equity (assets minus all other liabilities) was reported as \$1.1 trillion.¹⁸ Commercial banks exclude investment banks and other non-deposit taking banking institutions. The example of Bear Stearns has demonstrated that all the primary dealers in the US are now considered by the Fed and the Treasury to be too systemically important (that is too big, and/or too interconnected, to fail). The 1998 rescue of LTCM—admittedly without the use of any Fed financial resources or indeed of any public financial resources, but with the active “good offices” of the Fed—suggests that large hedge funds too may fall in the “too big or too interconnected to fail” category. We appear to have arrived at the point where any highly leveraged financial institution above a certain size is a candidate for direct or indirect Fed financial support, should it, for whatever reason, be at risk of failing.¹⁹

Like its private sector fellow-banks, the Fed is quite highly leveraged, with assets just under 22 times capital. The vast majority of its liabilities are currency in circulation (\$781 billion out of a total monetary base of \$812 billion). Currency is not just non-interest-bearing but also *ir-redeemable*: having a \$10 Federal Reserve note gives me a claim on the Fed for \$10 worth of Federal Reserve notes, possibly in different denominations, but nothing else. Leverage is therefore not an issue for this highly unusual inherently liquid domestic-currency borrower, as long as the liabilities are denominated in US dollars and not index-linked.

The BoE, whose balance sheet is shown in Table 4, also has negligible foreign exchange reserves of its own. The bulk of the UK's foreign exchange reserves are owned directly by the Treasury. The shareholders' equity in the BoE is puny, just under £2 billion. The size of its balance sheet grew a lot between early 2007 and March 2008, reflecting the loans made to Northern Rock as part of the government's rescue programme for that bank. The size of the balance sheet is around £100 billion, about 20 percent smaller than Northern Rock at its *acme*. Leverage is just under 50.

The size of the equity and the size of the balance sheet appear small in comparison to the possible exposure of the BoE to credit risk through its LLR and MMLR operations. Its total exposure to Northern Rock was, at its peak, around £25 billion. This exposure was, of course, secured against Northern Rock's prime mortgage assets. More important for the solvency of the BoE than this credit risk mitigation through collateral is the fact that the central bank's monopoly of the issuance of irredeemable, non-interest-bearing legal tender means that leverage is not a constraint on solvency as long as most of the rest of the liabilities on its balance sheet are denominated in sterling and consist of nominal, that is, non-index-linked, securities, as is indeed the case for the BoE.

The balance sheet of the ECB for end-year 2006 and 2007 is given in Table 5, that for the consolidated Eurosystem (the ECB and the 15 national central banks [NCBs] of the Eurosystem) as of 29 February 2008 in Table 6. The consolidated balance sheet of the Eurosystem is about 10 times the size of the balance sheet of the ECB, but the equity of the Eurosystem is about 17 times that of the ECB. Gearing

of the Eurosystem is therefore quite low by central bank standards, with total assets just over 19 times capital.

Between the end of 2006 and end-February 2008, the Eurosystem expanded its balance sheet by €237 billion. On the asset side, most of this increase was accounted for by a €67 billion increase in claims on the euro area banking sector and a €150 billion increase in other assets. Both items no doubt reflect the actions taken by the Eurosystem to relieve financial stress in the interbank markets and elsewhere in the euro area banking sector.

II.6b How will the central banks finance future LLR- and MMLR-related expansions of their portfolios?

Both the Fed and the BoE have tiny balance sheets and minuscule equity or capital relative to the size of the likely financial calls that may be made on these institutions. For instance, the exposure of the Fed to the Delaware SPV used to house \$30 billion (face value) worth of Bear Stearns' most toxic assets is \$29 billion. The Fed's total equity is around \$40 billion. Despite my earlier contention that there is nothing to prevent a central bank from living happily ever after with negative equity, I doubt whether the Fed would want to operate with its financial liabilities larger than its financial assets. It just doesn't look right.

It is clear that the exercise of the LLR and MMLR functions may require a further rapid and large increase in L , central bank holdings of private sector securities. The central bank can always finance this increase in its exposure to the private financial sector by increasing the stock of base money, M (presumably through an increase in bank reserves with the central bank). If the economy is in a liquidity crunch, there is likely to be a large increase in liquidity preference which will cause this increase in reserves with the central bank to be hoarded rather than loaned out and spent. This increase in liquidity will therefore not be inflationary, as long as it is reversed promptly when the liquidity squeeze comes to an end.

Alternatively, the central bank could finance an expansion in its holdings of private securities by reducing its holdings of government securities. Once these get down to zero, the only option left is for the

central bank to increase its non-monetary, interest-bearing liabilities, that is, an issuance of Fed Bills, BoE Bills or ECB Bills (or even Fed Bonds, BoE Bonds or ECB Bonds). As long as the central bank's claims on the private sector earn the central bank an appropriate risk-adjusted rate of return, issuing central bank bills or bonds to finance the acquisition of private securities will not weaken the solvency of the central bank *ex ante*. But if a significant amount of its exposure to the private sector were to default, the central bank would have to be recapitalised by the Treasury or have recourse to monetary financing. In the conventional balance sheet of the central bank, the result of a recapitalisation would be an increase in D , that is, it would look like a Treasury Bill or Treasury Bond "drop" on the central bank. It may well come to that in the US and the UK.

III. How did the three central banks perform since August 2007?

III.1 Macroeconomic stability

At the time the financial crisis erupted, in August 2007, all three central banks faced rising inflationary pressures and at least the prospect of weakening domestic activity. The evidence for weakening activity was clearest in the US. In the UK, real GDP growth in the third quarter of 2007 was still robust, although some of the survey data had begun to indicate future weakness. In the euro area also, GDP growth was healthy. As late as August, the ECB was verbally signalling an increase in the policy rate for September or soon after.

Since then, inflationary pressures have risen in all three currency areas, and so have inflationary expectations. There has been a marked slowdown in GDP growth, first in the US, then in UK and most recently in the euro area. While it is not clear yet whether any of the three economies are in technical recession (using the arbitrary definition of two consecutive quarters of negative real GDP growth), there can be little doubt that all three are growing below capacity, with unemployment rising in the US and in the UK and, one expects, soon also in the euro area.

Table 7
Monetary policy actions since August 2007 by the Fed,
ECB and BoE

- Official policy rate
 - Fed: -325 bps (current level: 2.00%)
 - ECB: +25 bps (current level: 4.25%)
 - BoE: -75 bps (current level: 5.00%)
- Unscheduled meetings, out-of-hours announcements
 - Fed: one for OPR (21/22 Jan.)
 - ECB: none
 - BoE: none
- Discount rate penalty
 - Fed: -75 bps (current level: 25 bps)
 - ECB: ± 0 bps (current level: 100 bps)
 - BoE: ± 0 bps (current level: 100 bps)
- Open mouth operations
 - ECB: repeated hints at/threats of OPR increases that did not materialise until July 2008 (“talk loudly & carry a little stick”)

The monetary response to rather similar circumstances has, however, been very different in the three economies, as is clear from the summary in Table 7.

The Fed cut its official policy rate aggressively—by 325 basis points cumulatively so far. On September 18, 2007, the Fed cut the federal funds target by 50 basis points to 4.75 percent, with a further reduction of 25 basis points following on October 31. On December 11 there was a further 25 basis points cut, on January 21, 2008 a 75 basis points cut, on January 30 a 50 basis points cut, on March 18 a 75 basis points cut and on April 30 another 25 basis points cut. This brought the federal funds target to 2.00 percent, where it remains at the time of writing (August 10, 2008). The Fed also reduced the “discount window penalty,” that is, the excess of the rate charged on overnight borrowing at the primary discount window over the federal funds target rate, from 100 bps to 50 bps on August 17, 2007 and to 25 bps on March 18, 2008. This cut in the discount rate penalty can be viewed as a liquidity management measure as well as a (second-order) macroeconomic policy measure. Finally, one of the Fed’s rate cuts (the 75 basis points reduction on January 21, 2008), was at an “unscheduled” meeting and was announced out of normal

working hours, thus signalling a sense of urgency in one interpretation, a sense of panic in another.

The BoE kept its official policy rate at 5.75 percent until December 6, 2007 when it made a 25 basis points cut. Further 25 bps cuts followed on February 7, 2008 and April 10, 2008, so Bank Rate now stands at 5.00 percent. The discount rate (standing lending facility) penalty over Bank Rate remained constant at 100 bps. There were no meetings or policy announcements on unscheduled dates or at unusual times.

The ECB kept its official policy rate unchanged at 4.00 percent until July 3, 2008 when it was raised to 4.25 percent, where it still stands. There has also been no change in the discount rate penalty: The marginal lending facility continues to stand at 100 basis points above the official policy rate. There were no meetings on unscheduled dates or announcements at non-standard hours. Unlike the other two central banks, the ECB repeatedly, between June 2007 and July 2008, talked tough about inflation and hinted at possible rate increases. This talk was matched by official policy rate action only on July 3, 2008.

The markedly different monetary policy actions of the Fed compared to the other two central banks can, in my view, not be explained satisfactorily with differences in objective functions (the Fed's dual mandate versus the ECB's and the BoE's lexicographic price stability mandate) or in economic circumstances. The slowdown in the US did come earlier than in the UK and in the euro area, but the inflationary pressures in the US were, if anything, stronger than in the UK and the euro area.

I conclude that the Fed overreacted to the slowdown in economic activity. It cut the official policy rate too fast and too far and risked its reputation for being serious about inflation. I believe that part of the reason for these policy errors is a remarkable collection of analytical flaws that have become embedded in the Fed's view of the transmission mechanism. These errors are shared by many FOMC members and by senior staff. They are worth outlining here, because they serve as a warning as to what can happen when the research and

economic analysis underlying monetary policy making become too insular and inward-looking, and is motivated more by the excessively self-referential internal dynamics of academic research programmes than by the problems and challenges likely to face the policy-making institution in the real world.

III.1a The macroeconomic foibles of the Fed

There are some key flaws in the model of the transmission mechanism of monetary policy that shapes the thinking of a number of influential members of the FOMC. These relate to the application of the Precautionary Principle to monetary policy making, the wealth effect of a change in the price of housing, the role of core inflation as a guide to future underlying inflation, the possibility of achieving a sustainable external balance for the US economy without going through a deep and/or prolonged recession, the effect of financial sector deleveraging on aggregate demand, and the usefulness of the monetary aggregates as a source of information about macroeconomic and financial stability.

III.1a(i) Risk management and the “Precautionary Principle”

Consider the following example of optimal decision making under uncertainty. I stand before an 11-foot-wide ravine that is 2,000 feet deep. I have to jump across. A safe jump is one foot longer than the width of the ravine. I can jump any distance, but a longer jump requires more effort, something I dislike moderately. I also am strongly averse to falling to my death. Without uncertainty, I make the shortest leap that will get me safely over the precipice—12 feet. Now assume that I cannot see how wide the ravine is. All I know is that its width is equally likely to be anywhere on the interval 1 foot to 21 feet. So the expected width of the ravine is 11 feet. There continues to be certainty about the depth of the ravine—2,000 feet, that is, certain death if I were to fall in. It clearly would not be rational for me to adopt the certainty-equivalent strategy and make a 12-foot jump. I would be cautious and make a much larger jump, of 23 feet. Caution and prudence here dictate more radical action—a longer jump. A dramatic departure from symmetry in the payoff function

accounts for the difference between rational behaviour and certainty-equivalent behaviour. The Fed justifies its radical interest cuts in part by asserting that these large cuts minimize the risk of a truly catastrophic outcome. I want to question whether the Fed's official policy rate actions can indeed be justified on the grounds that the US economy was tottering at the edge of a precipice, and that aggressive rate cuts were necessary to stop it from tumbling in.

Under Chairman Greenspan, so-called risk-based "decision theory" approaches became part of the common mindset of the FOMC (see Greenspan 2005). They continue to be influential in the Bernanke Fed. A clear articulation can be found in Mishkin (2008b). At last year's Jackson Hole Symposium, Martin Feldstein (2008) also made an appeal to a risk-based decision theory approach to justify looking after the real economy first, through aggressive interest rate cuts, despite the obvious risk this posed to inflation and moral hazard.

Mishkin (2008b) argued that the combination of non-linearities in the economy with both a higher degree of uncertainty and a high probability of extreme (including extremely bad) outcomes (so-called "fat tails") justified the Fed's focus on extreme risks. In addition, he asserts that the extreme risk faced by the US economy is a financial instability/collapse-led sharp contraction in economic activity. This is the "Precautionary Principle" (PP) applied to monetary policy. At times of high uncertainty, policy should be timely, decisive, and flexible and focused on the main risk.

Even where it is applied correctly, I don't think much of the PP. Except under very restrictive conditions, unlikely to be satisfied ever in the realm of economic policy making, I consider the behaviour it prescribes to be pathologically risk-averse. In its purest incarnation—under complete Knightian uncertainty—it amounts to a minimax strategy: You focus all your policy instruments on doing as well as you can in the worst possible outcome. Despite its axiomatic foundations, the minimax principle has never appealed to me either as a normative or a positive theory of decision under uncertainty.

But I don't have to fight the PP, or minimax, here. The application of the PP to the monetary policy choices made by the Fed in 2007

and 2008 is bogus. The PP came to the social sciences from the application of decision theory to regulatory decisions involving environmental risk (global warming, species extinction) or technological risk (genetically modified crops, nanotechnology). Its basic premise in these areas is “... *that one should not wait for conclusive evidence of a risk before putting control measures in place designed to protect the environment or consumers.*” (Gollier and Treich, 2003). For instance, Principle 15 of the 1992 Rio Declaration states, “*Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*”

Attempts to make sense of the PP in a setting of sequential decision making under uncertainty lead to the conclusion that, for something like the Rio Declaration version of the PP to emerge as a normative guide to behaviour, all of the following must be present (see Collier and Treich, 2003, from which the following sentence is paraphrased): a long time horizon, stock externalities, irreversibilities (physical and socio-economic), large uncertainties and the possibility of future scientific progress (learning). Short-term policy should keep the option value of future learning alive. When the long-term effects of certain contingencies are unknown (but may be uncovered later on), it may be optimal to be more cautious in the early stages of the sequential management of risk.

I believe the analysis of Collier and Treich to be essentially correct. The question then becomes: What does this imply for whether the Fed, in the circumstances of the second half of 2007 and the first half of 2008, did the right thing when it cut the official policy rate from 5.25 percent to 2.00 percent rather than cutting it by less, keeping it constant or raising it? The Fed decided to give priority to minimising the risk of a sharp contraction in real economic activity. It accepted the risk of higher inflation. How does this square with the PP?

The answer is: Not very well at all. The extreme risk faced by the US economy during the past year has not been a sharp contraction in real economic activity caused by a financial collapse. There is no irreversibility involved in a sharp contraction in economic activity. Mishkin's rather vague “non-linearities” are no substitute for the irreversibility

required for the PP to apply. This is *not* like a catastrophic species extinction or a sudden melting of the polar ice caps. The crash of 1929 became the Great Depression of the 1930s because the authorities permitted the banking system to collapse and did not engage in sustained aggressive expansionary fiscal and monetary policy even when the unemployment rate reached almost 25 percent in 1933. In addition, the international trading system collapsed.

The Fed as LLR and MMLR has effectively underwritten the balance sheet of all systemically important US banks (investment banks as well as commercial banks) with the rescue of Bear Stearns in March 2008. Current worries about the international trading system concern the absence of progress rather than the risk of a major outbreak of protectionism.

Most of all, should economic activity fall sharply and remain depressed for longer than is necessary to correct the fundamental imbalances in the US economy (the external trade deficit, excessive household indebtedness and the low national saving rate), monetary and fiscal policy can be used aggressively *at that point in time* to remedy the problem. There is no need to act now to prevent some irreversible or even just costly-to-reverse catastrophe from occurring. Boosting demand through expansionary monetary and fiscal policy is not hard. It is indeed far too easy. We are also not buying time to uncover some new scientific fact that will allow us to improve the short-run inflation-unemployment trade-off or to boost the resilience of the economy to future disinflationary policies. Cutting rates to support demand does not create or preserve option value. Even when there is a zero lower bound constraint on the short nominal interest rate and even if there is a non-negligible probability that this constraint will become binding, aggregate demand management continues to be effective. Indeed, it is precisely when the zero lower bound constraint on the nominal interest is binding that fiscal policy is at its most effective.

If anything, the (weak) logic of the PP points to giving priority to fighting inflation rather than to preventing a sharp contraction of demand and output. Output contractions can be reversed easily through expansionary monetary and fiscal policies. High inflation, once it becomes embedded in inflationary expectations, may take

a long time to squeeze out of the system again. If the sacrifice ratio is at all unfriendly, the cumulative unemployment or output cost of achieving a sustained reduction in inflation could be large. The irreversibility argument (strictly, the costly reversal argument) supports erring on the side of caution by not letting inflation and inflationary expectations rise.²⁰

“Fat tails”, the Precautionary Principle and other decision theory jargon should only be arbitrated into the area of monetary policy if the substantive conditions are satisfied. Today, in the US, they are not.²¹ With existing policy tools, we can address a disastrous collapse in activity if, as and when it occurs. There is no need for preventive or precautionary drastic action.

I agree that dynamic stochastic optimisation based on the LQG (linear-quadratic-Gaussian) assumptions, and the certainty-equivalent decision rules they imply are inappropriate for monetary policy design. This is because (1) the objectives of most central banks cannot be approximated well with a quadratic functional form (especially in the case of the BoE and the ECB with their lexicographic preferences), (2) no relevant economic model is linear and (3) the random shocks perturbing the economic system are not Gaussian.²² I was fortunate in having Gregory Chow as a colleague during my first academic job (at Princeton University). The periodic rediscoveries, in the discussion of macroeconomic policy design, of aspects of his work (Chow, 1975, 1981, 1997) are encouraging, but they also demonstrate that progress in economic science is not monotonic.

Mishkin (2008b) admits that “*Formal models of how monetary policy should respond to financial disruptions are unfortunately not yet available....*” This, however, does not stop him from giving, in that same speech, confident and quite detailed prescriptions for the response of monetary policy to financial disruptions. “*Monetary policy cannot—and should not—aim at minimizing valuation risk, but policy should aim at reducing macroeconomic risk.... Monetary policy needs to be timely, decisive, and flexible.... Monetary policy must be at least as preemptive in responding to financial shocks as in responding to other types of disturbances to the economy.*” Possibly, but not based on any rigorous analysis of a coherent, quantitative model of the US economy or any

other economy. Emphatic statements do not amount to a new science of monetary policy. Repeated assertion is not a third mode of scientific reasoning, on a par with induction and deduction.

III.1a(ii) **Housing wealth isn't wealth**

This bold statement was put to me about ten years ago by Mervyn King, now Governor of the BoE, then Chief Economist of the BoE, shortly after I joined the Monetary Policy Committee of the BoE as an External Member in June 1997. Like most bold statements, the assertion is not quite correct; the correct statement is that a decline in house prices does not make you worse off, that is, it does not create a pure wealth effect on consumer demand.

The argument is elementary and applies to coconuts as well as to houses. When does a fall in the price of coconuts make you worse off? Answer: when you are a net exporter of coconuts, that is, when your endowment of coconuts exceeds your consumption of coconuts. A net importer of coconuts is better off when the price of coconuts falls. Someone who is just self-sufficient in coconuts is neither worse off nor better off.

Houses are no different from durable coconuts in this regard. The fundamental value of a house is the present discounted value of its current and future rentals, actual or imputed. Anyone who is “long” housing, that is, anyone for whom the value of his home exceeds the present discounted value of the housing services he plans to consume over his remaining lifetime will be made worse off by a decline in house prices. Anyone “short” housing will be better off. So the young and all those planning to trade up in the housing market are made better off by a decline in house prices. The old and all those planning to trade down in the housing market will be worse off.

Another way to put this is that landlords are worse off as a result of a decline in house prices, while current and future tenants are better off. On average, the inhabitants of a country own the houses they live in; on average, every tenant is his own landlord and vice versa. So there is no net housing wealth effect. You have to make a distributional argument to get an aggregate pure net wealth effect from a change

in house prices. A formal statement of the proposition that a change in house prices has no wealth effect on private consumption demand can be found in Buiter (2008b,c). Informal statements abound (see e.g. Buchanan and Fiotakis, 2004, or Muellbauer, 2008).

Most econometric or calibrated numerical models I am familiar with treat housing wealth like the value of stocks and shares as a determinant of household consumption. They forget that households consume housing services (for which they pay or impute rent) but not stock services. An example is the FRB/US model. It is used frequently by participants in the debate on the implication of developments in the US housing market for US consumer demand. A recent example is Frederic S. Mishkin's (2008a) paper "Housing and the Monetary Transmission Mechanism." The version of the FRB/US model Mishkin uses *a priori* constrains the wealth effects of housing wealth and other financial wealth to be the same. The long-run marginal propensity to consume out of non-human wealth (including housing wealth) is 0.038, that is, 3.8 percent. In several simulations, Mishkin increases the value of the long-run marginal propensity to consume out of housing wealth to 0.076, that is, 7.6 percent, while keeping the long-run marginal propensity to consume out of non-housing financial wealth at 0.038.

The argument for an effect of housing wealth on consumption other than the pure wealth effect is that housing wealth is collateralisable. Households-consumers can borrow against the equity in their homes and use this to finance consumption. It is much more costly and indeed often impossible, to borrow against your expected future labour income. If households are credit-constrained, a boost to housing wealth would relax the credit constraint and temporarily boost consumption spending. The argument makes sense and is empirically supported (see e.g. Edelstein and Lum, 2004, or Muellbauer, 2008). Of course, the increased debt will have to be serviced, and eventually consumption will have to be brought down below the level it would have been at in the absence of the mortgage equity withdrawal. At market interest rates, the present value of current and future consumption will not be affected by the MEW channel.²³

Ben Bernanke (2008a), Don Kohn (2006), Fredric Mishkin (2008a), Randall Kroszner (2007) and Charles Plosser (2007) all have made statements to the effect that there is a pure wealth effect through which changes in house prices affect consumer demand, separate from the credit, MEW or collateral channel.²⁴ The total effect of a change in house prices on consumer demand adds the credit or collateral effect to the standard (pure) wealth effect. This is incorrect. The benchmark should be that the credit, MEW or collateral effect is *instead of* the normal (pure) wealth effect. By overestimating the contractionary effect on consumer demand of the decline in house prices, the Fed may have been induced to cut rates too fast and too far.

There are channels other than private consumption through which a change in house prices affects aggregate demand. One obvious and empirically important one is household investment, including residential construction. A reduction in house prices that reflects the bursting of a bubble rather than a lower fundamental value of the property also produces a pure wealth effect (Buiter, 2008b,c). My criticism of the Fed's overestimation of the effect of house price changes on aggregate demand relates only to the pure wealth effect on consumption demand, not to the "Tobin's q " effect of house prices on residential construction.

III.1a(iii) **The will-o'-the-wisp of "core" inflation**

The only measure of core inflation I shall discuss is the one used by the Fed, that is, the inflation rate of the standard headline CPI or PCE deflator excluding food and energy prices. Other approaches to measuring core inflation, including the vast literature that attempts to extract trend inflation or some other measure of "underlying" inflation using statistical methods in the time or frequency domains, including "trimmed mean" measures and "approximate band pass filters" will not be considered (see e.g. Bryan and Cecchetti 1994; Quah and Vahey, 1995; Baxter and King 1999; Cogley 2002; Cogley and Sargent, 2001, 2005; Dolmas, 2005; Rich and Steindel, 2007; Kiley, 2008).

I assume that the price stability leg of the Fed's mandate refers to price stability, now and in the future, defined in terms of a representative

basket of consumer goods and services that tries to approximate the cost of living of some mythical representative American. It is well-known that price stability, even in terms of an ideal cost of living index, cannot be derived as an implication of standard microeconomic efficiency arguments. The Friedman rule gives you a zero pecuniary opportunity cost of holding cash balances as (one of) the optimality criteria, that is, $i=i^M$. When cash bears a zero rate of interest, this gives us a zero risk-free nominal interest rate as (part of) the optimal monetary rule. With a positive real interest rate, this gives us a negative optimal rate of inflation for consumer prices, something even the ECB is not contemplating.

Menu costs imply the desirability of minimising price changes for those goods and services for which menu costs are highest. Presumably this would call for stabilisation of money wages, since the cost of wage negotiations is likely to exceed that of most other forms of price setting. With positive labour productivity growth, a zero money wage inflation target would give us a negative optimal rate of producer price inflation.

New-Keynesian sticky-price models of the Calvo-Woodford variety yield (in their simplest form) two distinct optimal inflation criteria, one for consumer prices and one for producer prices. Neither implies that stability of the sticky-price sub-index is optimal.

Equations (15) and (16) below show the log-linear approximation at the deterministic steady state of the (negative of the) social welfare function (which equals the utility function of the representative household) and of the New-Keynesian Phillips curve in the simple sticky-price Woodford-Calvo model, when the potential level of output (minus the natural rate of unemployment), \hat{y} , is efficient (see Calvo, 1983 Woodford, 2003; and Buiter, 2004).

$$\Lambda_t = E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+\delta} \right)^i \left((\pi_{t+i} - \tilde{\pi}_{t+i})^2 + \omega (y_{t+i} - \hat{y}_{t+i})^2 + \phi (i_{t+j} - i_{t+j}^M)^2 \right) \quad (15)$$

$$\delta > 0, \omega > 0, \phi \geq 0$$

$$\pi_t - \tilde{\pi}_t = \beta E_t (\pi_{t+1} - \tilde{\pi}_{t+1}) + \gamma (y_t - \hat{y}_t) + \varphi (i_t - i_t^M) \quad (16)$$

$$0 < \beta < 1; \gamma > 0$$

In the Calvo model of staggered overlapping price setting, in each period, a randomly selected constant fraction of the population of monopolistically competitive firms sets prices optimally. The remainder follows a simple rule of thumb or heuristic for its price. The inflation rate chosen by the constrained price setters in period t is $\tilde{\pi}_t$. Optimality in this model requires

$$i_t = i_t^M \quad (17)$$

$$\pi_t = \tilde{\pi}_t \quad (18)$$

Equations (17) and (18) then imply that $y_t = \hat{y}_t$.

The requirement in (17) that the pecuniary opportunity cost of holding cash be zero is Friedman's misnamed Optimal Quantity of Money rule. The second optimality condition, given in (18), requires that the headline producer price inflation rate, π , be the same as the inflation rate of the constrained price setters, $\tilde{\pi}$. If in any given period the inflation rate of the constrained price setters is predetermined, then the second optimality requirement becomes the requirement that overall producer price inflation accommodates the inflation rate set by the constrained price setters, whatever this happens to be. Even if one identifies the inflation rate set by the constrained price setters with "core" inflation (which would be a stretch), this New-Keynesian framework does not generate an optimal rate of inflation either for core inflation or for headline inflation. All it prescribes is a constant relative price of core to non-core goods and services.

Without luck or additional instruments (such as indirect taxes and subsidies driving a wedge between consumer and producer prices) it will not in general be possible to satisfy both the Friedman rule and the constant relative price rule (of free and constrained price setters). How then can this framework be used to rationalise (a) targeting Woodford-Calvo "core" inflation and (b) aiming for stability of the Woodford-Calvo "core" producer price level? Two steps are required. First, the Friedman rule is finessed or ignored. This requires either the counterfactual assumption that the interest rate on cash is not constrained to equal zero but can instead be set equal at all times to the interest rate on non-cash financial instruments (that is, equation 17

always holds, but i remains free), or the assumption that the technology and preferences in this economy take the rarefied form required to make the demand for cash independent of its opportunity cost, in which case $\phi = \varphi = 0$. Second, the Woodford-Calvo “core” inflation rate, which plays the role of the target inflation rate in the social welfare function (15) is zero: $\tilde{\pi} = 0$. This is the assumption Calvo made in his original paper (Calvo, 1983).

Clearly, the assumption that the constrained price setters will always keep their prices constant, regardless of the behaviour of prices and inflation in the rest of the economy is unreasonable. It assumes the absence of any kind of learning, no matter how partial and unsophisticated. It has strange implications, including the existence of a stable, exploitable inflation-unemployment trade-off or inflation-output gap trade-off across deterministic steady states. Calvo recognised the unpalatable properties of his unreasonable original price setting function in Calvo, Celasun and Kumhof (2007). An attractive alternative, in the spirit of John Flemming’s (1976) theory of the “gearing” of inflation expectations, would be to impose as a minimal rationality requirement the assumption that the inflation rate set by the constrained price setters is cointegrated with that of the unconstrained price setters or the headline inflation rate.

Because price stability cannot be rationalised as an objective of monetary policy using standard microeconomic efficiency arguments, I fall back on legal mandate/popular consensus justifications for price stability as an objective of monetary policy. In the US, the euro area and UK, stable prices or price stability is a legally mandated objective of monetary policy. In the UK, the Chancellor defines the price index. It is the CPI (the harmonised version). In the euro area the ECB’s Governing Council itself chooses the index used to measure price stability. Again, it is the CPI. In the US there is no such verifiable source of legitimacy for a particular index. I therefore appeal to what I believe the public at large understands by price stability, which is a constant cost of living.

I take it as given that the Fed’s definition of price stability is to be operationalized through a representative cost of living index. This means that the Fed does not care intrinsically about core inflation (in the

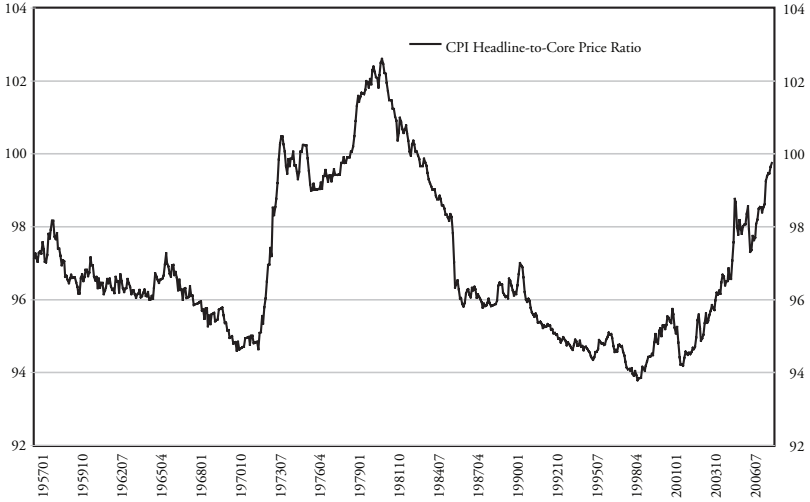
sense of the rate of inflation of a price index that excludes food and energy). Americans do eat, drink, drive cars, heat their homes and use air conditioning. The proper operational target implied by the price stability leg of the Fed's dual mandate is therefore headline inflation.

Core inflation is relevant to the price stability leg of the Fed's mandate to the extent that it is a superior predictor of future headline inflation, over the horizon that the Fed can influence headline inflation—a better predictor not only than headline inflation itself, but than any readily available set of predictors. After all, the monetary authority should not restrict itself to univariate or bivariate predictor sets, let alone univariate or bivariate predictor sets consisting of the price series itself and its components.²⁵

Non-core prices tend to be set in auction-type markets for commodities. They are flexible. Core goods and services tend to have prices that are subject to short-run Keynesian nominal rigidities. They are sticky. The core price index and its rate of inflation tend to be both less volatile and more persistent than the index of non-core prices and its rate of inflation, and also than the headline price index and its rate of inflation. However, the ratio of core to non-core prices and of the core price index to the headline price index is predictable, and so are the relative rates of inflation of the core and headline inflation indices. This is clear from Charts 6a and 6b. The phenomenon driving the increase in the ratio of headline to core prices in recent years is well-understood. Newly emerging market economies like China, India and Vietnam have entered the global economy as demanders of non-core commodities and as suppliers of core goods and services. This phenomenon is systematic, persistent and ongoing.

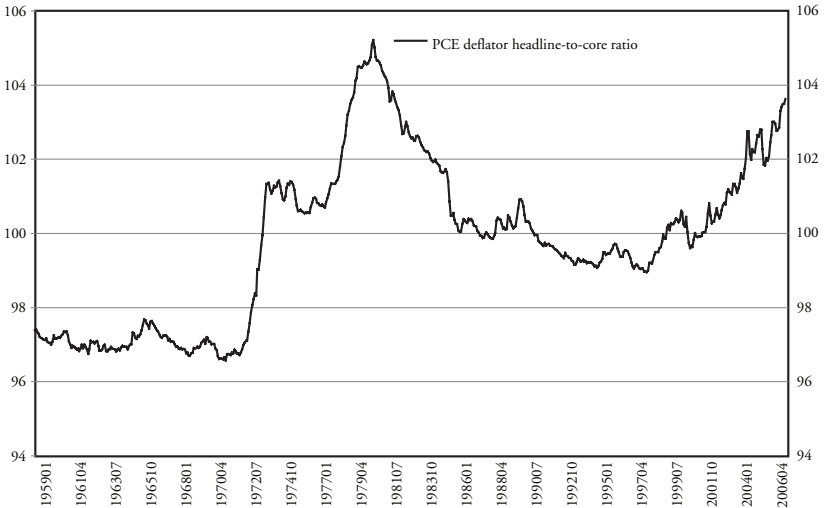
When core goods and services are subject to nominal price rigidities but non-core goods prices are flexible, a relative demand or supply shock that causes a permanent increase (decrease) in the relative price of non-core to core goods will, for a given path of nominal official policy rates, cause a temporary increase in the rate of headline inflation, and possibly a temporary reduction in the rate of core inflation as well.

Chart 6a
US CPI headline-to-core ratio
01/1957 - 04/2008; SA, 1982-84=100



Source: Bureau of Labor Statistics

Chart 6b
US PCE deflator headline-to-core ratio
01/1959 - 03/2008; SA, 2000=100



Source: Bureau of Economic Analysis

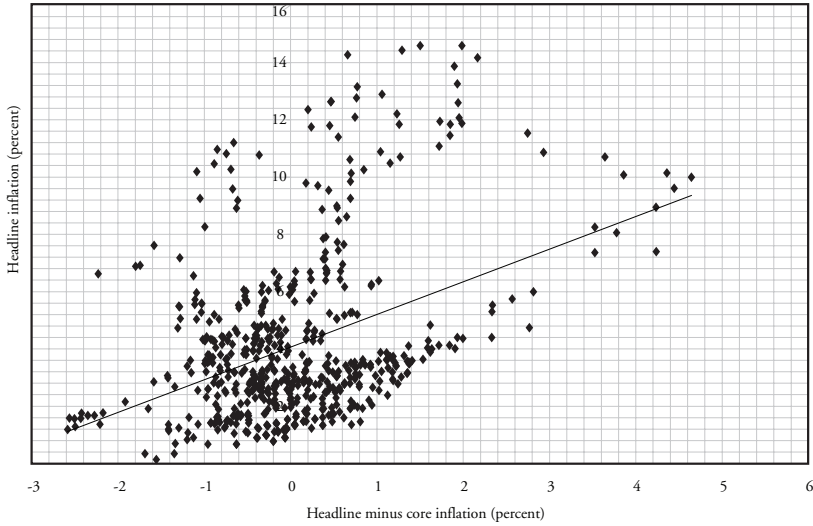
This pattern is clear from Charts 7a, b, c and d, which plot the difference between the headline inflation rate and the core inflation rate on the horizontal axis against the rate of headline inflation on the vertical axis. This is done, in Charts 7a and 7b, for the CPI over, respectively, the 1958-2008 period and the 1987-2008 period. It is repeated in Charts 7c and 7d for the PCE deflator over, respectively, the 1960-2008 and the 1987-2008 periods.

Therefore, when there is a continuing upward movement in the relative price of non-core goods to core goods, core inflation will be a poor predictor of future headline inflation for two reasons. First, even if headline inflation were unchanged and independent of the factors that drive the change in relative prices, core inflation would, for as long as the upward movement in the relative price of non-core goods continued, be systematically below both non-core inflation and headline inflation. Second, for a given path of nominal interest rates, the increase in the relative price of non-core goods will temporarily raise headline inflation above the level it would have been if there had been no increase in the relative price of non-core goods to core goods and services. The implication is that for many years now (starting around the turn of the century), the Fed has missed the boat on the implications of the global increase in the relative price of non-core goods for the usefulness of core inflation as a predictor of future headline inflation. Medium-term inflationary pressures have been systematically higher than the Fed thought they were.

I am not arguing that the Fed has focused on core rather than on headline inflation *because* this permits it to take a more relaxed view of inflationary pressures. My argument is that because the Fed, for whatever reason(s), decided to focus on core rather than on headline inflation, and because for most of this decade there has been a persistent increase in the relative price of non-core goods to core goods and services, the Fed has, for most of this decade, underestimated the underlying inflationary pressures in the US.

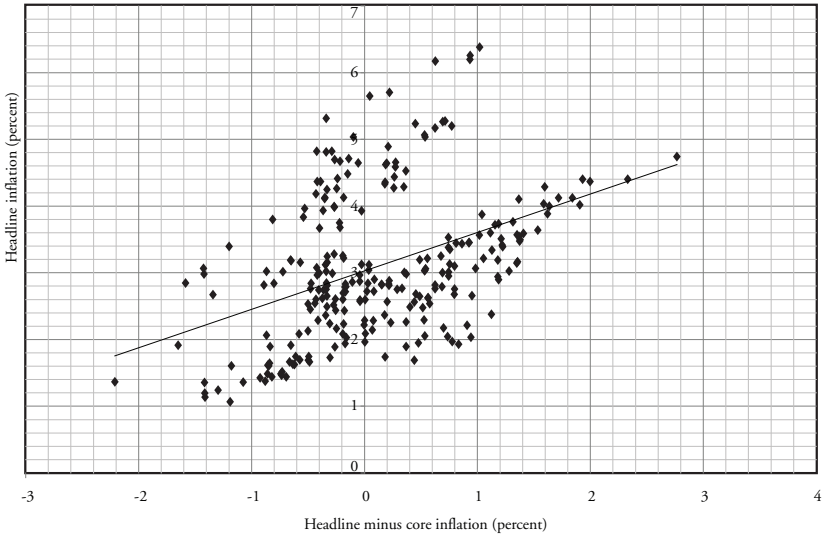
Should the recent upward trend in non-core to core prices go into reverse, the opposite bias would result. With a global economic slowdown in the works, a cyclical decline in real commodity prices is quite likely for the next couple of years or so. Following the end

Chart 7a
US CPI headline inflation vs. headline minus core inflation
1958/01 - 2008/04



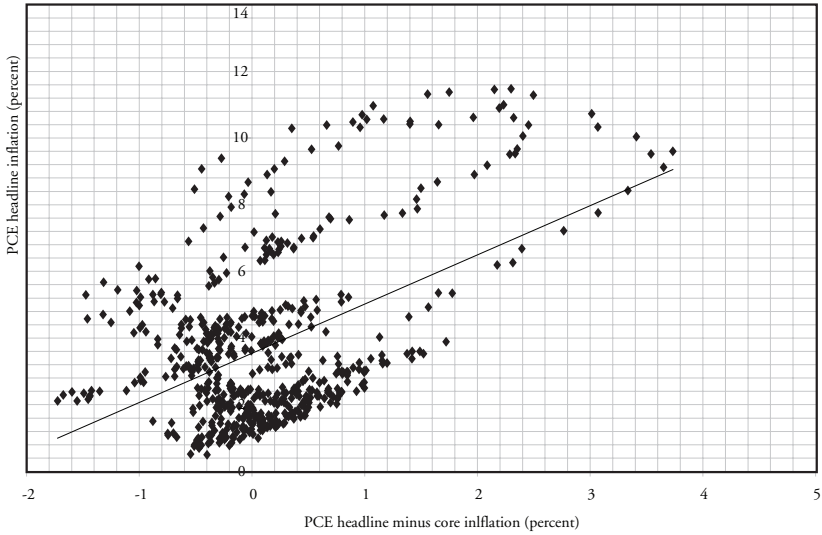
Source: Bureau of Labor Statistics

Chart 7b
US CPI headline inflation vs. headline minus core inflation
1987/01-2008/04



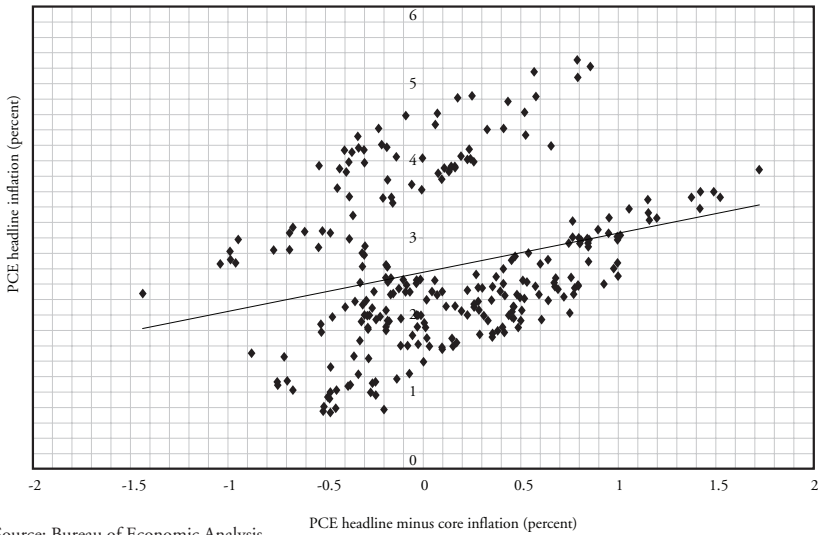
Source: Bureau of Labor Statistics

Chart 7c
US PCE headline inflation vs. headline minus core inflation
1960/01-2008/03



Source: Bureau of Economic Analysis

Chart 7d
US PCE headline inflation vs. headline minus core inflation
1987/01-2008/03



Source: Bureau of Economic Analysis

of this global cyclical correction, however, I expect that a full-speed resumption of commodity-biased demand growth and of core goods and services-biased supply growth in key emerging markets will in all likelihood lead to a further trend increase in the relative price of non-core goods to core goods and services.

The other main lesson from the core inflation debacle is that those engaged in applied statistics should not leave their ears and eyes at home. Specifically, it pays to get up from the keyboard and monitor occasionally to open the window and look out to see whether a structural break might be in the works that is not foreshadowed in any of the sample data at the statistician's disposal. Two-and-a-half billion Chinese and Indian consumers and producers entering the global economy might qualify as an epochal event capable of upsetting established historical statistical regularities.

Finally, a brief remark on the Fed's fondness for the PCE deflator. Communication with the wider public (all those not studying index numbers for a living) is made more complicated when the index in terms of which inflation and price stability are measured bears no obvious relationship to a reasonably intuitive concept like the cost of living. I believe the PCE deflator falls into this obscure category. Furthermore, being a price deflator (current-weighted), the PCE deflator (headline or core) will tend to produce inflation rates lower than the corresponding CPI index (which is base-weighted). Since 01/1987, the difference between the headline CPI and PCE deflator inflation rates has been 0.44 percent at an annual rate. The difference between the core CPI and PCE deflator inflation rates has been 0.45 percent. Over the longer period 01/1960-03/2008 the difference between the headline CPI and PCE inflation rates has been 0.47 percent, that between core CPI and PCE inflation rates 0.55 percent. This further reinforces the inflationary bias of the Fed's procedures.

III.1a(iv) Is the external position of the US sustainable? If not, can it be corrected without a recession?

The argument of this subsection is in two parts. First, the external positions of the US and the UK are unsustainable. Second, it is all but unavoidable that the US and the UK will have to go through prolonged

and/or deep slowdowns in economic activity to achieve sustainable external balances and desirable national saving rates. Attempts to stimulate demand, whether through interest rate cuts or through tax stimuli like the £100 billion fiscal package implemented in the US during the second quarter of 2008, are therefore counterproductive, as they delay a necessary adjustment. The additional employment and growth achieved through such monetary and fiscal stimuli are unsustainable because they make an already unsustainable imbalance worse. If the Fed's real economic activity leg of its dual mandate refers to *sustainable* growth and sustainable employment, the interest rate cut stimuli provided since August 2007 are therefore in conflict with that mandate.

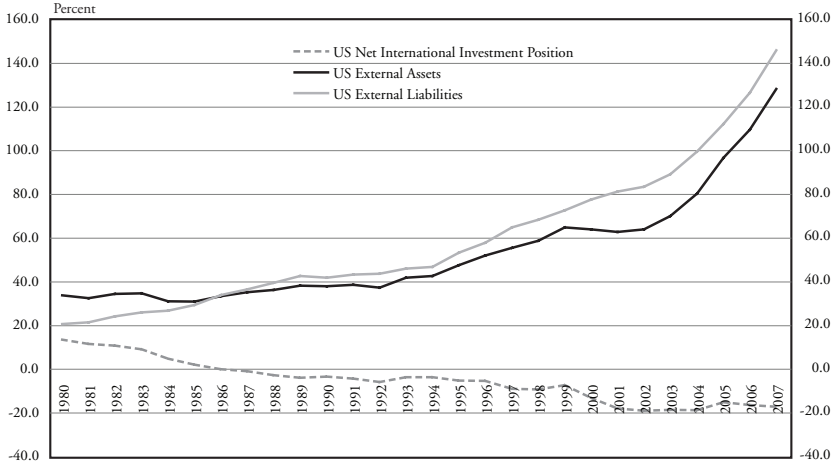
Almost the same conclusion is reached even if one is either not convinced or not bothered by the argument that the external position of the US economy is unsustainable. It is possible to reach pretty much the same conclusion as long as one subscribes to the argument that the US national saving rate is dangerously low for purely domestic reasons (providing for the comfortable retirement of an ageing population), and needs to be raised materially. Policies or shocks that raise the US national saving rate are highly unlikely to produce a matching increase in the US domestic investment rate, given the growing array of more profitable investment opportunities abroad, especially in emerging markets.

The unsustainability of the US and UK external balances

Around the middle of 2007, when the financial crisis started, the US had an external primary deficit of about six percent of GDP (see Chart 8b).²⁶ The US is also a net external debtor (see Chart 8a). Its net international investment position is not easily or accurately marked to market, but something close to a negative 20 percent of GDP is probably a reasonable estimate.

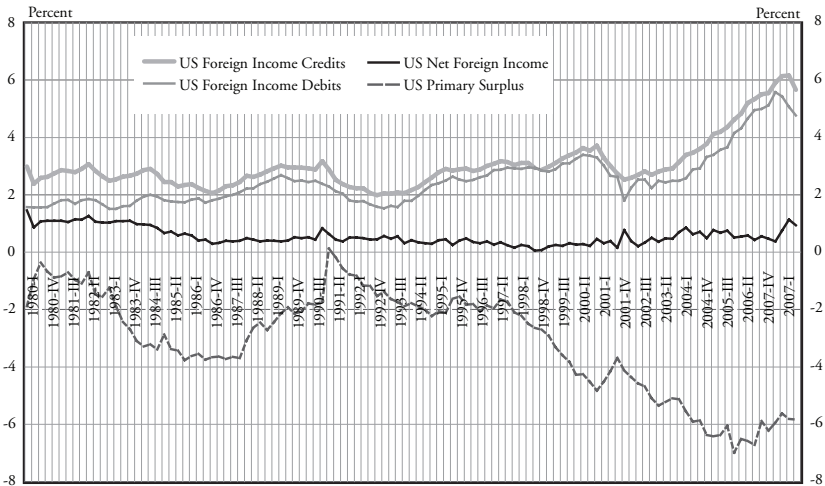
Let f_t be the ratio of end-of-period t net external liabilities as a share of period t GDP, r_t the real rate of return paid during period t on the beginning-of-period net foreign investment position, g_t the growth rate of real GDP between periods $t-1$ and t and x_t the external primary balance as a share of GDP. It follows that:

Chart 8a
US external assets and liabilities, 1980-2007
(percent of GDP)



Source: Bureau of Economic Analysis

Chart 8b
US investment income and primary surplus 1980Q1–2007Q1
(percent of GDP)



Source: Bureau of Economic Analysis

$$f_t \equiv \left(\frac{1+r_t}{1+g_t} \right) f_{t-1} - x_t \quad (19)$$

The primary surplus that keeps constant net foreign liabilities as a share of GDP, \bar{x}_t , is given by:

$$\bar{x}_t = \left(\frac{r_t - g_t}{1 + g_t} \right) f_{t-1}.$$

I assume that the long-run growth rate of the net external liabilities is less than the long-run rate of return on the net external liabilities or, equivalently, that the present discounted value of the net external liabilities is non-positive in the long run (the usual national solvency constraint). The nation's intertemporal budget constraint then becomes the requirement that the existing net external liabilities should not exceed the present discounted value of current and future primary external surpluses. This can be written more compactly as follows:

$$\bar{x}_t^p \geq \left(\frac{r_t^p - g_t^p}{1 + g_t^p} \right) f_{t-1} \quad (20)$$

Here \bar{x}_t^p is the *permanent* primary surplus as a share of GDP and r_t^p and g_t^p are the permanent real rate of return paid on the net external liabilities and the permanent growth rate of real GDP respectively. "Permanent" here is used in the sense of permanent income. Its approximate meaning is "expected long-run average" (see Buiter and Grafe, 2004). All I need to make my point is that the US *is* a net external debtor and that the permanent real rate of return paid on US net external liabilities in the future will indeed in the future exceed the permanent growth rate of US real GDP. If this second assumption is not satisfied, the US can engage in external Ponzi finance forever. Possible, but not likely, especially following the ongoing crisis.

Given $r_t^p > g_t^p$ and $f_{t-1} > 0$, it follows that the US will have to generate, henceforth, a permanent external primary surplus: $\bar{x}_t^p > 0$. Unless the US expects to be a permanent net recipient of foreign aid, this means that the US has to run a permanent trade surplus. From the position the US was in immediately prior to the crisis, this means

that a permanent increase in the trade balance surplus as a share of GDP of *at least* six percentage points is required.

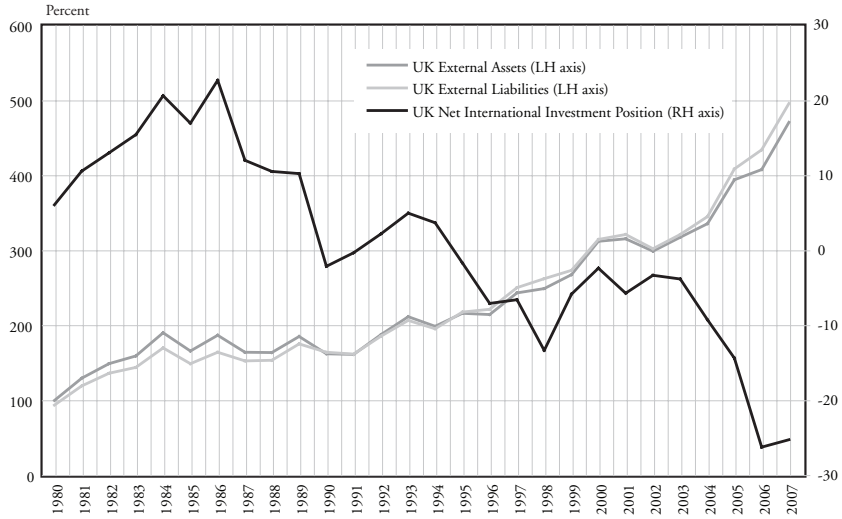
The UK is in a similar position, with a Net International Investment Position of around minus 27 percent of GDP in 2007 and a primary deficit of almost 5 percent of GDP. This can be seen in Charts 9a and 9b. Note that, unlike the US and the euro area, where gross external assets and liabilities are just over 100 percent of annual GDP, in the UK both external assets and external liabilities are close to 500 percent of annual GDP. The characterisation of the UK as a hedge fund is only a mild exaggeration.

The euro area, like the US and the UK, has a small negative Net International Investment Position. Unlike the US and the UK, its primary balance has averaged close to zero since the creation of the euro. Charts 10a and 10b show the behaviour of the external assets, liabilities and investment income for the euro area.

The mid-2007 6 percent of GDP US primary deficit was probably an overstatement of the structural trade deficit, because the US economy was operating above capacity. Since the middle of 2007, the US primary deficit has shrunk to about 5 percent of GDP. With the economy now operating with some excess capacity, this probably understates the structural external deficit. I will assume that the US economy has to achieve at least a five percent of GDP permanent increase in the primary balance to achieve external solvency. The corresponding figure for the UK is probably about at least four percent of GDP. The euro area has been in rough structural balance for a number of years.

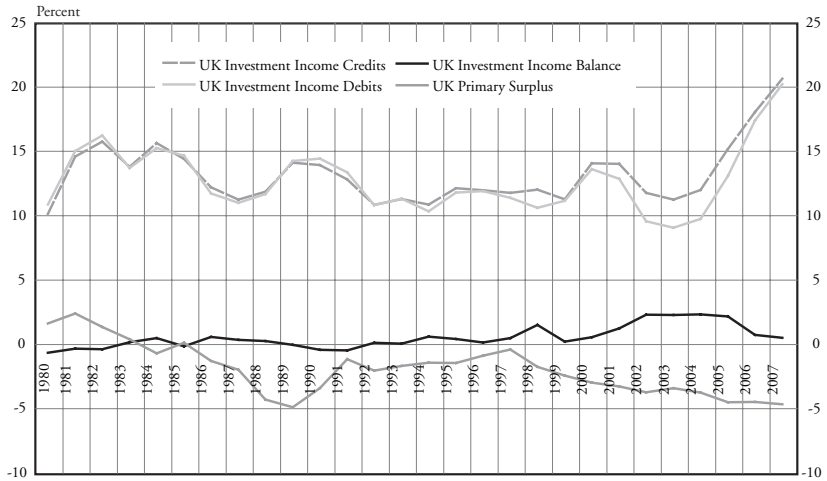
To say that the US needs a permanent 5 percent of GDP reduction in the external primary deficit is to say that the US needs a 5 percent fall in domestic absorption (the sum of private consumption, private investment and government spending on goods and services, or “exhaustive” public spending) relative to GDP. This reduction in domestic absorption is also necessary to support a lasting depreciation of the US real exchange rate (an increase in the relative price of

Chart 9a
UK external assets and liabilities, 1980-2007
(percent of GDP)



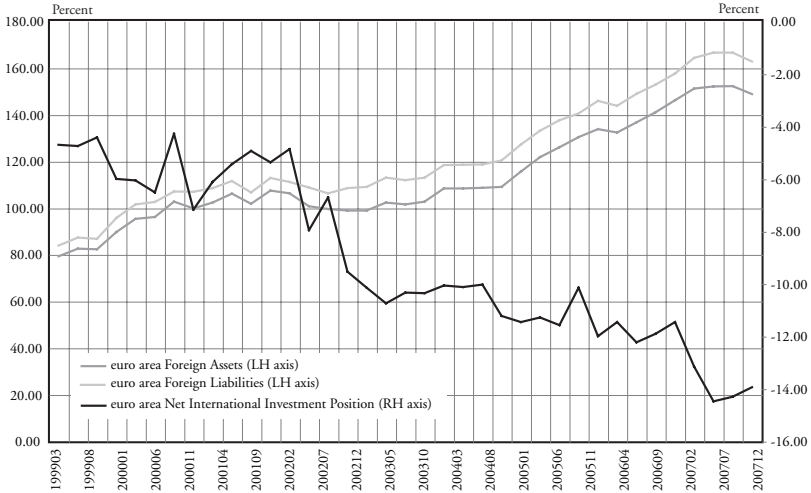
Source: Office of National Statistics

Chart 9b
UK investment income and primary surplus, 1980-2007
(percent of GDP)



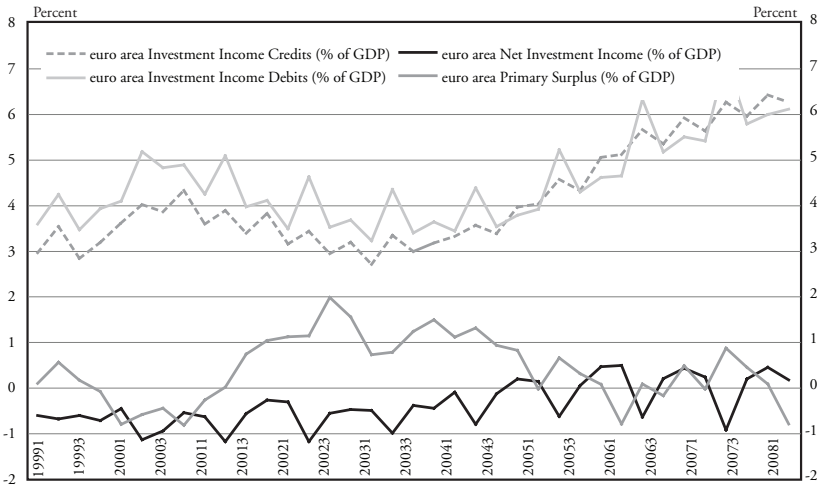
Source: Office of National Statistics

Chart 10a
Euro area external assets and liabilities, 1999Q1–2008Q1
(percent of GDP)



Source: Eurostat and ECB

Chart 10b
Euro area investment income and primary surplus,
1999Q1-2008Q1
(percent of GDP)



Source: Eurostat and ECB

traded to non-traded goods). Such a depreciation of the real exchange rate is an essential part of the mechanism for shifting resources from the non-traded sectors (construction, domestic banking and financial services) to the tradable sectors (manufacturing, tourism, international banking and financial services, and other tradable services).

The end of Ponzi finance for the US and the UK

My view that the US and the UK will have to achieve a large external primary balance correction to maintain external solvency is based on the assumption that, in the future, $r_t^p > g_t^p$, i.e. that permanent Ponzi finance (a growth rate of the debt permanently greater than the interest rate on the debt) will not be possible for the US or the UK.

I am therefore asserting that the future will, in this regard, be quite unlike the past. In the past couple of decades, as is clear from Charts 8b, 9b and 10b, both the US and the UK have been net debtor nations that received a steady stream of net payments from their creditors. As regards the net foreign asset income payments recorded in the balance of payments accounts, it looks therefore as though the US and the UK have not only been able, in the past, to engage in (temporary) Ponzi finance, they appear to have paid an effective negative nominal rate of return on their net external liabilities: Net Foreign Investment Income is positive for the US and the UK (zero for the euro area) even though the Net International Investment Position is negative for all three. If this could be sustained, it would be a form of “über-Ponzi finance.”

The reliability of the data summarized in Charts 8a,b, 9a,b and 10a,b is much debated, and the interpretation of the anomaly of a net debtor getting paid by his creditors is disputed (see e.g. Buiter, 2006; Gourinchas and Rey, 2007; and Hausmann and Sturzenegger, 2007). Part of the reason the US, the UK and (to a lesser extent) the euro area have been able to earn a much higher rate of return on their external assets than the rate of return earned by foreigners on their investments in the US and the UK, is that the US and the UK (Wall Street and the City of London) have, first, been acting as bankers to the world, providing unique liquidity and security for investments made in or channelled through these countries and, second, (may)

have been acting as venture capitalists to the world (Gourinchas and Rey, 2007), earning a much higher return on US FDI abroad than foreigners earned on FDI in the US. I have my doubts about the reliability of the data on which this second mechanism is based, but not on the historical accuracy of the first. It is my belief that the North Atlantic region financial crisis will do great and lasting damage to the ability of the US and the UK to borrow cheaply and invest in assets yielding superior rates of return.

Wall Street and the City of London have traded on the liquidity of their institutions and markets. Their leading banks and other financial institutions have benefited from huge liquidity premia and favourable risk spreads. These spreads reflected in part the perceived security of the investments that Wall Street and the City of London managed for clients or for their proprietary accounts.²⁷ More fundamentally, it reflected global confidence and trust in the absence of malfeasance and gross incompetence. These valuable virtues and talents could be found only among the professionals in the heartland of financial capitalism.

These unique assets, including trust and confidence, have been damaged badly. Key markets and institutions became illiquid and continue to be so. Incompetence, unethical practices and, not infrequently, outright illegal behaviour are now associated in the minds of the global investing community with many of the former giants of global finance in Wall Street and the City of London. That is why I have no serious reservations about assuming that, even for the US and the UK, we will have $r_i^p > g_i^p$ in the future: For the first time in a long time, the external intertemporal budget constraint will bite.

The rest of the world is unlikely to continue to provide the US and UK consumer (private or public) with credit on the terms of the past. The current financial crisis was made in the heartland of financial capitalism—on Wall Street, in the City of London, in Zurich and Frankfurt. It has revealed fundamental flaws in the heart of the financial system of the North Atlantic region. For many investors, the old, lingering suspicion that self-regulation meant no regulation has been confirmed. Those who sold or tried to sell this defective financial system to the rest of the world have been exposed as frauds or fools.

The rest of the world will not see the US (and the US dollar) or the UK (and sterling) or even the euro area and the euro as uniquely safe havens and as providers of uniquely safe and secure financial instruments. Risk premia for lending to the US and the UK are bound to increase significantly, even if there is no US dollar or sterling crisis. The position of New York and London as bankers to the world, and especially to the emerging markets, will be permanently impaired.

How and when to boost the external balance

If a large permanent decline in the ratio of domestic absorption to GDP is necessary, why wait, even if you could? Postponing the necessary adjustment will just raise the magnitude of the permanent correction that is eventually required. Five percentage points of GDP (a likely underestimate of the correction that is required) is already a very large permanent correction. Escalating that number further through inaction or, worse, through actions aimed at boosting consumption demand in the short run, risks destroying the credibility of an eventual adjustment. In addition, the terms of access to external finance can be expected to worsen rapidly for the US and the UK if durable adjustment measures are not implemented soon.

I believe that the required permanent reduction in domestic absorption relative to GDP in the US ought to come mainly through a reduction in private consumption. Public spending on goods and services in the US is already low by international standards. Underfunded public services and substandard infrastructure also support the view that exhaustive public spending should not be cut significantly. US private investment rates are not particularly high, either by historical or by international standards. There is also the need to invest on a large scale in energy security, energy efficiency and other green ventures. While a cyclical weakening of energy prices can be expected, the trend is likely to be upwards. The US is far less energy-efficient in production and consumption than Europe or Japan, and much of the US stocks of productive equipment and consumer durables (including housing) will have to be scrapped or adapted to make them economically viable at the new high real energy prices. US investment rates, private and public, should therefore not fall.

That leaves private consumption as the domestic spending or absorption component to be lowered permanently by at least five percentage points of GDP. The argument that the US will have to go through a protracted and/or deep slowdown to achieve a sustainable external balance is not dependent on whether it is private or public consumption that needs to be cut.

The US national saving rate is astonishingly low, both by international and by historical standards, as is apparent from Table 8. Of the G7 countries, only the UK comes close to saving as little as the US. The belief that saving is unnecessary because capital gains will provide the desired increase in real financial wealth has been undermined by the successive implosions of all recent asset booms/bubbles, including the tech bubble (which burst in late 2000) and the housing bubble (which burst at the end of 2006).

It is logically possible that a country like the US can reduce consumption as a share of GDP by five percentage points or more without this causing a temporary slowdown in economic activity. Asset markets (including the real interest rate and the real exchange rate) could adjust promptly and by the right amount to provide the correct signals for a reallocation of resources from consumption to domestic and foreign investment and from the non-traded to the traded sectors. Prices of goods and services and factor prices could respond promptly to re-enforce these asset market signals. Real resource mobility between the traded and non-traded sectors could be high enough to permit a sizable intersectoral reallocation of labour and capital without the need for periods of idleness or inactivity.

Absent a supply-side miracle, however, I believe that the US economy is too Keynesian in the short run to produce such a seamless and painless change in the composition of domestic production and in source of demand for domestically produced goods and services unless the right enabling macroeconomic policies are implemented. Although most policies and events that raise the national saving rate will result in a temporary decline in effective demand, in slowing or negative growth and in rising unemployment, in principle, the right combination of fiscal tightening and monetary loosening could boost

Table 8
Gross national saving rates for the G7
Percent of nominal GDP

	1990	2000	2001	2002	2003	2004	2005	2006	2007
Canada	17.3	23.6	22.2	21.2	21.4	22.8	23.7	24.3	..
France	20.8	21.6	21.3	19.8	19.1	19.0	18.5	19.1	19.3
Germany	25.3	20.2	19.5	19.4	19.5	21.5	21.8	23.0	25.2
Italy	20.8	20.6	20.9	20.8	19.8	20.3	19.6	19.6	19.7
Japan	33.2	27.5	25.8	25.2	25.4	25.8	26.8	26.6	..
United Kingdom	16.5	15.4	15.6	15.8	15.7	15.9	15.1	14.9	..
United States	15.3	17.7	16.1	13.9	12.9	13.4	13.5	13.7	..

Note: Based on SNA93 or ESA95 except Turkey that reports on SNA68 basis.
Sources: OECD, National accounts of OECD countries database.

the external primary deficit without changing aggregate demand for domestic output.²⁸

Unfortunately, instead of fiscal tightening we have had discretionary fiscal loosening in the US worth about \$150 billion since the crisis began. With these perverse fiscal policies in the US (from the perspective of restoring external balance), the re-orientation of domestic production towards tradables and the switch of global demand towards domestic goods is delayed and will ultimately be made more painful.

It is therefore ironic, and to me incomprehensible, that leading economists who have argued for decades that US households need to save more would, as soon as the US consumer is at long last showing signs of wanting to save more (that is, consume less), propose fiscal and monetary measures aimed at stopping the US consumer from doing what (s)he ought to have been doing all along. Martin Feldstein (2008) is a notable example; Larry Summers (2008) is another. This is a vivid example of St. Augustine's: "*Lord, give me chastity and virtue, but do not give it yet.*" The fall in private consumption growth, and indeed in private consumption, should be welcomed, not fought.

The Chairman of the Fed also appears to have dropped the qualifier “sustainable” from the objectives of growth and employment. Statements by Chairman Bernanke like the following abound: “...*we stand ready to take substantive additional action as needed to support growth and to provide additional insurance against downside risks*” (Bernanke, 2008a). The omission of the word “sustainable” in front of growth is no accident. The Fed has chosen to do all it can to maintain output and employment at the highest possible levels, with no regard to their sustainability.

III.1a(v) **How dangerous to the real economy is financial sector deleveraging?**

Consider the following stylized description of the financial system in the North Atlantic region in the 1920s and 1930s. Banks intermediate between households and non-financial corporations. There is a reasonable-size stock market, a bond market and a foreign exchange market. Banks are the only significant financial institutions—the financial sector is but one layer deep.

When the financial sector is but one layer deep, the collapse of the net worth of financial sector institutions and the contraction of the gross balance sheet of the financial sector can seriously impair the entire intermediation process. The spillovers into the real economy—household spending and investment spending by non-financial corporates—are immediate and direct. This was the picture in the Great Depression of the 1930s. This is the world studied in depth by the current Fed Chairman, Ben Bernanke, but it is not the world we live in today.

Today, the financial sector is many layers deep. Most financial institutions interact mainly with other financial institutions rather than with households or non-financial enterprises. They lend and borrow from each other and invest in each others’ contingent claims. Part of this financial activity is socially productive and efficiency-enhancing. Part of it is privately profitable but socially wasteful churning, driven by regulatory arbitrage and tax efficiency considerations. During periods of financial boom and bubble, useless financial products and pointless financial enterprises proliferate, often achieving enormous

scale. Finance is, after all, trade in promises, and can be scaled almost costlessly, given optimism, confidence, trust and gullibility.

Interestingly, during the most recent leverage boom, many of the non-bank financial businesses that accounted for much of the increase in leverage, chose to hold a non-negligible part of their assets as bank deposits and also borrowed from banks on a sizable scale. So the growth of bank credit to non-bank financial entities and the growth of the broad monetary aggregates tracked the financial, credit and leverage boom quite well. We don't know whether this is a stable structural relationship or just a fragile co-movement between jointly endogenous variables. Still, it suggests that central banks that take their financial stability role seriously should pay attention to the broad monetary aggregates and to the behaviour of bank credit, even if these aggregates are useless in predicting inflation or real economic activity in real time (see e.g. Adalid and Detken, 2007, and Greiber and Setzer, 2007).

The visible sign of this growth of intra-financial sector intermediation/churning is the growth of the gross balance sheets of the financial sector and the growth of leverage, both in the strict sense of, say, assets to equity ratios and in the looser sense of the ratio of gross financial sector assets or liabilities to GDP. During the five years preceding the credit crunch, this financial leverage was rising steadily, without much apparent impact on actual or potential GDP. If it had to be brought back to its 2002 level over, say, a five-year period, it is likely that no one would notice much of an impact on real or potential GDP. The orderly, gradual destruction of "inside" assets and liabilities need not have a material impact on the value of the "outside" assets and on the rest of the real economy.

But financial sector deleveraging and leveraging are not symmetric processes, in the same way that assets price booms and busts are not symmetric. Compared to the deleveraging phase, the increasing leverage phase is gradual. Rapid deleveraging creates positive, dysfunctional feedback between falling funding liquidity, distress sales of assets, low market liquidity, falling asset prices and further tightening of funding liquidity.

At some point, the deleveraging, even though it still involves almost exclusively the destruction of inside assets (and the matching inside liabilities), will impair the ability of the financial sector as a whole to supply finance to financial deficit units in the household sector and the non-financial corporate sector. Among the outside assets whose value collapses is the equity of the banks and other financial intermediaries. Given external (regulatory) and internal prudential lower limits on permissible or desirable capital ratios, these intermediaries are faced with the choice of reducing or suspending dividends, initiating rights issues or restricting lending to new or existing customers. Inevitably, lending is cut back and the financial crunch is transmitted to households and non-financial enterprises. The LLR and MMLR roles of the central bank, backed by the Treasury, are designed to prevent excessively speedy, destructive deleveraging. If it does that, there can be massive gradual deleveraging in the financial sector, without commensurate impact on households and non-financial corporates.

Inside and outside assets

I believe that the Fed has consistently overestimated the effect of the overdue sharp contraction in the size of the financial sector balance sheet on the real economy. Much of this can, I believe, be attributed to a failure to distinguish carefully between inside and outside assets. All financial instruments are inside assets. If an inside asset loses value, there is a matching decline in an inside liability. Both should always be considered together. This has not been common practice.

Just one example. Even before August 9, 2007, Chairman Bernanke provided estimates of the loss the US banking sector was likely to suffer on its holdings of subprime mortgages due to write-downs and write-offs on the underlying mortgages. For instance, on July 20, 2007, in testimony to Congress, Chairman Bernanke stated subprime-related losses could be up to \$100 billion out of a total subprime mortgage stock of around \$2 trillion; there have been a number of higher estimates since then. Not once have I heard a member of the FOMC reflect on the corresponding gain on the balance sheets

of the mortgage borrowers. Mortgages are inside assets/liabilities. So are securities backed by mortgages.

Consider a household that purchases for investment purposes a second home worth \$400,000 with \$100,000 of its own money and a non-recourse mortgage of \$300,000 secured against the property.²⁹ Assume the price of the new home halves as soon as the purchase is completed. With negative equity of \$100,000 the homeowner chooses to default. The mortgage now is worth nothing. The bank forecloses, repossesses the house and sells it for \$200,000, spending \$50,000 in the process.

The loss of net wealth as a result of the price collapse and the subsequent default and repossession is \$250,000: the \$200,000 reduction in the value of the house and the \$50,000 repossession costs (lawyers, bailiffs, etc.) The homeowner loses \$100,000: his original, pre-price collapse equity in the house—the difference between what he paid for the house and the value of the mortgage he took out. The bank loses \$150,000: the sum of the \$100,000 excess of the value of the mortgage over the post-collapse price of the house and the \$50,000 real foreclosure costs. The \$300,000 mortgage is an inside asset—an asset to the bank and a liability to the homeowner-borrower. When it gets wiped out, the borrower gains (by no longer having to service the debt) what the lender loses.

The legal event of default and foreclosure, however, is certainly not neutral. In this case it triggers a repossession procedure that uses up \$50,000 of real resources. This waste of real resources would, however, constitute aggregate demand in a Keynesian-digging-holes-and-filling-them-again sense, a form of private provision of pointless public works.

Continuing the example, how does the redistribution, following the default, of \$100,000 from the bank to the defaulting borrower—the write-off of the excess of the face value of the mortgage over the new low value of the house—affect aggregate demand? There is one transmission channel that suggests it is likely that demand would have been weaker if, following the default, the lender had continued recourse to the borrower (say, through a lien on the borrower's future

income or assets). The homeowner-borrower is likely to have a higher marginal propensity to spend out of current resources than the owners of the bank—residential mortgage borrowers are more likely to be liquidity-constrained than the shareholders of the mortgage lender. This transmission channel has, as far as I can determine, never been mentioned by any FOMC member.

Finally, we have to allow for the effect of the mortgage default on the willingness and ability of the bank to make new loans and to roll over existing loans. Clearly, the write-off or write-down of the mortgage will put pressure on the bank's capital. The bank can respond by reducing its dividends, by issuing additional equity or by curtailing lending. The greatest threat to economic activity undoubtedly comes from curtailing new lending and the refusal to renew maturing loans.

The magnitude of the effect on demand of a cut in bank lending depends on whom the banks are lending to and what the borrower uses the funds for. If the banks are lending to other financial intermediaries that are, directly or indirectly, lending back to our banks, then there can be a graceful contraction of the credit pyramid, a multi-layered deleveraging without much effect on the real economy. If bank A lends \$1 trillion to bank B, which then uses that \$1 trillion to buy bonds issued by bank A, there could be a lot of gross deleveraging without any substantive impact on anything that matters. With a few more near-bank or non-bank intermediaries interposed between banks A and B, such intra-financial sector lending and borrowing (often involving complex structured products) has represented a growing share of bank and financial sector business this past decade.

In our non-Modigliani-Miller world, financial structure matters. We cannot just “net out” inside financial assets and liabilities—they are an essential part of the transmission mechanism. But there also is no excuse for ignoring half of the distributional effects inherent in changing valuations of inside assets and liabilities. If their public statements are anything to go by, the Fed and the FOMC may have systematically overestimated the effects of declining inside financial asset valuations on aggregate demand.

III.1a(vi) Disdain for the monetary aggregates

Monetary targeting for macroeconomic stability died because the velocity of circulation of any monetary aggregate turned out to be unpredictable and unstable. Even so, the decision to cease publishing M3 statistics effective 23 March 2006 was extraordinary. The reason given was: “*M3 does not appear to convey any additional information about economic activity that is not already embodied in the M2 aggregate. The role of M3 in the policy process has diminished greatly over time. Consequently, the costs of collecting the data and publishing M3 now appear to outweigh the benefits.*”

Information is probably the purest of all pure public goods. The cost-benefit analysis argument against its continued publication, free of charge to the ultimate user, by a public entity like the Fed, is completely unconvincing. Broad monetary aggregates, including M3 and their counterparts on the asset side of the banking sector’s balance sheet are in any case informative for those interested in banking sector leverage and other financial stability issues, including asset market booms and bubbles (see e.g. Ferguson, 2005; Adalid and Detken, 2007; and Greiber and Setzer, 2007). The decision to discontinue the collection and publication of M3 data supports the view that the Fed took its eye off the credit boom ball just as it was assuming epic proportions.

The decision to discontinue publication of the M3 series also smacks of intellectual hubris; effectively, the Fed is saying: We don’t find these data useful. Therefore *you* shall not have them free of charge any longer.

III.1b *The world imports inflation*

All three central banks have tried to absolve themselves of blame for the recent bouts of inflation in their jurisdictions by attributing much or most of it to factors beyond their control—global relative price shocks, global supply shocks, global inflation or global commodity price inflation. A prominent use of this fig-leaf can be found in the open letter to the Chancellor of the Exchequer by Mervyn King, Governor of the BoE, in May 2008.³⁰ The gist of the Governor’s analysis was: it’s all global commodity prices—something beyond our control.

I will quote him at length, so there is no risk of distortion:

“Inflation has risen sharply this year, from 2.1% in December to 3.3% in May. That rise can be accounted for by large and, until recently, unanticipated increases in the prices of food, fuel, gas and electricity. These components alone account for 1.1 percentage points of the 1.2 percentage points increase in the CPI inflation rate since last December. Those sharp price changes reflect developments in the global balance of demand and supply for foods and energy. In the year to May:

- *world agricultural prices increased by 60% and UK retail food prices by 8%.*
- *oil prices rose by more than 80% to average \$123 a barrel and UK retail fuel prices increased by 20%*
- *wholesale gas prices increased by 160% and UK household electricity and gas bills by around 10%*

The global nature of these price changes is evident in inflation rates not only in the UK but also overseas, although the timing of their impact on consumer prices differs across countries. In May, HICP inflation in the euro area was 3.7% and US CPI inflation was 4.2%.”

Later on in the open letter the Governor amplifies the argument that this increase in inflation has nothing to do with the BoE:

“There are good reasons to expect the period of above-target inflation we are experiencing now to be temporary. We are seeing a change in commodity, energy and import prices relative to the prices of other goods and services. Although this clearly raises the price level, it is not the same as continuing inflation. There is not a generalised rise in prices and wages caused by rapid growth in the amount of money spent in the economy. In contrast to past episodes of rising inflation, money spending is increasing at a normal rate. In the year to 2008 Q1, it rose by 5½%, in line with the average rate of increase since 1997—a period in which inflation has been low and stable. Moreover, in recent months the growth rate of the broad money supply has eased and credit conditions have tightened. This will restrain the growth of money spending in the future.” (emphasis in the original).

Very similar statements have been made by President Jean-Claude Trichet of the ECB and Chairman Ben Bernanke. Here is a quote from the August 7, 2008 Introductory statement before the press conference by President Trichet:

“...Annual HICP inflation has remained considerably above the level consistent with price stability since last autumn, reaching 4.0% in June 2008 and, according to Eurostat’s flash estimate, 4.1% in July. This worrying level of inflation rates results largely from both direct and indirect effects of past sharp increases in energy and food prices at the global level” (Trichet, 2008).

Ditto for Chairman Bernanke (2008):

“Inflation has remained high, largely reflecting sharp increases in the prices of globally traded commodities.”

And, in the same speech:

“Rapidly rising prices for globally traded commodities have been the major source of the relatively high rates of inflation we have experienced in recent years, underscoring the importance for policy of both forecasting commodity price changes and understanding the factors that drive those changes.”

This analysis makes no sense. Except at high frequencies, headline inflation can be effectively targeted and controlled by the monetary authority and is therefore the responsibility of the monetary authority. Supply shocks or demand shocks make the volatility of actual headline inflation around the target higher, but should not create a bias. The only obvious caveat is that the economy in question have a floating effective exchange rate. This is the case for the UK and the euro area. The US is hampered somewhat in its monetary autonomy by the fact that the Gulf Cooperation Council members and some other countries continue to peg to the US dollar, and by the fact that the exchange rate with the US dollar of the Chinese Yuan continues to be managed in a rather unhelpful manner by the Chinese authorities. Although the Yuan appreciated vis-à-vis the US dollar by more than 10 percent in 2007 and by more than 7 percent so far this year, it is clearly not a market-determined exchange rate.

If we add together the statements by the world's central bank heads (from the industrial countries, from the commodity-importing emerging markets and from the commodity exporting emerging markets) on the origins of their countries' inflation during the past couple of years, we must conclude that interplanetary trade is now a fact: The world is importing inflation from somewhere else (Wolf, 2008).

Consider the following stylised view of the inflation process in an open economy. The consumer price level, as measured by the CPI, say, is a weighted average of a price index for core goods and services and a price index for non-core goods. Core goods and services have sticky prices—these are the prices that account for Keynesian nominal rigidities (money wages and prices that are inflexible in the short run) and make monetary policy interesting. Non-core goods are commodities traded in technically efficient auction markets. It includes oil, gas and coal, metals and agricultural commodities, both those that are used for food production and those that provide raw materials for industrial processing, including bio fuels. The prices of non-core goods are flexible.

I will treat the long-run equilibrium relative price of core and non-core goods and services as determined by the rest of the world. In the short run, nominal rigidities can, however, drive the domestic relative price away from the global relative price.

I also make domestic potential output of core goods and services a decreasing function of the relative price of non-core goods to that of core goods and services. The effect of an increase in real commodity prices on productive potential in the industrial countries is empirically well-established. A recent study by the OECD (2008) suggests that the steady-state effect of a \$120 per barrel oil price could be to lower the steady-state path of US potential output by about four percentage points, and that of the euro area by about half that (reflecting the lower euro area energy-intensity of GDP).³¹ The short-and medium-term effect on the growth rate of potential output in the US of the real energy price increase would be about 0.2 percent per annum, and half that in the euro area. Negative effects on potential output of the higher cost of capital since the summer of 2007 could magnify the negative potential growth rate effects, according to the

OECD study, to minus 0.3 percent per annum for both the US and the euro area.

I also treat the world (foreign currency) price of non-core goods as exogenous. It simplifies the analysis, but is not necessary for the conclusions, if we assume that the country produces only core goods and services and imports all non-core goods. Non-core goods are both consumed directly and used as imported raw materials and intermediate inputs in the production of core goods and services. The weight of non-core goods in the CPI, which I will denote μ , represents both the direct weight of non-core goods in the consumption basket and the indirect influence of core goods prices as a variable cost component in the production of core goods and services. I haven't seen any up-to-date input-output matrices for the US, the euro area and the UK, so I will have to punt on μ . For illustrative purposes, assume that $\mu = 0.25$ for the UK, 0.10 for the US and 0.15 for the euro area.

The inflation rate is the proportional rate of change of the CPI. If π is the CPI inflation rate, π^c the core inflation rate and π^n the non-core inflation rate, then:

$$\pi = (1 - \mu) \pi^c + \mu \pi^n \quad (21)$$

The inflation rate of non-core goods measured in domestic currency prices is the sum of the world rate of inflation of non-core goods π^f and the proportional rate of depreciation of the currency's nominal exchange rate, ε . That is,

$$\pi^n = \pi^f + \varepsilon \quad (22)$$

By assumption, the central bank has no influence on the world rate of inflation of non-core goods, π^f . The same cannot be said, however, for the value of the nominal exchange rate. High global inflation need not be imported if the currency is permitted to appreciate. In the UK, between end of the summer of 2007 and the time of Governor King's open letter in May 2008, sterling's effective exchange rate depreciated by 12 percent, reinforcing rather than offsetting the domestic inflationary effect of global price increases. The heads of our three central banks appear to treat the nominal exchange rate as exogenous—independent of monetary policy.³²

The values of μ are probably quite reasonable, but the one-for-one instantaneous *structural* pass-through assumed in equation (22) for exchange rate depreciation on the domestic currency prices of non-core goods is somewhat over the top, at any rate in the short run. But it is a reasonable benchmark for medium- and long-term analysis. In the short run, one can, for descriptive realism, add a little distributed lag or error-correction mechanism to (22), reflecting pricing-to-market behaviour etc.

Core inflation, which can be identified with domestically generated inflation in the simplest version of this approach, depends on such things as the inflation rate of unit labour costs and of unit rental costs plus the growth rate of the mark-up. For simplicity, I will assume that core inflation depends on the domestic output gap, $y_t - \hat{y}_t$, on expected future headline inflation, $E_t \pi_{t+1}$ and on past core inflation, so core inflation is driven by the following process:

$$\pi_t^c = \gamma(y_t - \hat{y}_t) + \beta E_t \pi_{t+1} + (1 - \beta)\pi_{t-1}^c \quad (23)$$

$$\gamma > 0, 0 < \beta \leq 1$$

Monetary policy influences core inflation through two channels: by raising interest rates and expectations of future policy rates, it can lower output and thus the output gap. And if past, current and anticipated future actions influence expectations of future CPI inflation, that too will reduce inflation today, through the (headline) expectations channel.

It is true that an increase in the relative price of non-core goods to core goods and services means, given a sticky nominal price of core goods and services, an increase in the general price level but not, in and of itself, ongoing inflation. That is arithmetic. With the domestic currency price of core goods and services given in the short run, the only way to have an increase in the relative price of non-core goods is to have an increase in the domestic currency price of non-core goods. The level of the CPI therefore increases. This one-off increase in the general price level will show up in real time as a temporary increase in CPI inflation. If there is a sequence of such relative price increases, there will be a sequence of such temporary increases in CPI inflation, which will rather look like, but is not, ongoing inflation.

Of course, as time passes even sticky Keynesian prices become unstuck. The nominal price of core goods and services can and does adjust. It can even adjust in a downward direction, as the spectacular declines in IT-related product prices illustrate on a daily basis. Whether the medium-term and longer-term increase in the relative price of non-core goods and services will continue to be reflected in a higher future path for the CPI, an unchanged CPI path or even an ultimately lower CPI path, is determined by domestic monetary policy.

Furthermore, an increase in the relative price of non-core goods to core goods and services does more than cause a one-off increase in the price level. As argued above, and as supported by many empirical studies, including the recent OECD (2008) study cited above, it reduces potential output or productive capacity by making an input that is complementary with labour and capital more expensive.³³ Letting $\frac{p^n}{p^c}$ denote the relative price of non-core and core goods, I write this as:

$$\hat{y}_t = \bar{y}_t - \eta \frac{p_t^n}{p_t^c} \quad (24)$$

$$\eta > 0$$

In addition, if labour supply is responsive to the real consumption wage, then the adverse change in the terms of trade that is the other side of the increase in the relative price of non-core goods to core goods and services will reduce the full-employment supply of labour, and this too will reduce productive capacity. Thus, unless actual output (aggregate demand) falls by more than potential output as a result of the adverse terms of trade change, the output gap will increase and the increase in the relative price of non-core goods will raise domestic inflationary pressures for core goods and services.

Clearly, the adverse terms of trade change will lower the real value of consumption demand, measured in terms of the consumption basket, if claims on domestic GDP (capital and labour income) are owned mainly by domestic consumers. It lowers the purchasing power of domestic output over the domestic consumption bundle. Real income measured in consumer goods falls, so real consumption

measured in consumer goods should fall. But even if the increase in the relative price of non-core goods is expected to be permanent, real consumption measured in terms of the consumption bundle is unlikely to fall by a greater percentage than the decline in the real consumption value of domestic production. With homothetic preferences, a permanent deterioration in the terms of trade will not change consumption measured in terms of GDP units. If the period utility function is Cobb-Douglas between domestic output and imports, the adverse terms of trade shock lowers potential output but does not reduce domestic consumption demand for domestic output.

Unless the sum of investment demand for domestic output, public spending on domestic output and export demand falls in terms of domestic output, aggregate demand (actual GDP) will not fall. The output gap therefore increases as a result of an increase in the relative price of non-core goods to goods and services. Domestic inflationary pressures rise. Interest rates have to rise to achieve the same inflation trajectory. This inflationary impact of the increase in the relative price of commodities appears to be ignored by the Governor, the President and the Chairman.

III.1c False comfort from limited “pass-through” of inflation expectations into earnings growth?

Both the Fed and the BoE (less so the ECB) take comfort from the fact that earnings growth has remained moderate despite the increase in inflation expectations, based on both break-even inflation calculations (or the inflation swap markets) and on survey-based expectations. For instance, in the exchange of letters between the Governor of the BoE and the Chancellor in May 2008, it was noted by the Chancellor that, although median inflation expectations for the coming year had risen to 4.3 percent in the Bank’s own survey, earnings growth (including bonuses) is running at only 3.9 percent.

However, this observation does not mean that inflation expectations are not translated, *ceteris paribus*, one-for-one into higher wage settlements or into higher actual inflation. Time series analysis (earnings growth is not rising) is not the same as counterfactual analysis

(earnings growth would have been the same if inflation expectations had not risen).

It is certainly possible that the global processes that have depressed the share of labour income in GDP in most industrial countries during the past 10 years (labour-saving technical change, China and India entering the global markets as producers of goods and services that are frequently competitive with those produced by the labour force in the advanced industrial countries, increased cross-border labour mobility, legal constraints weakening labour unions etc.) have not yet run their course and that labour's share will continue to decline. Arithmetically, a decrease in labour's share in GDP is an increase in the mark-up of the GDP deflator on unit labour costs. So if an increase in the expected rate of (consumer price) inflation coincided with a reduction in labour's share of GDP because of structural factors (and if no other determinant of earnings growth changed), unit labour cost growth could well rise (in a time-series sense) by less than the increase in expected inflation or might even decline. The price inflation process (on the GDP deflator definition) would, however, include the growth rate of the mark-up on unit labour costs, and would show the full impact of the increase in expected inflation (even in a time-series sense).

Clearly, the GDP deflator is not quite the same as the core price index, but qualitatively, the point remains valid, that a declining equilibrium share of labour will be offset, in the price inflation process, by a rising equilibrium mark-up on unit labour cost and that this can distort the interpretation of simple correlations between inflation expectations and earnings growth.

III.2 Financial stability: LLR, MMLR and Quasi-fiscal actions

III.2a The Fed

The Fed, as soon as the crisis hit, injected liquidity into the markets at maturities from overnight to three-months. The amounts injected

were somewhere between those of the BoE (allowing for differences in the size of the US and UK economies) and those of the ECB.

III.2a(i) Extending the maturity of discount window loans

On August 17, 2007 the Fed extended the maturity of loans at the discount window from overnight to up to one month. On March 16, 2008, it further extended the maximum term for discount window lending to 90 days. These were helpful measures, permitting the provision of liquidity at the maturities it was actually needed.

III.2a(ii) The TAF

On December 12, 2007, the Fed announced the creation of a temporary term auction facility (TAF). This allows a depository institution to place a bid for a one-month advance from its local Federal Reserve Bank at an interest rate that is determined as the result of an auction. The TAF allows the Fed to inject term funds through a broader range of counterparties and against a broader range of collateral than open market operations. When the normal open market operations counterparties are hoarding funds, and the unsecured interbank market is not disseminating liquidity provisions efficiently throughout the banking sector, this facility is clearly helpful.

III.2a(iii) International currency swaps

Also on December 12, the Fed announced swap lines with the European Central Bank and the Swiss National Bank of \$20 billion and \$4 billion, respectively. On March 11, 2008, these swap lines were increased to \$30 billion and \$6 billion, respectively. This, I have suggested earlier, represents either the confusion of motion with action or an unwarranted subsidy to the private banks able to gain access to this foreign exchange rather than having to acquire it more expensively through the private swap markets. Banks in the euro area and Switzerland were not liquid in euros/Swiss francs but short of US dollars because the foreign exchange markets had become illiquid. These banks were short of liquidity—full stop—that is, short of liquidity in any currency.

This is unlike the case of Iceland, where the Central Bank on May 16, 2008, arranged swaps for euros with the three Scandinavian central banks. Since the Icelandic banking system is very large relative to the size of the economy and has much of its balance sheet (including a large amount of short-term liabilities) denominated in foreign currencies rather than in Icelandic kroner, the effective performance of the LLR and MMLR functions requires the central bank to have access to foreign currency liquidity. With no one interested in being long Icelandic kroner, the swap facilities are an essential line of defence for the Icelandic LLR/MMLR.

III.2a(iv) The TSLF

On March 11, 2008, the Fed announced that it would expand its existing overnight securities lending program for primary dealers by creating a Term Securities Lending Facility (TSLF). Under the TSLF, the Fed will lend up to \$200 billion of Treasury securities held by the System Open Market Account to primary dealers secured for a term of 28 days by a pledge of other collateral. The Facility was extended beyond the 2008 year-end in July 2008, and the maturity of the loans was increased to three months. The first TSLF auction took place on March 27, with \$75 billion offered for a term of 28 days, too late to be helpful to Bear Stearns, for which the Fed had to provide extraordinary LLR support on March 14. The price is set through a single-price auction.³⁴

The range of collateral is quite wide: all Schedule 2 collateral plus agency collateralized-mortgage obligations (CMOs) and AAA/Aaa-rated commercial mortgage-backed securities (CMBS), in addition to the AAA/Aaa-rated private-label residential mortgage—backed securities (RMBS) and OMO-eligible collateral.³⁵ Until the creation of the Primary Dealer Credit Facility (PDCF, see below) the Fed could not lend cash directly to primary dealers. Instead it lends highly liquid Treasury bills which the primary dealers then can convert into cash. This facility extends both the term of the loans from the Fed to primary dealers and the range of eligible collateral. In principle this is a useful arrangement for addressing a liquidity crisis. The design, however, has one huge flaw.

An extraordinary feature of the arrangement is that the collateral offered by a primary dealer is valued by the clearing bank acting as agent for the primary dealer.³⁶ Apparently this is a standard feature of the dealings between the Fed and the primary dealers. Primary dealers cannot access the Fed directly, but do so through a clearing bank—their dealer. As long as the clearing bank which acts as agent for the primary dealer in the transaction is willing to price the security (say, by using an internal model), the Fed will accept it as collateral at that price. The usual haircuts, etc., will, of course, be applied to these valuations.

This arrangement is far too cosy for the primary dealer and its clearer. The incentive for collusion between the primary dealer and the clearer, to offer pig's ear collateral but value it as silk purse collateral, will be hard to resist. This invites adverse selection: The Fed is likely to find itself with overpriced, substandard collateral. Offering access to this adverse selection mechanism today creates moral hazard in the future. It does so by creating incentives for future reckless lending and investment by primary dealers aware of these future opportunities for dumping bad investments on the Fed as good collateral through the TSLF. More recently, the Fed extended the TSLF through the addition of a Term Securities Lending Facility Options Program (TOP). This rather looks to me like gilding the lily.

III.2a(v) The PDCF

On March 16, 2008, the Primary Dealer Credit Facility (PDCF) was established, for a minimum period of six months. This again was too late to be helpful in addressing the Bear Stearns crisis. Primary dealers of the Federal Reserve Bank of New York are eligible to participate in the PDCF via their clearing banks. It is an overnight loan facility that provides funding to primary dealers in exchange for a specified range of eligible collateral, including all collateral eligible for tri-party repurchase agreements arranged by the Federal Reserve Bank of New York (that is, all collateral eligible for pledge in open market operations), as well as all investment-grade corporate securities, municipal securities, mortgage-backed securities and asset-backed securities for which a price is available from the primary

dealer's clearing bank. The rate charged is the one at the primary discount window to depository institutions for overnight liquidity, currently 25 bps over the federal funds target rate.

This facility effectively extends overnight borrowing at the Fed's primary discount window to primary dealers, at the standard primary discount window rate. Note again the extraordinary valuation mechanism put in place for securities offered as collateral: "*The pledged collateral will be valued by the clearing banks based on a range of pricing services.*"³⁷ This is the same "adverse-selection-today-leading-to-moral-hazard-tomorrow-machine" created by the Fed with the TSLF.

III.2a(vi) Bear Stearns

On March 14, 2008, the Fed agreed to lend US\$29 billion to Bear Stearns through JPMorgan Chase (on a non-recourse basis). Bear Stearns is an investment bank and a primary dealer. It was not regulated by the Fed (which only regulates depository institutions) but by the SEC. Bear Stearns was deemed too systemically important (probably by being too interconnected rather than too big) to fail.

It is not clear why Bear Stearns could not have borrowed at the regular Fed primary discount window. It is true that investment banks had not done so since the Great Depression, but it would have been quite consistent with the Fed's legislative mandate. The Federal Reserve Act (1913) allows the Federal Reserve to lend, in a crisis, to just about any institution, organisation or individual, and against any collateral the Fed deems fit (see also Small and Clouse, 2004).

Specifically, if the Board of Governors of the Federal Reserve System determine that there are "*unusual and exigent circumstances*" and at least five (out of seven) governors vote to authorize lending under Section 13(3) of the Federal Reserve Act, the Federal Reserve can discount for individuals, partnerships and corporations (IPCs) "*notes, drafts and bills of exchange indorsed or otherwise secured to the satisfaction of the Federal Reserve bank...*"

The combination of the restriction of "unusual and exigent circumstances" and the further restriction that the Federal Reserve can discount only to IPCs "unable to secure adequate credit accommo-

dations from other banking institutions,” fits the description of a credit crunch/liquidity crisis like a glove. So why did the Fed not determine before March 14 that there were “unusual and exigent circumstances” that would have allowed Bear Stearns direct access to the discount window?

It is also a mystery why a *special resolution regime* analogous to that administered by the FDIC for insured depositary institutions (discussed in Section II.3a) did not exist for Bear Stearns. The experience of LTCM in 1998 should have made it clear to the Fed that there were institutions other than deposit-taking banks that might be too systemically significant to fail, precisely because, like Bear Stearns, their death throes might, through last-throw-of-the-dice asset liquidations, cause illiquid asset prices to collapse and set in motion a dangerous chain reaction of cumulative market illiquidity and funding illiquidity. An SRR could have ring-fenced the balance sheet of Bear Stearns and permitted the analogue of *Prompt Corrective Action* to be implemented. The entire top management could have been fired without any golden handshakes. If necessary, regulatory insolvency could have been declared for Bear Stearns. The shareholders would have lost their voting power and would have had to take their place in line, behind all other claimants. Outright nationalisation of Bear Stearns could have created a better alignment of incentives that was actually achieved, although a drawback of nationalisation would have been that all creditors of Bear Stearns would have been made whole.

Instead we have a \$10 per share payment for the shareholders, what looks like a sweetheart deal for JPMorgan Chase, and a \$29 billion exposure for the US taxpayer to an SPV in Delaware, which has \$30 billion of Bear Stearns’ most toxic assets on its balance sheet. Only \$1 billion of JPMorgan Chase money stands between losses on the assets and the \$29 billion “loan with equity upside” provided by the Fed.

III.2a(vii) **Bear Stearns’ bailout as an example of confusing the LLR and MMLR functions**

The rescue of Bear Stearns represents the confusion of the lender-of-last-resort role of the traditional central bank and the market-maker-of-last-resort role of the modern central bank. Bear

Stearns was an investment bank. No investment bank is systemically important in the sense that no investment bank performs tasks that cannot be performed readily and with comparable effectiveness by other institutions. Even the primary dealer and broker roles of Bear Stearns could have been taken over promptly by the other primary dealers and brokers.

Bear Stearns was rescued because it was “too interconnected to fail.” It was feared that, in a last desperate attempt to stave off insolvency, Bear Stearns would have unloaded large quantities of illiquid securities in dysfunctional, illiquid securities markets. This would have caused a further dramatic decline in the market prices of these securities. With mark-to-market accounting and through margin calls linked to these valuations, further sales of illiquid securities by distressed financial institutions would have been triggered. The losses associated with these “panic sales” would have reduced the capital of other financial institutions, requiring them to cut or eliminate dividends, raise new capital, cut new lending or reduce their investments. A vicious cycle could have been triggered of forced sales into illiquid markets triggering funding liquidity problems elsewhere, necessitating further liquidations of illiquid asset holdings.

This chain of events is possible and may even have been plausible at the time. The solution, however, is to truncate the vicious downward spiral of market illiquidity and funding illiquidity right at the point where Bear Stearns was distress-selling its illiquid assets. By acting as MMLR—either by buying these securities outright or by accepting them as collateral at facilities like the TAF (extended to include investment banks as eligible counterparties), the TSLF or the PDCF—the central bank could have put a floor under the prices of these securities and would thus have prevented a vicious downward spiral of market and funding illiquidity. Whether Bear Stearns would have been able to survive with the valuations of their assets realised at these TAF-, TSLF- or PDCF-type facilities, would no longer have been systemically relevant.

The arrangements for acting as MMLR for investment banks did not, unfortunately, exist when Bear Stearns collapsed. Now that they do, they should be kept alive, on a stand-by or as-needed basis.

They may have to be expanded to include other highly leveraged financial institutions that are too interconnected to fail. As *quid pro quo*, all institutions eligible for MMLR (and/or LLR) support should be subject to common regulatory requirements, including a common special resolution regime. Combined with a proper punitive pricing of securities offered for outright purchase or as collateral, moral hazard will be minimized.

III.2a(viii) Fannie and Freddie

On Sunday, July 13, 2008, the Fed, in a coordinated action with the Treasury, announced that it would provide the two GSEs, Fannie Mae and Freddie Mac, with access to the discount window on the same terms as commercial banks. The announcement was not very informative as regards the exact conditions of access:

“The Board of Governors of the Federal Reserve System announced Sunday that it has granted the Federal Reserve Bank of New York the authority to lend to Fannie Mae and Freddie Mac should such lending prove necessary. Any lending would be at the primary credit rate and collateralized by U.S. government and federal agency securities.”

It isn't clear from this whether the two GSEs have access only to overnight collateral (at a rate 25 basis points over the federal funds target rate) or are able to obtain loans of up to 3-month maturity, as commercial banks can.

As long as the collateral the Fed accepts from Fannie and Freddie consists of US government and federal agency securities only, the expansion of the set of eligible discount window counterparties to include Fannie and Freddie does not represent a material quasi-fiscal abuse of the Fed. If at some future date the maturity of the loans extended to Fannie and Freddie at the discount window were to be longer than overnight, and if lower quality collateral were to be accepted and not priced appropriately, Fannie's and Freddie's access to the discount window could become a conduit for quasi-fiscal subsidies.

This is not, I believe, an idle concern. The Fed's opening of the discount window to the two GSEs was announced at the same time as some potentially very large-scale contingent quasi-fiscal commit-

ments by the Treasury to these organisations, including debt guarantees and the possibility of additional equity injections. There also is the worrying matter that, even though Fannie and Freddie now have access to the discount window, there is no special resolution regime for the two GSEs to constrain the incentives for excessive risk taking created by access to the discount window.

III.2a(ix) Lowering the discount window penalty

In Section III.1, I listed the lowering (in two steps) of the discount rate penalty from 100 to 25 basis points as a stabilisation policy measure, although it is unlikely to have had more than a negligible effect, except possibly as “mood music”: it represents the marginal cost of external finance only for a negligible set of financial institutions.

The discount rate penalty reductions should, however, be included in the financial stability section as an essentially quasi-fiscal measure. On August 17, 2007, there were no US financial institutions for whom the difference between able to borrow at the discount rate at 5.75 percent rather than at 6.25 percent represented the difference between survival and insolvency; neither would it make a material difference to banks considering retrenchment in their lending activity to the real economy or to other financial institutions. This reduction in the discount window penalty margin was of interest only to institutions already willing and able to borrow at the discount window (because they had the kind of collateral normally expected there). It was an infra-marginal subsidy to such banks—a straight transfer to their shareholders from the US taxpayers. It also will have boosted moral hazard to a limited degree by lowering the penalty for future illiquidity.

III.2a(x) Interest on reserves

Reserves held by commercial banks with the Fed are currently non-remunerated. As I pointed out in Section II.5, this hampers the Fed in keeping the effective federal funds rate close to the federal funds target. Commercial banks have little incentive to hold excess reserves with the central bank. If there is excess liquidity in the overnight interbank market, banks will try to lend it out overnight at any

positive rate rather than holding it at a zero overnight rate as excess reserves with the Fed. Clearly it makes sense for interest to be paid on excess reserves at an overnight rate equal to the federal funds target rate. Under existing legislation, the Fed will have the authority to pay interest on reserves starting in October 2011. The Fed has asked Congress for this date to be brought forward.

The proposal clearly makes sense, but if interest at the federal funds target rate is paid on both required and excess reserves, the proposed policy change represents a quasi-fiscal tax cut benefiting the shareholders of the banks. In a first-best world, the Fed would not collect quasi-fiscal taxes through unremunerated reserves. However, to correct this problem now, as a one-off, would look like a further reward to the banks for past imprudent behaviour and would also be distributionally unfair. The Fed should insist that interest be paid only on excess reserves held by the commercial banks, with zero interest on required reserves. Once the dust has settled, the question of the appropriate way to tax the commercial banks and fund the Fed can be addressed at leisure.

III.2a(xi) Limiting the damage of the current crisis versus worsening the prospects for the next crisis

There can be little doubt that the Fed has done many things right as regards dealing with the immediate liquidity crisis. First, it used its existing facilities to accommodate the increased demand for liquidity. It extended the maturity of its discount window loans. It widened the range of collateral it would accept in repos and at the discount window. It created additional term facilities for existing counterparties through the TAF. It increased the range of eligible counterparties by creating the TSLF and the PDCF and it extended discount window access to Fannie and Freddie. It also stopped a run on investment banks by bailing out Bear Stearns.

However, the way in which some of these “putting-out-fires-manoeuvres” were executed seems to have been designed to maximise bad incentives for future reckless lending and borrowing by the institutions affected by them. Between the TAF, the TSLF, the PDCF, the rescue of Bear Stearns and the opening of the discount window to the

two GSEs, the Fed and the US taxpayer have effectively underwritten directly all of the “household name” US banking system—commercial banks and investment banks—and probably also, indirectly, most of the other large highly leveraged institutions.

This was done without the extraction of any significant quid pro quo and without proportional and appropriate pain for shareholders, directors, top managers and creditors of the institutions that benefited. The privilege of access to Fed resources was extended without a matching expansion of the regulatory constraints traditionally put on counterparties enjoying this access. Specifically, the new beneficiaries have not been made subject to a Special Resolution Regime analogous to that managed by the FDIC for federally insured commercial banks.

The valuation of the collateral for the TSLF and the PDCF by the clearer acting for the borrowing primary dealer seems designed to maximise adverse selection. The discount rate penalty cuts were infra-marginal transfer payments from the taxpayers to the shareholders of banks already using or planning to use the discount window facilities. Asking for the decision to pay interest on bank reserves to be brought forward without insisting that required reserves remain non-remunerated likewise represents an unnecessary boon for the banking sector.

III.2a(xii) Cognitive regulatory capture of the Fed by vested interests

In each of the instances where the Fed maximised moral hazard and adverse selection, obviously superior alternatives were available—and not just with the benefit of hindsight. Why did the Fed not choose these alternatives? I believe a key reason is that the Fed listens to Wall Street and believes what it hears; at any rate, the Fed acts as if it believes what Wall Street tells it. Wall Street tells the Fed about its pain, what its pain means for the economy at large and what the Fed ought to do about it. Wall Street’s pain was great indeed—deservedly so in many cases. Wall Street engaged in special pleading by exaggerating the impact on the wider economy of the rapid deleveraging (contraction of the size of the balance sheets) that was taking place. Wall Street wanted large rate cuts

fast to assist it in its solvency repairs, not just to improve its liquidity, and Wall Street wanted the provision of ample liquidity against overvalued collateral. Why did Wall Street get what it wanted?

Throughout the 12 months of the crisis, it is difficult to avoid the impression that the Fed is too close to the financial markets and leading financial institutions, and too responsive to their special pleadings, to make the right decisions for the economy as a whole. Historically, the same behaviour has characterised the Greenspan Fed. It came as something of a surprise to me that the Bernanke Fed, if not quite a clone of the Greenspan Fed, displays the same excess sensitivity to Wall Street concerns.

The main recent evidence of Fed excess sensitivity to Wall Street concerns are, in addition to the list of quasi-fiscal features of the liquidity-enhancing measures listed in Section III.2a(xi), the excessive cumulative magnitude of cuts in the official policy rate since August 2007 (325 basis points), and especially the 75 basis points cut on January 21/22, 2008.

As regards the “panic cut”, the only “news” that could have prompted the decision on January 21, 2008, to implement a federal funds target rate cut of 75 bps, at an unscheduled meeting, and to announce that cut out of normal working hours the next day was the high-frequency movement in stock prices and the palpable fear in the financial sector that the stock market rout in Europe on Monday January 21, 2008 (a US stock market holiday), and at the end of the previous week, would spill over into the US markets.³⁸

To me, both the cumulative magnitude of the official policy rate cuts and their timing provide support for what used to be called the “Greenspan put” hypothesis, but should now be called the “Greenspan-Bernanke put” or “Fed put” hypothesis.³⁹ A complete definition of the “Greenspan-Bernanke put” is as follows: It is the aggressive response of the official policy rate to a sharp decline in asset prices (especially stock prices) and other manifestations of financial sector distress, even when the asset price falls and financial distress (a) are unlikely to cause future economic activity to weaken by more than required to meet the Fed’s mandate and (b) do not convey new information about future

economic activity or inflation that would warrant an interest rate cut of the magnitude actually implemented.

Mr. Greenspan and many other “put deniers” are correct in drawing attention to the identification problems associated with establishing the occurrence of a “Greenspan-Bernanke put.” The mere fact that a cut in the policy rate supports the stock market does not mean that the value of the stock market is of any inherent concern to the policy maker. This is because of the causal and predictive roles of asset price changes. Falling stock market prices reduce wealth and weaken corporate investment; falling house prices reduce the collateral value of residential property and weaken housing investment. Forward-looking stock prices can anticipate future fundamental developments and thus be a source of news.

Nevertheless, looking at the available data as a historian, and constructing plausible counterfactuals as a “laboratory economist,” it seems pretty evident to me that the Fed under both Greenspan and Bernanke has cut rates more vigorously in response to sharp falls in stock prices than can be rationalised with the causal effects of stock prices on household spending and on private investment, or with the predictive content of unexpected changes in stock prices.

Both the 1998 LTCM and the January 21/22, 2008, episodes suggest that the Fed has been co-opted by Wall Street—that the Fed has effectively internalised the objectives, concerns, world view and fears of the financial community. This socialisation into a partial and often distorted perception of reality is unhealthy and dangerous.

It can be called *cognitive regulatory capture* (or *cognitive state capture*), because it is not achieved by special interests buying, blackmailing or bribing their way towards control of the legislature, the executive, the legislature or some important regulator or agency, like the Fed, but instead through those in charge of the relevant state entity internalising, as if by osmosis, the objectives, interests and perception of reality of the vested interest they are meant to regulate and supervise in the public interest.

The literature on regulatory capture, and its big brother, state capture, is vast (see e.g. Stigler, 1971; Levine and Forrence, 1990; Laffont and Tirole, 1991; Hellman, et al., 2000; and Hanson and Yosifon, 2003). Capture occurs when bureaucrats, regulators, judges or politicians instead of serving the public interest as they are mandated to do, end up acting systematically to favour specific vested interests—often the very interests they were supposed to control or restrain in the public interest. The phenomenon is theoretically plausible and empirically well-documented. Its application to the Fed is also not new. There is a long-standing debate as to whether the behaviour of the Fed during the 1930s can be explained as the result of regulatory capture (see e.g. Epstein and Ferguson, 1984, and Philip, et al., 1991).

The conventional choice-theoretic public choice approach to regulatory capture stresses the importance of collective action and free rider considerations in explaining regulatory capture (see Olsen, 1965). Vested interests have a concentrated financial stake in the outcomes of the decisions of the regulator. The general public individually have less at stake and are harder to organise. I prefer a more social-psychological, small group behaviour-based explanation of the phenomenon. Whatever the mechanism, few regulators have succeeded in escaping in a lasting manner their capture by the regulated industry. I consider the hypothesis that there has been regulatory capture of the Fed by Wall Street during the Greenspan years, and that this is continuing into the present, to be consistent with the observed facts.

There is little room for doubt, in my view, that the Fed under Greenspan treated the stability, well-being and profitability of the financial sector as an objective in its own right, regardless of whether this contributed to the Fed's legal macroeconomic mandate of maximum employment and stable prices or to its financial stability mandate. Although the Bernanke Fed has but a short track record, its too often rather panicky and exaggerated reactions and actions since August 2007 suggest that it also may have a distorted and exaggerated view of the importance of financial sector comfort for macroeconomic stability.

III.2b The ECB

The ECB immediately injected liquidity both overnight and at longer maturities on a very large scale indeed, but, at least as regards interbank spreads, with limited success (see Chart 4), and also with no greater degree of success than the Fed or the BoE (but see Section II3b for a caution about the interpretation of the similarity in Libor-OIS spreads). The ECB's injection of €95 billion into the Eurosystem's money markets on August 9, 2007, is viewed by many as marking the start of the crisis.⁴⁰

As regards the effectiveness of its liquidity-enhancing open market interventions on the immediate crisis (as opposed to the likelihood and severity of future crises) the ECB has been both lucky and smart. It was lucky because, as part of the compromise that created the supranational European Central Bank, the set of eligible collateral for open market operations and at the discount window and the set of eligible counterparties, were defined as the union rather than the intersection of the previous national sets of eligible collateral and eligible counterparties.⁴¹

As a result, the ECB could accept as collateral in its repos and at the discount window a very large set of securities, including private securities (even equity) and asset-backed securities like residential mortgage-backed securities. The ratings requirements were also very loose compared to those of the BoE and even those of the Fed: Eligible securities had to be rated at least in the single A category by one or more of the recognised rating agencies. The only dimension in which the ECB's eligible collateral was more restricted than the BoE's was that the ECB only accepts euro-denominated securities. Currently around 1700 banks are eligible counterparties of the Eurosystem for open market operations. The Fed has 20 (the primary dealers) and the BoE 40 (reserve scheme participants); around 2100 banks have access to the ECB's discount window, as against 7500 for the Fed and 60 for the BoE.

The ECB was smart in using the available liquidity instruments quite aggressively, injecting above-normal amounts of liquidity against a wide range of collateral at longer maturities (and mopping most of it up again in

the overnight market). It is important to note that injecting X amount of liquidity at the 3-month maturity and taking X amount of liquidity out at the overnight maturity is not neutral if the intensity of the liquidity crunch is not uniform across maturities. The liquidity crunch that started in August 2007 clearly was not. Maturities of around one month were crucial for end-of-year reasons and maturities from three months to a year were crucial because that was where the markets had seized up completely. The ECB consciously tried to influence Euribor-OIS spreads to the extent that it interpreted these as reflecting illiquidity and liquidity risk rather than credit risk.

No major Euro Area bank has failed so far. Some small German banks fell victim to unwise investments in the ABS markets, and some fairly small hedge funds failed, but no institution of systemic importance was jolted to the point that a special-purpose LLR rescue mission had to be organised.

I have one concern about the nature of the ECB's liquidity-oriented open market operations and about its collateral policy at the discount window. This concerns the pricing of illiquid collateral offered by banks. We know the interest rates and fees charged for these operations, and the haircuts applied to the valuations. But we don't know the valuations themselves. The ECB uses market prices when a functioning market exists. For some of the assets it accepts as collateral there is no market benchmark.

The ECB does not make the mistake the Fed makes in its pricing of the collateral offered at the PDCF and TSLF. The ECB *itself* determines the price/valuation of the collateral when there is no market price. But the ECB does not tell us what these prices are, nor does it put in the public domain the models or methodologies it uses to price the illiquid securities. Requests to ECB Governing Council members and to ECB and NCB officials to publish the models used to price illiquid securities and to publish, with an appropriate delay to deal with commercial sensitivity, the actual valuations of specific, individual items of collateral have fallen on deaf ears.

There is therefore a risk that banks use the ECB as lender of first resort rather than last resort, if the banks can dump low-grade collateral on the Eurosystem and have it valued as high-grade collateral.⁴² Since at least the beginning of 2008, persistent market talk has it that Spanish, Irish and Dutch banks may be in that game, getting an effective subsidy from the Eurosystem and becoming overly dependent on the Eurosystem as the funding source of first choice.

Late May 2008, Fitch Ratings reported that Spanish banks had, during recent months, created ABS, structured to be eligible for use as collateral with the ECB (strictly, with the NCBs that make up the Eurosystem), that were riskier than the ABS structures they put together before the crisis. Accepting higher-credit-risk collateral need not imply a subsidy from the Eurosystem to the banks, as long as the valuation or pricing of these securities for collateral purposes reflects the higher degree of credit risk attached to them. One wonders whether such risk-sensitive pricing is actually taking place, especially when ECB officials publicly worry about the creditworthiness of securities accepted as collateral by the ECB when it provides liquidity to the markets or at the discount window.

Although RMBS backed by mortgages originated by the borrowing bank itself are not eligible as collateral with the Eurosystem, RMBS issued by parties with whom the borrowing bank has quite a close relationship (through currency hedges with the issuer or guarantor of the RMBS or by providing liquidity support for the RMBS).

In principle, the higher credit risk attached to securities for which the borrower and the issuer/guarantor are close (compared the credit risk attached to similar securities issued or guaranteed by a bank that is independent of the borrowing bank) could be priced so as to reflect their higher credit risk. We have no hard information on whether such credit-risk-sensitive pricing actually takes place. I fear that if it were, we would have been told, and that the lack of information is supportive of the view that implicit subsidisation is taking place.

As long as the risk-adjusted rate of return the ECB gets on its loans is appropriate, there is nothing inherently wrong with the ECB taking credit risk onto its balance sheet. But if it routinely values the

mortgage-backed securities offered by the Spanish banks as if the mortgages backing the securities were virtually free of default risk, then the ECB is bound to be overvaluing the collateral it is offered. In the first half of 2008, Spanish commercial banks, heavily exposed to the Spanish construction and real estate sectors, are reported to have repoed at least € 46 billion worth of their assets in exchange for ECB liquidity. Participants in these repo transactions have told me that no mortgages offered to the Eurosystem as collateral have been priced at less than 95 cents on the euro. This seems generous given the dire straits the Spanish economy, and especially the construction and real estate sectors, now are in. Of course, haircuts are (as always) applied to these valuations.⁴³

It is essential that all the information required to verify whether the pricing of collateral accepted by the Eurosystem is subsidy-free be in the public domain. That information is not available today.

Because part of the collateral offered the Eurosystem is subject to default risk, there could be a case for concern even if, *ex ante*, the default risk is appropriately priced. In the event a default occurs (that is, if both the counterparty borrowing from the Eurosystem defaults and at the same time the issuer of the collateral defaults), the Eurosystem will suffer a capital loss. In practice, it would be one of the NCBs of the euro area that would suffer the loss rather than the ECB, as repos are conducted by the NCBs.

Although the ECB's balance sheet is small and its capital tiny, the consolidated Eurosystem has a huge balance sheet and a large amount of capital (see Table 6). The balance sheet could probably stand a fair-sized capital loss. But there always is a capital loss so large that it would threaten the ability of the Eurosystem to remain solvent while adhering to its price stability mandate. The ECB/Eurosystem would need to be recapitalised, but by which national fiscal authorities and in which proportions? Unlike the Fed and the BoE, where it is clear which fiscal authority stands behind the central bank, that is, stands ready to recapitalise the central bank should the need arise, the fiscal vacuum within which the ECB, and to some degree the rest of the Eurosystem also, operate leaves a question mark behind the question: Who would bail out the ECB?

This question may not yet be urgent now, because even euro area banks with large cross-border activities still tend to have fairly clear national identities. But this is changing. Banca Antonveneta, the fourth largest Italian bank, was owned by ABN-AMRO, a Dutch bank which is now in turn owned by Royal Bank of Scotland (UK), Fortis (Belgium) and Santander (Spain).⁴⁴ Would the Italian Treasury bail out Banca Antonveneta? Soon there will be banks incorporated not under national banking statutes but under European law, as *Societas Europaea*. One large German financial group with banking interests, Allianz, has already done so. Given this uncertainty, it may be understandable that ECB officials are more concerned than Fed and BoE officials about carrying credit risk on the Eurosystem's balance sheet.

Although the ECB has done well in its MMLR function, albeit with the major caveat as regards the pricing of illiquid collateral, its LLR ability has not yet been tested. This is perhaps just as well. The ECB has no formal supervisory or regulatory role vis-à-vis euro area banks. The Treaty neither rules out such a role nor does it require one. In practice, no regulatory and supervisory role for the ECB has as yet evolved. Banking sector regulation and supervision in the euro area is a mess. In some countries the central bank is regulator and supervisor. Spain, France, Ireland and the Netherlands are examples. In others the central bank shares these roles with another agency. Germany is an example with the Bundesbank and BaFin (the German Financial Supervisory Authority) sharing supervisory responsibilities.⁴⁵ In yet other countries the central bank has no regulatory and supervisory role at all. Austria and Belgium are examples.

Since the crisis started, the ECB has complained regularly, and at times even publicly, about the lack of information it has at its disposal about potentially systemically important individual institutions. In the case of some euro area national regulators, there even exist legal obstacles to sharing information with the ECB. Compared to the Fed and the BoE, the ECB is therefore very close to the BoE which, when the crisis started, had essentially no individual institution-specific information at its disposal. The Fed, with its (shared) regulatory and supervisory role, has better information.

On the other hand, the ECB appears much less moved by the special pleading emanating from the euro area financial sector than the Fed appears to be by Wall Street. This is not surprising. Without a supervisory or regulatory role over euro area financial institutions and markets, regulatory capture is less likely.

III.2c The BoE

As regards the fulfilment of its LLR and MMLR functions, the BoE missed the boat completely at the beginning of the crisis. This state of affairs lasted till about November 2007. Indeed, the Governor of the BoE did not, as far as I have been able to ascertain, use in public the words “credit crunch,” “liquidity crisis” or equivalent words until March 26, 2008 (King, 2008).

The UK turned out, when the run on Northern Rock started on September 15, 2007, to have no effective deposit insurance scheme. The amounts insured were rather low (up to £30,000) and had a 10 percent deductible after the first £2,000. Worse, it could take up to six months to get your money out, even if it was insured. This is supposed to be corrected by new legislation and institutional reform.

The BoE also turned out to be hopelessly (and quite unnecessarily) confused about what its legal powers and constraints were in the exercise of its LLR role. The Governor, for instance, argued on September 20, 2007, before the House of Commons Treasury Committee, that legislation introduced under an EU directive (the Market Abuse Directive) prevented covert support to individual institutions (the BoE had received legal advice to this effect). Since then what always was apparent to most has become apparent to all: Neither the MAD nor the UK’s transposition of that Directive into domestic law prevented the kind of covert support the BoE would have liked to offer to Northern Rock. Finally, there was no Special Resolution Regime for banks in the UK. There was therefore just the choice between the regular corporate insolvency regime and nationalisation. On February 18, 2008, the Chancellor announced the nationalisation of Northern Rock.

The BoE's performance as lender of last resort, including its covert role in orchestrating private sector support for individual troubled institutions, was much more effective when Bradford & Bingley (a British mortgage lender whose exposure to the wholesale markets was second only to that of Northern Rock) got into heavy weather with a rights issue in May and June 2008.⁴⁶ Neither Northern Rock nor Bradford & Bingley were in any sense systemically important institutions, but when HBOS, the fourth largest UK banking group by market capitalisation experienced trouble with its £4 billion rights issue (announced in April 2008), during June and July 2008, systemic stability was clearly at stake. The BoE and the banking and financial sector regulator, the Financial Services Authority (FSA), helped keep the underwriters on board.

As noted earlier, both at its discount window (the standing lending facility) and in repos, the BoE only accepted (and accepts) the narrowest possible kind of collateral (UK sovereign debt or better). This made it impossible for the BoE to offer effective liquidity support when markets froze.

For a long time, the BoE spoke in public as if it believed that what the banks were facing was essentially a solvency problem, with no material contribution to the financial distress coming from illiquid markets and from illiquid but solvent institutions (see e.g. the paper submitted to the Treasury Committee by Mervyn King on September 12, 2007, the day before the Northern Rock crisis blew up [King, 2007]).

When the crisis started, the BoE injected liquidity on a modest scale, at first only in the overnight interbank market. Rather late in the day, on September 19, 2007, it reversed this policy and offered to repo at three-month maturity, and against a wider than usual range of eligible collateral, including prime mortgages, but subject to an interest rate floor 100 basis points above Bank Rate, that is, effectively at a penalty rate, regardless of the quality of the collateral. No one came forward to take advantage of this facility; fear of being stigmatised may have been as important a deterrent as the penalty rate charged.

The Bank was extremely reluctant to try to influence, let alone target, interest rates at maturities longer than the overnight rate. It is true that, when markets are orderly and liquid, the authorities cannot independently set more than one rate on the yield curve. When the BoE sets the overnight rate, this leaves rates at all longer maturities to be market-determined, that is, driven by fundamentals such as market expectations of future official policy rates and default risk premia. When markets are disorderly and illiquid, however, there is a term structure of liquidity risk premia in addition to a term structure of default-risk-free interest rates and a term structure of default risk premia. It is the responsibility of the central bank, as MMLR, to provide the public good of liquidity in the amounts required to eliminate (most of) the liquidity risk premia at the maturities that matter (anything between overnight and one year).

Early in the crisis, the BoE's public statements suggested that it interpreted most the spread between Libor and the OIS rate at various maturities as default risk spreads rather than, at least in part, as liquidity risk spreads. Later during the crisis, in February 2008, the BoE published, in the February Inflation Report (Bank of England, 2008), a decomposition of the one-year Libor-OIS spread between a default risk measure (extracted from CDS spreads) and a liquidity premium (the residual). It concluded that although early in the crisis most of the Libor-OIS spread was due to liquidity premia, towards the end of the sample period the importance of default risk premia had increased significantly.

The decomposition is, unfortunately, flawed because the CDS market throughout the crisis has itself been affected significantly by illiquidity. The paper is, however, of interest as evidence of the evolving and changing views of the BoE as to the empirical relevance of liquidity crises. This changing view was also reflected in an evolving policy response. The BoE gradually began to act as a MMLR.

At the end of 2007, the BoE initiated a number of special auctions at one-month and three-month maturities against a wider range of collateral, including prime mortgages and securities backed by mortgages.

On April 21, 2008, the BoE announced the creation of the Special Liquidity Scheme (SLS), in the first instance for £100 billion, which would lend Treasury bills for one year to banks against collateral that included RMBS, covered bonds (that is, collateralised bonds) and ABS based on credit card receivables. Technically, the arrangement was described as a swap, although it can fairly be described as a one-year collateralised loan of Treasury bills to the banks. It is similar to the TSLF created for primary dealers in the US, although the maturity of the loans is longer (one year as against one month in the US).

The BoE has made much of the fact that the SLS will only accept as collateral securities backed by “old” mortgages, that is, mortgages issued before the end of 2007. The facility is meant to solve the “stock overhang” problem but not to encourage the banks to engage in new mortgage lending using the same kind of RMBS that have become illiquid. It is, however, not obvious that without the government (not necessarily the BoE) lending a hand, securitisation of new mortgages will get off the ground any time soon.

Accepting new mortgage-backed securities as collateral in repos might help revive sensible forms of securitisation, if the mortgages backing the securities satisfy certain verifiable criteria (loan to value limits, income and financial health verification for borrowers, no track record of loan default, etc.). It is true that in the UK, and *a fortiori* in the US, there was, prior to the summer of 2007, securitisation of home loans that ought never to have been made, including many of the US subprime loans. But the fact that, during the year since August 2007, there have been just two new residential mortgage-backed issues in the markets in the UK, suggests that the securitisation baby has been thrown out with the subprime bathwater. These securities should, of course, be valued aggressively if offered as collateral in repos, to avoid subsidies to home lenders or home borrowers.

The BoE itself determines the valuation of any illiquid assets offered as collateral in the SLF. This should help it avoid the adverse selection problem created by the Fed with its PDCF and TSLF. The haircuts and other terms of the SLS were also quite punitive, judging from the howls of anguish emanating from the banking community, who nevertheless make ample use of the Facility. As with the Fed and the ECB,

the BoE does not make public any information about the actual pricing of specific collateral or about the models used to set these prices. Without that information, we cannot be sure there is no subsidy to the banks involved in the arrangement. There can also be no proper accountability of the BoE to Parliament or to the public for the management of public funds involved.

It is clear that the so-called Tripartite Arrangement between the Treasury, the BoE and the FSA did not work. It is also clear, however, that these are the three parties that must be involved and must cooperate to achieve financial stability. The central bank has the short-term liquid deep pockets and the market knowledge. The Treasury, backed by the taxpayer, has the long-term deep non-inflationary pockets. The FSA has the individual institution-specific knowledge. The problems in the UK had more to do with failures in the legal framework (deposit insurance, lender of last resort immunities, the insolvency regime and SRR for banks) than with poor communication and cooperation between the central bank, the regulator and the Treasury.

IV. Conclusion

Following a 15-year vacation in inflation targeting land with hardly a hint of systemic financial instability, the central banks in the North Atlantic region were, in the middle of 2007, faced with the unpleasant combination of a systemic financial crisis, rising inflation and weakening economic activity. Fighting three wars at the same time was not something the central banking community was prepared for. The performance of the central banks considered in this paper, the Fed, the ECB and the BoE, ranged, not surprisingly, from not too bad (the ECB) to not very good at all (the Fed).

As regards macroeconomic stability, the interest rate decisions of the Fed are hard to rationalise in terms of its official mandate (sustainable growth/employment and price stability). This is not the case for the ECB and the BoE, with their lexicographic price stability mandates. The excessively aggressive interest rate cuts of the Fed reflect political pressures (the Fed is the least operationally independent of the three central bank), excess sensitivity to financial sector concerns (reflecting

cognitive regulatory capture) and flaws in the understanding of the transmission mechanism by key members of the FOMC.

As regards financial stability, an ideal central bank would have combined the concern about moral hazard of the BoE with the broad sets of eligible counterparties and eligible instruments that enabled the ECB, right from the start of the crisis, to be an effective market maker of last resort, and the institution-specific knowledge that made the Fed an effective lender of last resort. The reality has been that the BoE mismanaged liquidity provision as market maker of last resort and as lender of last resort early in the crisis, and that the Fed has created moral hazard in an unprecedented way.

Until the public is informed in detail about the way the three central banks price the illiquid collateral they are offered (at the discount window, in repos, and at any of the many facilities and schemes that have been created), there has to be a concern that all three central banks (and therefore indirectly the taxpayers and beneficiaries of other public spending) may be subsidising the banks through these LLR and MMLR facilities. This concern is most acute as regards the Fed, whose valuation procedures at the TSLF and PDCF are an open invitation to adverse selection.

As regards the desirability of institutionally combining or separating the roles of the central bank (as lender of last resort and market maker of last resort) and that of regulator and supervisor for the financial sector, we are between a rock and a hard place. A regulator and supervisor (like the Fed) is more likely to have the institution-specific information necessary for the effective performance of the LLR role. However, regulatory capture of the regulator/supervisor is likely.

Central banks without regulatory or supervisory responsibilities like the BoE (for the time being) and the ECB are less likely to be captured by vested financial sector interests. But they are also less likely to be well-informed about possible liquidity or solvency problems in systemically important financial institutions. There is unlikely to be a fully satisfactory solution to the problem of providing central banks with the information necessary for effective discharge of their LLR responsibility without at the same time exposing them

to the risk of regulatory capture. The best safeguards against capture are openness and accountability. It is therefore most disturbing that all three central banks are pathologically secretive about the terms on which financial support is made available to struggling institutions and counterparties.

Taking the official policy rate-setting decision away from the central bank may reduce the damage caused by regulatory capture of the central bank by financial sector interests. Moving the rate setting authority out of the central bank could therefore be especially desirable if the central bank is given supervisory and regulatory powers.

The market maker of last resort has the same position in relation to market liquidity for a transactions-oriented system of financial intermediation, as is held by the lender of last resort in relation to funding liquidity for a relationships-oriented system of financial intermediation. The central bank is the natural entity to fulfill both the LLR and MMLR functions.

There is an efficiency-based case for government intervention to support illiquid markets or instruments and to support illiquid but solvent financial institutions that are deemed systemically important. As the source of ultimate domestic-currency liquidity, the central bank is the natural agency for performing both the market maker of last resort and the lender of last resort function. Liquidity is a public good that can be provided privately, but only inefficiently.

There is also an efficiency-based case for government intervention to support insolvent financial institutions that are deemed systemically important. This, however, should not be the responsibility of the central bank.

The central bank should not be required to provide subsidies, either through liquidity support or any other way, to institutions known to be insolvent. If institutions deemed to be solvent turn out to be insolvent, and if the central bank as a result of financial exposure to such institutions suffers a loss, this should be compensated forthwith by the Treasury, whenever such a loss would impair the ability of the central bank to pursue its macroeconomic stability objectives.

It would be even better if any securities purchased outright by the central bank or accepted as collateral in repos and other secured transactions that are not completely free of default risk, were to be transferred immediately to the balance sheet of the Treasury (say through a swap for Treasury Bills, at the valuation put on these risky securities when they were acquired by the central bank). That way, the division of labour and responsibilities between liquidity management and insolvency management (or bailouts) is clear. Each institution can be held accountable to Parliament/Congress for its mandate. If the central bank plays a quasi-fiscal role, that clarity, transparency and accountability becomes impaired.

Central banks can effectively perform their market maker of last resort function by expanding traditional open market operations and repos. This means increasing the volumes of their outright purchases or loans and extending their maturity, at least up to a year in the case of repos. It means extending the range of eligible counterparties to include all institutions deemed systemically important (too large or too interconnected to fail). It also means extending the range of securities eligible for outright purchase or for use as collateral to include illiquid private securities.

Regulatory instruments should be used to address financial asset market bubbles and credit booms. Specifically, supplementary capital requirements and liquidity requirements should be imposed on all systemically important highly leveraged institutions—commercial banks, investment banks, hedge funds, private equity funds or whatever else they are called or will be called. These supplementary capital and liquidity requirements could either be managed by the central bank in counter-cyclical fashion or be structured as automatic financial stabilisers, say by making them increasing functions of the recent historical growth rates of the value of each firm's assets.

To minimise moral hazard (incentives for excessive risk-taking in the future) all institutions that are eligible counterparties in MMLR operations and/or users of LLR facilities should be regulated according to common principles and should be subject to a common Special Resolution Regime allowing for Prompt Corrective Action,

including the condition of regulatory insolvency and the possibility of nationalisation.

All securities purchased outright or accepted as collateral should be priced punitively to minimize moral hazard. If necessary, the central bank should organise reverse auctions to price securities for which there is no market benchmark.

The creation and proliferation of obscure and opaque financial instruments can be discouraged through the creation of a positive list (regularly updated) of securities that will be accepted by the central bank as collateral at its MMLR and LLR facilities. Securities that don't appear on the list can be expected to trade at a discount relative to those that do.

Finally, for those whose attention span is the reciprocal of the length of this paper, some do's and don'ts for central banks.

Assign specific tools to specific tasks or objectives.

1. Assign the official policy rate to the macroeconomic stability objective(s).
 - Do not use the official policy rate as a liquidity management tool or as a quasi-fiscal tool to recapitalise banks and other highly leveraged entities.
2. Assign regulatory instruments to the damping of asset price bubbles.
 - Do not use the official policy rate to target asset price bubbles in their own right.
3. Assign liquidity management tools, including the lender-of-last-resort and market-maker-of-last-resort instruments, to the pursuit of financial stability for counterparties believed to be solvent.
4. Use explicit fiscal tools (taxes and subsidies) and on-budget and on-balance-sheet fiscal resources for strengthening the capital adequacy of systemically important institutions.
 - Do not use the central bank as a quasi-fiscal agent of the Treasury.

5. Use regulatory instruments and the punitive pricing of liquidity to mitigate moral hazard.

This past year has been the first since I left the Monetary Policy Committee of the BoE that I really would have liked to be a central banker.

Author's note: I would like to thank my discussants, Alan Blinder and Yutaka Yamaguchi, for helpful comments, and the audience for its lively participation. Alan's contribution demonstrated that you can be both extremely funny and quite wrong on the substance of the issues. This paper builds on material written, in a variety of formats, since April 2008. I would like to thank Anne Sibert, Martin Wolf, Charles Goodhart, Danny Quah, Jim O'Neill, Erik Nielsen, Ben Broadbent, Charles Calomiris, Stephen Cecchetti, Marcus Miller and John Williamson for many discussions of the ideas contained in this paper. They are not responsible for the end product. The views expressed are my own. They do not represent the views of any organisation I am associated with.

Endnotes

¹The official inflation targets are 2.0 percent *per annum* for the BoE and just below 2.0 percent for the ECB, both for the CPI. I assume the Fed's unofficial centre for its PCE deflator inflation comfort zone to be 1.5 percent. Given the recent historical wedge between US PCE and CPI inflation, this translates into an informal Fed CPI inflation target of just below 2.0 percent.

²The long-term inflation expectations data for the euro area should be taken with a pinch of salt. The reported euro area survey-based inflation expectations are the predictions of professional forecasters rather than those of a wider cross-section of the public, as is the case for the US and UK data (see European Central Bank, 2008). The euro area professional forecasters are either very trusting/gullible or know much more than the rest of us, as their 5-years-ahead forecast flat-lines at the official target throughout the sample, despite a systematic overshooting of the target in the sample. Using market-based estimates of inflation expectations, either break-even inflation rates from nominal and index-linked public debt or inflation expectations extracted from inflation swaps, would not be informative during periods of illiquid and disorderly financial markets. Even if the markets for these instruments themselves remain liquid, the yields on these instruments will be distorted by illiquidity elsewhere in the system.

³The Federal Reserve Act, Section 2a. Monetary Policy Objectives, states: "The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." [12 USC 225a. As added by act of November 16, 1977 (91 Stat. 1387) and amended by acts of October 27, 1978 (92 Stat. 1897); Aug. 23, 1988 (102 Stat. 1375); and Dec. 27, 2000 (114 Stat. 3028)].

⁴I can therefore avoid addressing the anomaly (putting it politely) of the exchange rate, foreign exchange reserves and foreign exchange market intervention being under Treasury authority in the US (with the Fed acting as agent for the Treasury), or of the Council of Ministers of the EU (or perhaps of the euro area?) being able to give "exchange rate orientations" to the ECB. Clearly, in a world with unrestricted international mobility of financial capital, setting the exchange rate now and in the future effectively determines the domestic short risk-free nominal interest rate as a function of the foreign short risk-free nominal interest rate (there will be an exchange rate risk premium or discount unless the path of current and future exchange rates is deterministic). If the US Treasury were really determined to manage the exchange rate, the Fed would only have an interest rate-setting role left to the extent that the US economy is large enough to influence the world short risk-free nominal interest rate.

⁵The non-negativity constraint on the nominal yield of non-monetary securities is the result of (a) the arbitrage requirement that the yield on non-monetary instruments, i , cannot be less than the yield on monetary securities, i^M , that is, $i \geq i^M$ and (b) the practical problems of paying any interest at all on currency, that is, $i^M \approx 0$. This is because currency is a negotiable bearer bond. Paying interest, positive or negative, on negotiable bearer securities, while not impossible, is administratively awkward and costly. This problem does not occur in connection with the payment of interest, positive or negative, on the other component of the monetary base, bank reserves held with the central bank. Reserves held with the central bank are “registered” financial instruments. The issuer knows the identity of the holder. Paying interest, at a positive or negative rate, on reserves held with the central bank is trivially simple and administratively costless. Charging a negative nominal interest rate on borrowing from the central bank (secured or unsecured, at the discount window or through open market operations) is also no more complicated than paying a positive nominal interest rate. If the practical reality that paying (negative) interest on currency is not feasible or too costly sets a zero floor under the official policy rate, this would, in my view be a good argument for doing away with currency altogether (see Buiter and Panigirtzoglou, 2003).

Various forms of E-money provide near-perfect substitutes for currency, even for low income households. The existence of currency is, because of the anonymity it provides, a boon mainly to the grey and black economy and to the outright criminal fraternity, including those engaged in tax evasion, money laundering and terrorist financing. The Fed has reduced its subsidisation of such illegality and criminality by restricting its largest denomination currency note to \$100. The ECB practices no such restraint and competes aggressively for the criminal currency market with €200 and €500 denomination notes. When challenged on this, the ECB informs one that this is because in Spain people like to make housing transactions in cash. I am sure they do. With the collapse of the Spanish housing market, this argument for issuing euro notes in denominations larger than €20 at most, may now have lost whatever merit it had before.

⁶The complete list includes gilts (including gilt strips), sterling Treasury bills, BoE securities, HM Government non-sterling marketable debt, sterling-denominated securities issued by European Economic Area central governments and major international institutions, euro-denominated securities (including strips) issued by EEA central governments and central banks and major international institutions where they are eligible for use in Eurosystem credit operations, all domestic currency bonds issued by other sovereigns eligible for sale to the Bank. These sovereign and supranational securities are subject to the requirement that they are issued by an issuer rated Aa3 (on Moody’s scale) or higher by two or more of the ratings agencies (Moody’s, Standard and Poor’s, and Fitch).

⁷The three-month OIS rate is the fixed leg of a three-month swap whose variable leg is the overnight secured lending rate. This can be interpreted (ignoring inflation risk premia) as the market’s expectation of the official policy rate over a three-month horizon.

⁸Most of the RMBS issue by Alliance & Leicester was bought by a single Continental European bank. It is therefore akin to a private sale rather than a sale to market sale to non-bank investors.

⁹Macroeconomic theory, unfortunately, has as yet very little to contribute to the key policy issue of liquidity management. The popularity of complete contingent markets models in much of contemporary macroeconomics, both New Classical (e.g. Lucas, 1975), Lucas and Stokey (1989) and New Keynesian (e.g. Woodford, 2003) means that in many (most?) of the most popular analytical and calibrated (I won't call them empirical) macroeconomic dynamic stochastic general equilibrium models, the concept of liquidity makes no sense. Everything is perfectly liquid. Indeed, with complete contingent markets there is never any default in equilibrium, because every agent always satisfies his intertemporal budget constraint. All contracts are costlessly and instantaneously enforced. *Ad hoc* cash-in-advance constraints on household purchases of commodities or on household purchases of commodities and securities don't create behaviour/outcomes that could be identified with liquidity constraints.

The legal constraint that labour is free (slavery and indentured labour are illegal) means that future labour income makes for very poor collateral, and that workers cannot credibly commit themselves not to leave an employer, should a more attractive employment opportunity come along. This can perhaps be characterised as a form of illiquidity, but it is a permanent, exogenous illiquidity, almost technological in nature. Much of the theoretical (partial equilibrium) work on illiquidity likewise deals with the consequences of different forms of exogenous illiquidity rather than with the endogenous illiquidity problem that suddenly paralysed many asset-backed securities markets starting in the summer of 2007. The profession entered the crisis equipped with a set of models that did not even permit questions about market liquidity to be asked, let alone answered.

Much of macroeconomic theorising of the past thirty years now looks like a self-indulgent working and re-working to death of an uninteresting and practically unimportant special case. Instead of starting from the premise that markets are complete unless there are strong reasons for assuming otherwise, it would have been better to start from the position that markets don't exist unless very special institutional and informational conditions are satisfied. We would have a different, and quite possibly more relevant, economics if we had started from markets as the exception rather than the rule, and had paid equal attention to alternative formal and informal mechanisms for organising and coordinating economic activity. My personal view is that over the past 30 years, we have had rather too much Merton (1990) and rather too little Minsky (1982) in our thinking about the roles of money and finance in the business cycle.

¹⁰The label "market maker of last resort" is more appropriate than the alternative "buyer of last resort," because so much of the MMLR's activity turns out to be in collateralised transactions, especially repos, rather than in outright purchases. A

repo is, of course a *sale and repurchase* transaction, so the label “buyer of last resort” would not have been descriptively correct.

¹¹The Switzerland-domiciled part of the Swiss banking system (as distinct from the foreign subsidiaries which may have access to LLR and MMLR facilities in their host countries) probably owes its competitive advantage less to conventional banking prowess as to the bank secrecy it provides to the global community of tax evaders and others interested in hiding their income and assets from their domestic authorities.

¹²For a conflicting and very positive appraisal of the Greenspan years see Blinder and Reis (2005).

¹³In the case of the Fed, the legal restrictions on paying interest on reserves (about to be abolished) are a further obstacle to sensible practice.

¹⁴For descriptive realism, I assume $\dot{z}^M=0$.

¹⁵Note that $E_t E_{t-1} I_{t,t-1} = E_{t-1} I_{t,t-1} = \frac{1}{1+i_t}$.

¹⁶Central bank current expenses C^b can at most be cut to zero.

¹⁷Source: IMF <http://www.imf.org/external/np/stal/ir/8802.pdf>.

¹⁸A footnote in the Federal Reserve Bulletin (2008) informs us that “This balancing item is not intended as a measure of equity capital for use in capital adequacy analysis. On a seasonally adjusted basis, this item reflects any differences in the seasonal patterns estimated for total assets and total liabilities.” That is correct as regards the use of this measure in regulatory capital adequacy analysis. For economic analysis purposes it is, however, as close to \mathbb{W} as we can get without a lot of detailed further work.

¹⁹The example of the failure of the Amaranth Advisors LLC hedge fund in September 2006 suggests that AUM of US\$9 billion is no longer “large.”

²⁰Levin, Onatski, Williams and Williams (2005) contains some support for this view. They report the finding that the performance of the optimal policy in a “microfounded” model of a New-Keynesian closed economy with capital formation, assumed to represent the US, is closely matched by a simple operational rule that focuses solely on stabilizing nominal wage inflation. Admittedly, there is no financial sector or financial intermediation in the model, the model is (log-)linear and the disturbances are (I think) Gaussian. But the optimal monetary policy is derived by optimising the (non-quadratic) preferences of the representative household and there is Brainard-type parameter uncertainty about 31 parameters.

²¹My cats, however, do indeed have fat tails, so there may be new areas of application for the PP.

²²Non-linearities abound in even the simplest monetary model. To name but a few: the non-negativity constraint on the nominal interest rate; the non-negativity

constraint on gross investment; positive subsistence constraints on consumption; borrowing constraints; the financial accelerator (Bernanke and Gertler, 1989; Bernanke, Gertler and Gilchrist, 1999; Bernanke, 2007); local hysteresis due to sunk costs; any model in which (a) prices multiply quantities and (b) asset dynamics are constrained by intertemporal budget constraints. Although the time series used by econometricians are short (at most a couple of centuries for most quantities; a bit longer for a very small number of prices), the estimated residuals often exhibit both skew and kurtosis. From other applications of dynamic stochastic optimisation we know that different non-linearities generated huge differences in the optimal decision rule. In the theory of optimal investment under uncertainty, strictly convex costs of capital stock adjustment make gradual adjustment of the capital stock optimal. Sunk costs of investment and disinvestment make for “bang-bang” optimal investment rules and for “zones of inaction.” For an exploration of some of the implications of uncertainty for optimal monetary policy outside the LQG framework, see the collection of articles in Federal Reserve Bank of St. Louis *Review* (2008).

²³In the previous statement I hold constant (independent of the individual household’s consumption vs. saving decision) the future expected and actual sequence of after-tax labour income, profits, interest rates and asset prices. In a Keynesian, demand-constrained equilibrium, the aggregation of the individual consumption choices, now and in the future, will in general affect the equilibrium levels of output, employment, interest rates and asset prices.

²⁴At the request of Anil Kashyap, I here provide the relevant quotes. I omitted them in the version presented at the Symposium because I felt there was no need to “rub in” the errors. All that matters is that this shared analytical error may well have led to an excessively expansionary policy by the Fed.

Bernanke (2007): *“If the financial accelerator hypothesis is correct, changes in home values may affect household borrowing and spending by somewhat more than suggested by the conventional wealth effect because changes in homeowners’ net worth also affect their external finance premiums and thus their costs of credit.”*

Kohn (2006): *“Between the beginning of 2001 and the end of 2005, the constant-quality price index for new homes rose 30 percent and the purchase-only price index of existing homes published by the Office of Federal Housing Enterprise Oversight (OFHEO) increased 50 percent. These increases boosted the net worth of the household sector, which further fueled (sic) the growth of consumer spending directly through the traditional ‘wealth effect’ and possibly through the increased availability of relatively inexpensive credit secured by the capital gains on homes.”*

Kroszner (2005): *“As some of the ‘froth’ comes off of the housing market—thereby reducing the positive ‘wealth effect’ of the strength in the housing sector—and people fully adjust to higher energy prices, I see the growth in real consumer spending inching down to roughly 3 percent next year.”*

Kroszner (2008): “*Falling home prices can have local and national consequences because of the erosion of both property tax revenue and the support for consumer spending that is provided by household wealth.*”

Mishkin (2008a, p.363): “*By raising or lowering short-term interest rates, monetary policy affects the housing market, and in turn the overall economy, directly and indirectly through at least six channels: through the direct effects of interest rates on (1) the user cost of capital, (2) expectations of future house-price movements, and (3) housing supply; and indirectly through (4) standard wealth effects from house prices, (5) balance sheet, credit-channel effects on consumer spending, and (6) balance sheet, credit channel effects on housing demand.*”

Mishkin (2008a, p. 378): “*Although FRB/US does not include all the transmission mechanisms outlined above, it does incorporate direct interest rate effects on housing activity through the user cost of capital and through wealth (and possibly credit-channel) effects from house prices, where the effects of housing and financial wealth are constrained to be identical.*”

Plosser (2007): “*Changes in both home prices and stock prices influence household wealth and therefore impact consumer spending and aggregate demand.*”

Plosser (2007): “*To the extent that reductions in housing wealth do occur because of a decline in house prices, the negative wealth effect may largely be offset for many households by higher stock market valuations.*”

²⁵The technically excellent recent paper by Kiley (2008) is therefore, as regards the usefulness of core inflation as the focus of the price stability leg of the Fed’s dual mandate, completely beside the point. It shows that, if you want to predict future headline inflation *and* you restrict your data set to current and past headline inflation and core inflation, you should definitely make use of the information contained in the core inflation data. But who would predict or target future inflation making use only of current and past headline and core inflation data?

²⁶A nation’s primary deficit is its current account deficit, excluding net foreign investment income or, roughly, the trade deficit plus net grant outflows.

²⁷In part, it may also be a peso-problem or “fake alpha” phenomenon, that is, the higher expected return is a compensation for risk that has not (yet) materialised. The market is aware of the risk, and prices it, but the econometrician has insufficient observations on the realisation of the risk in his sample.

²⁸A boost to public spending on goods and services or measures to stimulate domestic capital formation would help sustain demand but would prevent the necessary correction of the external account.

²⁹To avoid getting hoist immediately on my own “housing wealth isn’t wealth” petard, assume that the value of the first home equals the present value of the remaining lifetime housing services the homeowner plans to consume. At the end

of the exercise, the reader can decide for him or herself whether this economy contains a non-homeowning renter who may be better off as the result of the fall in the price of the second home. To make the example work as stands, the second home should be a buy-to-let purchase aimed at the foreign tourist trade.

³⁰The open letter procedure is a useful part of the communication and accountability framework of the BoE. It requires the Governor to write an open letter to the Chancellor whenever the inflation rate departs by more than 1 percent from its target (in either direction). In that open letter, the Governor, on behalf of the Monetary Policy Committee (MPC) gives the reasons for the undershoot or overshoot of the inflation target, what the MPC plans to do about it, how long it is expected to take until inflation is back on target and how all this is consistent with the Bank's official mandate. The current inflation target is an annual inflation rate of 2 percent for the Consumer Price Index (CPI). With actual year-on-year inflation at 3.3 percent in May 2008, an open letter (the second since the creation of the MPC in 1997) was due.

³¹\$120 per barrel would be a 240 percent increases in the 20-year average real price of oil for the US and a 170 percent increase for the euro area.

³²Perhaps the Treasury sets it? See endnote 4.

³³Complementary in the sense that an increase in the energy input raises the marginal products of labour and capital.

³⁴The TSLF is a single-price auction, where accepted dealer bids will be awarded at the same fee rate, which is equal to the lowest fee rate at which any bid was accepted. Dealers may submit two bids for the basket of eligible general Treasury collateral at each auction.

³⁵Schedule 1 collateral is all collateral eligible for tri-party repurchase agreements arranged by the Open Market Trading Desk (that is, all collateral acceptable in regular Fed open market operations). Schedule 2 collateral is all Schedule 1 collateral plus AAA/Aaa-rated Private-Label Residential MBS, AAA/Aaa-rated Commercial MBS, Agency CMOs and other AAA/Aaa-rated ABS.

³⁶It is revalued daily to ensure that, should the value of the collateral have declined, the primary dealer puts up the additional collateral required to restore the required level of collateralisation. With a well-designed revaluation mechanism, such "margin calls" do, of course, make sense.

³⁷http://www.newyorkfed.org/markets/pdcf_terms.html.

³⁸Apparently the French central bank President had not bothered to inform his US counterpart that a possible reason behind the stock market rout in Europe could be the manifestation of the stock sales prompted by the discovery at the Société Générale of Mr. Kerviel's exploits. If true it is extraordinary.

³⁹The term was coined as a characterisation of the interest rate cuts in October and November 1998 following the collapse of Long-Term Capital Management (LTCM).

⁴⁰Short-term credit markets froze up after the French bank BNP Paribas suspended withdrawals from three investment funds/hedge funds it owned, citing problems in the US subprime mortgage sector. BNP said it could not value the assets in the funds, because the markets for pricing the assets had disappeared.

⁴¹Eleven countries joined together to form the Eurosystem on January 1, 1999. There are 15 euro area members now and 16 on January 1, 2009, when Slovakia joins.

⁴²The probability of default on a collateralised loan like a repo is the joint probability of both the borrowing bank defaulting and the issuer of the security used as collateral defaulting. The probability of such a double default will be low but not zero under current circumstances. It may be quite high, when RMBS are offered as collateral, if the borrowing bank is also the bank that originated the mortgages backing the RMBS.

⁴³Between August 2007 and July 2008, the share of Spanish banks in the Eurosystem's allocation of main refinancing operations and longer-term refinancing operations went up from about 4 percent to over 10.5 percent. The share of Irish banks went up from around 4.5 percent to 9.5 percent. It cannot be a coincidence that Spain and Ireland are the euro area member states with the most vulnerable construction and real estate sectors. Another measure of the increase in the scale of the Eurosystem's lending to the Spanish banks since the beginning of the crisis in August 2007, is the value of the monthly loans extended to Spanish banks by the Banco de España. This went from a low of about €23 billion in August 2007 to a high of more than €75 billion in December 2007 (for those worried about seasonality, the December 2006 figure was just under €30 billion).

⁴⁴On May 30, 2008, Banco Santander sold Antonveneta to Banca Monte dei Paschi di Siena, an Italian bank, so the fiscal backing question mark raised by the takeovers highlighted in the main text has been erased again. This does not affect the relevance of the point that with foreign-owned banks, operating in many jurisdictions, it is not obvious which national fiscal authorities will foot the fiscal cost of a bailout. The point applies across the world, but is especially pressing for the euro area, where a supranational central bank operates alongside 15 national fiscal authorities and no supranational fiscal authority.

⁴⁵BaFin is short for Bundesanstalt für Finanzdienstleistungsaufsicht.

⁴⁶Bradford & Bingley's £400 million cash call closed on Friday, August 15, 2008. The six high street banks that, at the prompting of the BoE and the Financial Services Authority, had agreed to underwrite the rights issue are likely to be left with sizeable unplanned stakes in B&B.

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Commentary: Central Banks and Financial Crises

Alan S. Blinder

Buiter papers don't pull punches. They have attitude. They often feature an alluring mix of brilliant insights and outrageous statements. And they tend to be verbose. This tome displays all those traits. But since it runs 141 pages, I have about 6 seconds per page. So I must be selective. I will therefore concentrate on two big issues: Generically, what are the proper functions of a central bank? Specifically, has the Fed's performance in this crisis really been that bad? Starting with the second.

Does the Fed deserve such low marks?

Willem's critique of the Fed boils down to saying it was both too soft-hearted and extremely muddled in its thinking. Its attempts to avoid painful adjustments that were necessary, appropriate, and in many ways inevitable have planted moral hazard seeds all over the financial landscape. And its entire framework for conducting monetary policy is fundamentally wrong. Other than that, it did well!

Now, you have to give credit to a guy with the nerve to come here, with black bears on the outside and the FOMC on the inside, and be so critical of the Fed—which has earned kudos in the financial community. But those very kudos, Willem says, are symptomatic of a deep problem. In his words, “a key reason [for the policy errors] is

that the Fed listens to Wall Street and believes what it hears...the Fed is too close to the financial markets and leading financial institutions, and too responsive to their special pleadings, to make the right decisions for the economy as a whole” (pg. 599-600).

There is a valid point here. I am, after all, the one who warned that central banks must be as independent of the markets as they are of politics—that they must “listen to the markets” only in the sense that you *listen* to music, not in the sense that you *listen* to your mother—and that central banks sometimes fail to do so.¹ But has the Fed really done as badly as Willem says?

I think not. While the Fed’s performance has not been flawless, I think it’s been pretty good *under the circumstances*. Those last three words are important. Recent circumstances have been trying and, in many respects, unique. Unusual and exigent circumstances, to coin a phrase, require improvisation on the fly—and improvisation is rarely perfect. So I give the Fed high marks while Willem gives them low ones.

Let me illustrate the different grading standards with a short, apocryphal story that Willem may remember from his childhood in Holland (even though it’s based on an *American* story). One day, a little Dutch boy was walking home when he noticed a small leak in the dike that protected the town. He started to stick his finger in the hole. But then he remembered the moral hazard lessons he had learned in school. “Wait a minute,” he thought. “The companies that built this dike did a terrible job. They don’t deserve a bailout, and doing so would just encourage more shoddy construction. Besides, the foolish people who live here should never have built their homes on a flood plain.” So the boy continued on his way home. Before he arrived, the dike burst and everyone for miles around drowned—including the little Dutch boy.

Perhaps you’ve heard the Fed’s alternative version of the story. In this kinder, gentler version, the little Dutch boy, somewhat desperate and worried about the horrors of a flood, stuck his finger in the dike and held it there until help arrived. It was painful and not guaranteed to work—and the little boy would rather have been doing other

things. But he did it anyway. And all the people who lived behind the dike were saved from the error of their ways.

While you decide which version you prefer, I will take up three of Willem's six criticisms of the Fed's monetary policy framework. I don't have time for all six.

The risk management approach

First, methinks the gentleman doth protest too much about the difference between optimization with a quadratic loss function and the Fed's risk management approach, which allegedly focused exclusively on output while ignoring inflation. Many of you will recall that, at the 2005 Jackson Hole conference, some of us debated whether these two approaches were different *at all*.² I think they are different. But the truth is that, with a quadratic loss function, any shock that raises the unemployment forecast and lowers the inflation forecast should induce easier monetary policy. You don't need minimax or anything fancy to justify rate cuts.

Welcoming a recession?

Second, the spirit of Andrew Mellon apparently lives on in the person of Willem Buiter. Mellon's famous advice to President Hoover in 1931 was:

Liquidate labor, liquidate stocks, liquidate the farmers, liquidate real estate. It will purge the rottenness out of the system... . People will work harder, live a more moral life...and enterprising people will pick up the wrecks from less competent people.

Willem's advice to Chairman Bernanke in 2008 is that the U.S. economy needs a recession—and the sooner the better. Why? Because a recession is the only way to whittle the current account deficit down to size—you might say, to “purge the rottenness out of the system.” Is that really true? What about expenditure switching at approximate full employment? Isn't that what we did, approximately, during the Clinton years—using a policy mix of fiscal consolidation and easy money?

Core or headline inflation?

Third, I still think the FOMC is correct to focus more on core than headline inflation. Let me explain with the aid of a quotation from Willem's paper and some charts from a forthcoming paper by Jeremy Rudd and me.³ Willem observes that, "Core inflation is relevant to the price stability leg of the Fed's mandate to the extent that it is a superior predictor of future headline inflation, over the horizon that the Fed can influence headline inflation" (pg. 559). Exactly right.⁴ Let's apply that idea.

Chart 1 depicts the simplest and most benign case: an energy price spike like OPEC II. The relative price of energy shoots up *but then falls back to where it began*. The right-hand panel, based on an estimated monthly pass-through model, shows that such a shock should, first, boost headline inflation way above core, but subsequently push headline well *below* core. The effects on both headline and core inflation beyond two years are negligible. It seems clear, then, that a rational central bank would focus on core inflation and ignore headline.

Chart 2 shows a less benign sort of energy shock: The relative price of energy jumps to a higher plateau *and remains there*. OPEC I was a concrete example. Once again, the right-hand panel shows that headline inflation leaps above core, but then converges quickly back to it. However, this time core and headline wind up permanently higher. They are also substantially identical after about seven months. So, over the relevant time horizon, it seems that the central bank should again concentrate on core, not headline.

Chart 3 depicts the nastiest case which, unfortunately, may apply to the years since 2002. Here the relative price of oil keeps on rising for years. As you can see, both headline and core inflation increase, and there is no tendency for headline to converge back to core. In this case, one can make a coherent argument that the central bank should focus on headline inflation.

So is Willem's criticism correct? Well maybe, but only with the wisdom of hindsight. When there are big surprises, you can be right

Chart 1

Effect of a temporary spike in energy prices

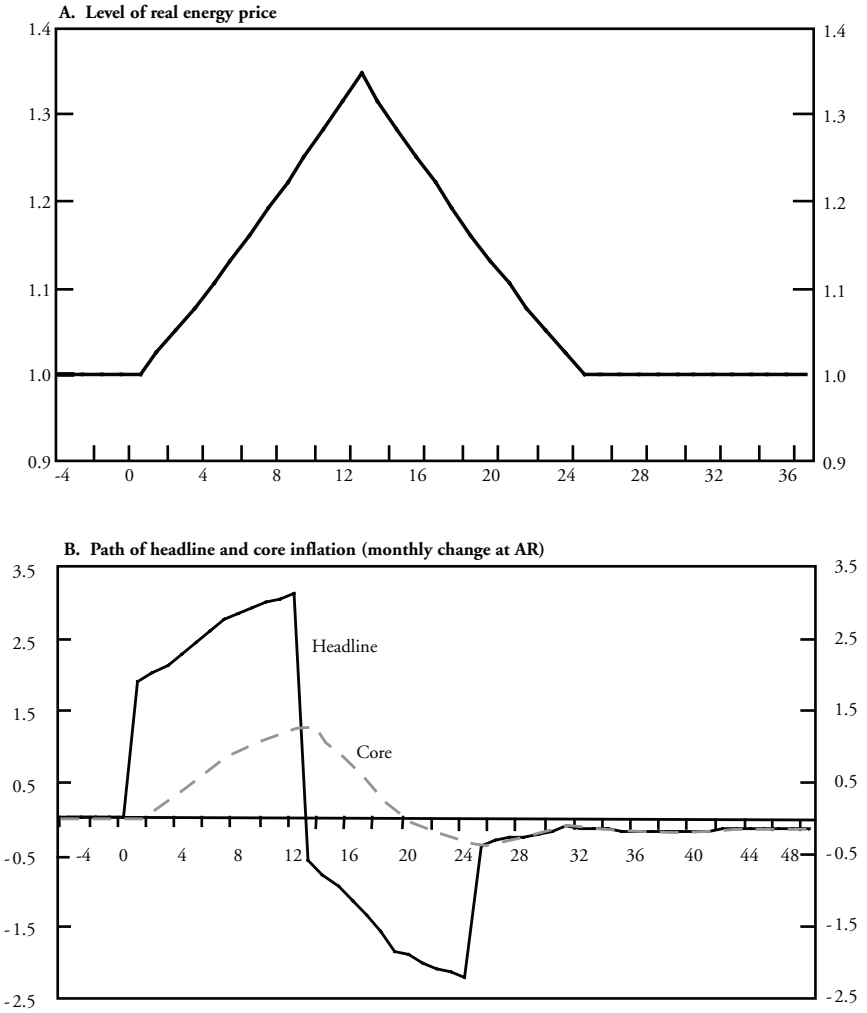


Chart 2

Effect of a permanent jump in energy prices

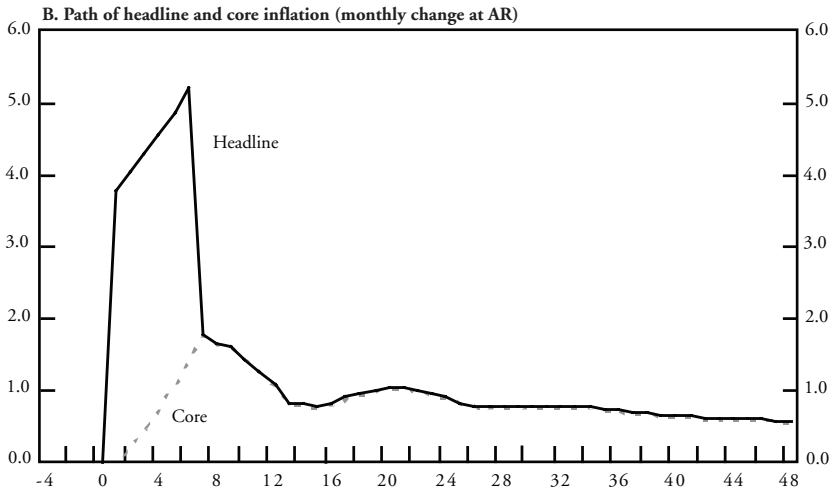
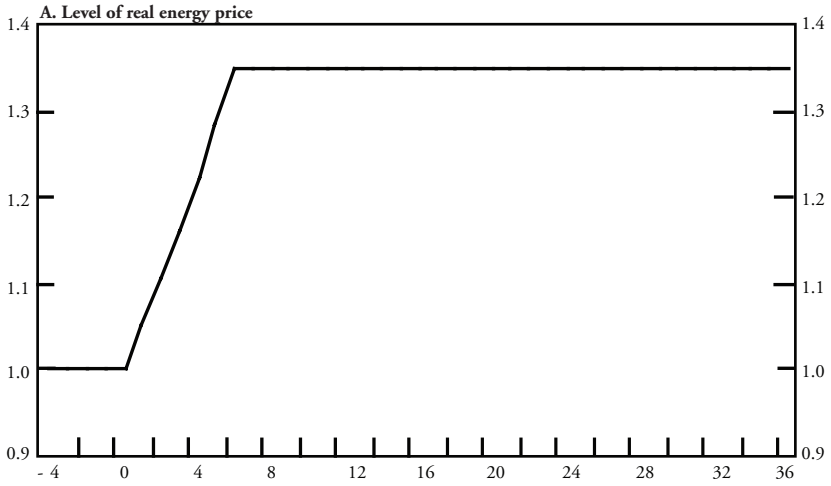
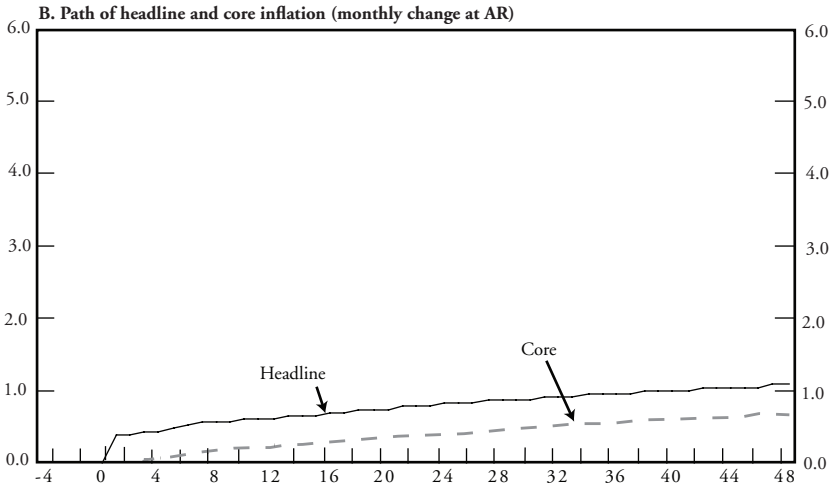
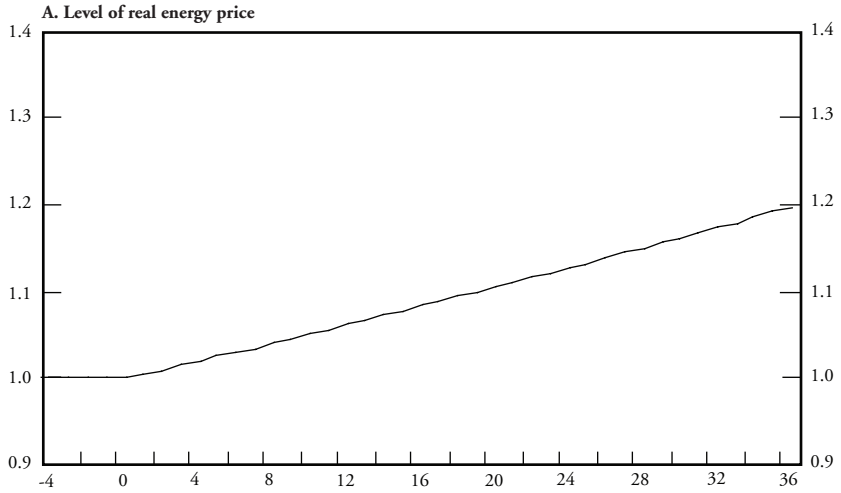


Chart 3 Effect of a steady rise in energy prices



ex ante but wrong *ex post*. It is well known that the Fed does not attempt to forecast the price of oil but uses futures prices instead. It is also well known that futures prices underestimated subsequent actual prices consistently throughout the period, regularly forecasting either flat or declining oil prices. Thus the Fed inherited and acted upon the markets' mistakes—a forgivable sin, in my book. Remember also that no relative price can rise without limit. Oil prices are finally plateauing or coming down, which will restore the case for core.

While I could spend more time defending the FOMC against Willem's many charges, I think I've now said enough to ingratiate myself to our hosts. So let's proceed to the more generic issues.

What should a central bank do?

On our first day in central banking kindergarten, we all learned that a central bank has four basic functions:

1. to conduct macroeconomic stabilization policy, or perhaps just to create low and stable inflation; let's call this "monetary policy proper;"
2. to preserve financial stability, which sometimes means acting as lender of last resort;
3. to safeguard what is often called the financial "plumbing"; and
4. to supervise and regulate banks.

Willem doesn't much care for this list. In previous incarnations, he has argued that the central bank should pursue price stability *and nothing else*, including no responsibility for either unemployment or financial stability.⁵ But here he changes his mind and focuses on the lender of last resort (LOLR) function, number 2 on the list. In doing so, he ignores the plumbing issue entirely; he argues that central banks should not supervise banks; and he even suggests—heavens to Betsy!—transferring responsibility for monetary policy decisions elsewhere. I respectfully disagree on all counts.

Monetary policy proper

On the second day of central banking kindergarten, we all learn that most central banks have multiple monetary policy instruments, including the policy interest rate (in the U.S., the federal funds rate) and lending to banks, which itself includes price (in the U.S., the discount rate), any sort of quantity rationing (including “moral suasion”), and the LOLR function. Willem muses about separating the responsibility for interest rate from this other stuff, which would be quite a radical step.

Why? He explains that while the central bank will “have to *implement* the official policy rate decision...it does not have to make the interest rate *decision*” because it is “not at all self-evident” that the same skills and knowledge are needed to set the interest rate as to manage liquidity (pg. 530). “Not at all self-evident” seems a pretty thin basis for such a momentous change.

On behalf of all the current and past central bankers in the room, may I suggest that it *is* self-evident that the lender of last resort should also set the interest rate? Reason #1: Emergency liquidity provision occasionally becomes an integral and vital part of monetary policy just as they taught us in central banking kindergarten. Having the Fed set the discount rate while someone else sets the funds rate is akin to putting two sets of hands on the steering wheel. Reason #2: Aren't we really concerned about financial stability because of what financial *instability* might do to the overall economy? Who, after all, cares about even wild gyrations in small, idiosyncratic financial markets that have negligible macro impacts? Reason #3: If we take interest rate setting away from the central bank, to whom shall we give it? To a decisionmaking body without the means to execute its decision? To an agency that will almost certainly be less independent than the central bank?

Safeguarding the financial plumbing

To my way of thinking, but apparently not to Willem's, one reason central banks have LOLR powers is precisely to enable them to keep the plumbing working during crises. And indeed, central banks

throughout history have used the window lending for precisely this purpose. I submit that this connection is also self-evident.

Bank supervision

I come, finally, to the most controversial function. Whether or not the central bank should supervise banks has been vigorously debated for years now, and there are arguments on both sides. Or perhaps I should say there *were* arguments on both sides until the Northern Rock debacle showed us what can happen when a central bank doesn't know what's happening inside a bank to which it might be called upon to lend. Yet, somehow, Willem reaches the opposite conclusion. Why? Because he claims that "cognitive regulatory capture" led the Fed astray. Yet he himself acknowledges that "institution-specific knowledge...made the Fed an effective lender of last resort" (pg. 613). I could rest my case on that statement. It would seem peculiar to leave the lender of last resort ignorant of the creditworthiness of potential borrowers.

Market maker of last resort

While Willem generally wants to clip the central bank's wings, he does want to expand the LOLR function to what he calls acting as the MMLR. I don't much care for the name, since market making normally means buying and selling to smooth or profit from price fluctuations. But what Willem *means* by MMLR makes sense: "during times when systemically important financial markets have become disorderly and illiquid...the market maker of last resort either buys outright...or accepts as collateral...systemically important financial instruments that have become illiquid" (pg. 525).

Ironically, that description fits the Fed's recent lending policies to a tee. However, Willem raises two legitimate criticisms. First, the Fed values the collateral it takes at prices provided by the clearing banks—which seems rather too trusting. I agree. Second, the Fed has ignored Bagehot's advice to charge a penalty rate. Lending below market is like making a fiscal transfer—which Willem justifiably questions. But I part company when he argues that central banks should lend *only* at appropriate risk-adjusted rates. Because the LOLR serves a

social purpose broader than profit maximization, it is easy to justify expected risk-adjusted losses in an emergency.

In sum, while there is surely room for improvement around the edges, I don't believe that either the structure or framework of U.S. monetary policy needs the kind of wholesale overhaul that Willem recommends. Cosmetic surgery, maybe. But not a lobotomy.

Endnotes

¹See Alan S. Blinder, *Central Banking in Theory and Practice* (MIT Press, 1998), pp. 59-62, which was expanded upon in Alan S. Blinder, *The Quiet Revolution* (Yale, 2004), Chapter 3. These first of these books was the Robbins Lectures given at the LSE in 1996, which were in turn based on my Marshall Lectures, given at Cambridge in 1995 and hosted by Professor Willem Buiter!

² See Alan S. Blinder and Ricardo Reis, "Understanding the Greenspan Standard", in Federal Reserve Bank of Kansas City, *The Greenspan Era: Lessons for the Future* (proceedings of the August 2005 Jackson Hole conference), pp. 11-96 and the ensuing discussion.

³Alan S. Blinder and Jeremy Rudd, "The Supply-Shock Explanation of the Great Stagflation Revisited", paper under preparation for the NBER conference on The Great Inflation, September 2008.

⁴Neither Buiter nor I mean to imply that past inflation is the *only* variable relevant to forecasting future inflation.

⁵Willem Buiter, "Rethinking Inflation Targeting and Central Bank Independence," inaugural lecture, London School of Economics, October 2006.

Commentary: Central Banks and Financial Crises

Yutaka Yamaguchi

I want to thank first the Kansas City Fed for inviting me to this splendid symposium. I have found Dr. Buiters's paper long, comprehensive, thought-stimulating and, of course, provocative. It is an interesting read unless you belonged to one of the targeted institutions. In what follows, I will talk more about my own observations mostly on the Fed, rather than offer direct comments on the paper, but I hope my remarks will cross the path of Dr. Buiters's here and there.

The author is highly critical of the Fed's performance in the past year, particularly in monetary policy. The sharp contrast between the Fed and the ECB (and the Bank of England) in monetary policy raises a legitimate question of why the Fed has been so aggressively easing.

The Fed's trajectory since last summer appears to me broadly consistent with the weakening U.S. economic growth and the Fed's dual mandate. But the Fed would not have eased as much as it has if it had not adhered to the "risk management" aspect of monetary policy. The relevant risks here are twofold: a financial systemic instability and inflation. They are both hard to reverse once set in motion or embedded in the system. They point to different policy responses.

The Fed must have weighed the relative importance of these threats and “gambled,” to borrow the word used by Martin Feldstein, to place higher emphasis on the risk of financial disruptions leading to even weaker economic activity. I am sympathetic to this decision and therefore to the Fed’s monetary policy trajectory since last summer.

Now let me examine this “risk management” approach in a broader perspective. As I do so, I’ll be a bit less sympathetic. This approach is a key component of the so-called “clean up the mess after a bubble bursts” argument. It has been a conventional wisdom in recent years among many central bankers around the world. But the ongoing crisis prompts me to revisit the argument. Three questions come to my mind.

The first is about the timing of such “clean up” operation. Taking a look at the Japanese episode first, the Tokyo stock market peaked at the end 1989. The Bank of Japan began to cut the policy rate one-and-a-half years later in July 1991. The lag from the property market peak is a bit ambiguous, given the nature of the market, but it was probably a little shorter. Twenty-some years later, the U.S. housing market peaked in the second half of 2005. The Fed started to ease two years later. Thus, there is striking similarity between the two countries in the timing of the first interest rate cut after a major bubble burst. The similarity has good reasons: It is difficult to recognize on real time if a bubble has in fact burst or not; it is also difficult to ease monetary policy when economic growth still looks robust and financial markets still stable. Yet if the central bank waited till a turbulence has erupted, it might well be too late. When should the central bank start the mopping-up operation?

The second question relates to the exceptional uncertainty in the post-bubble period. We observe in the U.S. economy today unique and substantial uncertainty over the extent of housing price decline, magnitude of losses incurred by the financial system, strength of financial “headwind” against the economy, inflationary potential and so on. These special forces tend to cloud the economic and price picture and, if anything, should make it more difficult for the central bank to take “decisive” actions. Such uncertainty is not new nor is limited to the current U.S. scene. We went through a similar phase of extraordinarily low visibility in the early 1990s. In fact, concern

about a resumption of asset price inflation was rather prevalent even a few years after the stock and property market peaks. It is sometimes argued that Japanese monetary policy failed to take early on some decisive easing actions, such as large and permanent interest rate reduction. The failure to do so, the argument goes, led the economy to deflation. Such argument is totally negligent of the then-existing uncertainty and seems to me quite unrealistic.

Uncertainty over the state of the financial system is particularly relevant for the central bank. When the financial system gets badly impaired in terms of its capital, it becomes vulnerable to shocks. Sentiment shifts often and false dawn arrives a number of times. Above all, monetary policy transmission seriously weakens if not totally breaks down. In the case of Japan, systemic stability was restored only when significant capital was injected into the banking system using public funds. In my view, the lesson to draw from the Japanese episode should be, above all, the importance of an early and large-scale recapitalization of the financial system. How it can be done should vary according to the given circumstances and national context.

The third and last question as regards the “clean up the mess strategy” is that it is inappropriately generalizing one specific experience of addressing the collapsing tech bubble by aggressive rate cuts. But the tech bubble was not after all a major credit bubble. It did not leave behind a massive pile of nonperforming assets. The U.S. financial system was able to emerge from the bubble’s aftermath relatively unscathed. The tech bubble and its aftermath was, if I may say so, an easier type to “clean up” ex-post; it does not have universal applicability to other episodes. From the standpoint of securing financial stability, credit bubbles should be the focus of attention.

This brings me to the final segment of my remarks: the role of monetary policy vis-à-vis credit cycle. Proposals abound these days on how to restrain excessive credit growth in times of upswing. Most of them, including Dr. Buiter’s, advocate some regulatory measures. Few are in favor of “leaning against the wind” by monetary policy—so had I thought until I listened to Prof. Shin yesterday.

Some proposals to use regulatory measures appear sensible. However, I remain skeptical if a regulatory approach alone would work. I happen to belong to the dying species of former central bankers who have had experiences in the past in direct credit controls. Even in the days of heavily regulated banking and financial markets, outright controls tended to invite serious distortions in credit flows. Bank of Japan's guidance on bank lending, for example, was clearly more effective when supported by higher interest rates, as higher funding cost partially offset the banks' incentive to lend. That was then. The world has vastly changed, and we now live in highly sophisticated financial markets. Still, importance of affecting the incentives has not much changed. For instance, if we look at the sequence of what happened in the run-up to the current crisis, there was a sustained easy money and low interest rate environment, which drove market participants to search for yield, which resulted in much tighter credit spreads, which then prompted many players to raise leverage, and things collapsed. Simply capping on leverage, for instance, might invite circumventions and distortions unless the root cause of credit expansion was not addressed.

I believe a more balanced and symmetric approach to address credit cycles, including "leaning against the wind" by monetary policy, is worth considering in the pursuit for both monetary and financial stability.

General Discussion: Central Banks and Financial Crises

Chair: Stanley Fischer

Mr. Fischer: We all quote Bagehot selectively and forget he operated in a fixed exchange rate environment. Willem says the U.S. has to get the current account adjusted and at the same time should be running higher interest rate policies. The dollar must be an essential part of any of that adjustment, and higher U.S. interest rates don't help in that regard. The Bagehot rules don't translate exactly to a system where the exchange rate is flexible.

Secondly, about Mundell's Principle of Effective Market Classification. One of the first things that we learned in micro is about constrained optimization. Sometimes you have one constraint and two objectives, and you have to trade off between them. That's micro. In macro and in the Mundell Principle—incidentally I learned of it as being Tinbergen's Principle—rhetoric tends towards the view that you need as many instruments as targets, and that tradeoffs somehow are not allowed. We all frequently say, "Well, the Fed's only got one instrument. It has to fix the inflation rate." There may be reasons of political economy to say that, but it's not true in general that you can't optimize unless you have as many instruments as targets.

Mr. Barnes: In criticizing the Fed for being too sensitive to perceived downside risks in the economy, Willem asserted it's easier for a central bank to respond to a sharp downturn in activity than to

respond to embedded inflation expectations. That may be true a lot of the time, but it is not clear to me it is true in the context of a post-credit boom when you have high risk of negative feedback loops. I would argue the experience of Japan suggests it can be very difficult to get out of an economic downturn in that kind of environment.

Mr. Makin: I very much enjoyed all three presentations. I wanted to very quickly ask the question regarding the little boy with his finger in the dike.

First, is the little boy the Fed, the Treasury, or some other institution? Secondly, I think you said, "He keeps his finger in the dike until help arrives and everybody is better off."

What if it takes a really long time for help to arrive in the sense he stuck his finger in the dike and a big wave came along called a recession? What would he do then? Those become critical issues. Finally, in order to influence the answer, I would suggest the bad wall construction was probably the fault of the commercial banks and the people. Silly to be living on the flood plain are the real estate speculators. Maybe with that richer texture, you could comment.

Mr. Frenkel: At this conference, we have discussed issues on housing, financial markets, regulation, incentives, moral hazard, etc., but we have discussed very little the macro picture. That is also the way I see Willem's paper.

Three years ago at this conference, we said the current account deficit of the United States is too big, it is not sustainable, and it must decline. The U.S. dollar is too strong, it is not sustainable, and it must decline. The housing market boom is not sustainable; prices must decline. The Chinese currency, along with other Asian currencies, is too weak; they must rise. Some even said interest rates may be too low and pushing us into more risky activities, so we must think about risk management.

Here we are three years later and all of these things have happened. We may have had too much of these good things. There are a lot of spillover effects, negative things or whatever. But what we have had is a massive adjustment that was called for, needed, and recognized.

Within this context, the question is, How come all of these disruptions have not yet caused a deeper impact on the U.S. real output? There the answer is the foreign sector. We have had a fantastic cushion coming from the foreign sector. In fact, if you look at U.S. growth, you see all the negative contributions that came from the housing shrinkage were offset by the positive contribution that came from exports. That positive contribution was induced among others by the declining dollar and all of the things we knew had to happen.

In fact, we are in a new paradigm in which last year 70 percent of world growth came from emerging markets and only 30 percent from the advanced economies. Within this context, when the dust settles and the financial crisis is behind us, and the lessons are learned, let's remember one thing. This cushion of the foreign sector is essential for the era of globalization.

All of these calls for protectionism that are surfacing in Washington and elsewhere, including the U.S. election debate, would be a disaster. The only reason why the United States is not in a recession today, in spite of the fact there is a significant slowdown, is the foreign sector. We can talk about extinguishing fires and all of these other things, but we need to remember the macro system must produce current account deficits and imbalances that do not create incentives for protectionism. Let's bring the discussion back to the macro issues.

Mr. Mishkin: When I read this paper, I said this paper has a lot of bombs, but maybe a better way to characterize it is there are a lot of unguided missiles that have been shot off now in this context. I only want to deal with one of them, which is the issue of the risk management precautionary principle approach.

Willem is even stronger in his statement because he just called it "bogus" in the paper, but actually calls it "bogus science" in his presentation. His reasoning here is the only reason you would use a precautionary principle, or this risk management approach, which many know I advocated, is because of potential for irreversibility in terms of something bad happening.

He goes to the literature on environmental risk to discuss this. I wish he had actually read some of the literature on optimal monetary

policy because it might have been very helpful in this context. Indeed, the literature on optimal monetary policy does point out when you have nonlinearities, where you can get an adverse feedback loop, in particular the literature I am referring to—which has been very well articulated—is on the zero lower bound interest rate literature. In fact, it argues what you need to do is act more aggressively in order to deal with the potential for a nonlinear feedback loop. On that context, the issue of science here does have something to say, and we do have literature on optimal monetary policy that I think is important to recognize in terms of thinking about this.

One other thing is that Mr. Yamaguchi mentioned the Adrian-Shin paper. I didn't make a comment on that before, but one little comment here. What that paper does—which is very important—shows there is another transmission mechanism of monetary policy. That was very important. It indicates you should take a look at that in terms of assessing what the appropriate stance of monetary policy should be.

It does not argue you have to go and lean against the wind in terms of asset price bubbles. We should be very clear in terms of what the contribution of the paper was. In this case, I am agreeing with Willem, just so we even it up.

Mr. Trichet: I thought the session was particularly stimulating. Alan, you said it was not Willem's habit to pull punches. Well, I think we had a demonstration because we had our own punches, too.

I would like to make two points. The first point is to see in which universe the various central banks are placed. For us, things are very clear. We have—as I have often said—one needle in our compass. We don't have to engage in any arbitrage between various goals. We have a single goal, which is to deliver price stability in the medium term.

It is true that at the very beginning of the turmoil and turbulences in mid-2007, we thought it was very important to make this point as clearly as possible. It was nothing new there, of course, because it was only a repetition of what we had always said. It was understood quite correctly that we had one needle in our compass, and we were very clear in saying that we then would strictly separate between what was

needed for monetary policy to deliver price stability in the medium term and what was needed to handle the operational framework in a period of very high tensions in the money market.

My second point relates to the remark by Willem or Peter before, namely that the ECB did pretty well in the circumstances of turmoil in terms of the handling of the operational framework.

After further reflection, and taking due account of the very special natural environment of Jackson Hole that is full of biodiversity, it seems to me that the notion to consider regarding the origin of our operational framework is diversity. We had to merge a lot of various frameworks in order to have our system operate from the very start of the euro. Three elements stand out: first, in contrast to the Bank of England or the Fed, we accepted private paper from the very beginning in our operational framework, which was a tradition in at least three countries, including Germany, Austria, France, and others.

Second, we could refinance over three months because again it was a tradition which had been a useful experience in a number of countries, again including Germany. And third, we had a framework with a very large number of counterparties, which appears to have been, in the circumstances, extraordinarily useful because we could provide liquidity directly to a very broad set of banks and did not need to rely on a few banks to onlend liquidity received from the central bank.

All this, I would say, was the legacy of the start of the euro. It permitted us to go through the full period without changing our operational framework. Of course, we continuously reviewed this framework, as we have done in the past before the turmoil as well.

Again, I believe that the diversity of the origin of our operational framework, due to the fact we had to merge a large number of traditions and a large number of experiences, proved very valuable.

That being said, we have exactly the same problems as all other central banks. We still are in a market correction. For a long time, I hesitated to mention the word “crisis” myself and preferred to label it “a market correction of great magnitude with episodes of a high level of

volatility and turbulences.” I remained with this characterization until, I would say, Bear Stearns. Now I am prepared to speak of a crisis.

Let me conclude by saying how useful I find interactions like this one. We need a lot of collegial wisdom to continue to handle the situation, and I will count on our continuous exchange of experiences and views.

Mr. Sinai: Of the many, many points in this interesting paper, there are two I want to comment on. One is in support of Professor Buiter, and the other is not.

One is on core inflation, and the other is on the asset bubbles and whether central banks should intervene earlier. On this last one, I don't really see how the consequences of asset bubbles are in current existing policy approaches, looking back over the last few bubbles we have had, either in the policy framework at the time and policy rates or in financial markets.

For example, the U.S. housing boom-bust cycle and housing price-asset bubble bursting. It is a bust and I would argue that we are in the midst, and still are, of an asset-price bubble bursting. We also have a credit and debt bubble, and those prices and those securities that represent that have been bursting and declining as well. We see that all around us all the time.

I don't think that was in the approaches of any central bank a year or two ago—the consequences of what we see today and of what is showing up in terms of the impacts. Similarly so, the dot-com stock market bubble's bursting—and some people call the general U.S. stock market bubble bursting in 2000-01—that wasn't in the existing approach to monetary policy, and its consequences surely affected the future distribution of outcomes.

For an issue of not leaning against the wind and not acting preemptively in an insipient bubble, these two examples in the recent history convince me we ought to seriously consider alternatives to waiting, to waiting until after a bubble bursts—that is, what you call the Greenspan-Bernanke way—and what I just heard Rick Mishkin continue to support. Of the choices available, there is a lot to be

said for finding methods to intervene earlier when you have insipient bubbles. That would be true for all central banks, and we have an awful lot of them.

There was sentiment here last year, I think Jacob Frenkel and Stan Fischer, increasing sentiment in the central bank community to think about intervening before a bubble bursts. So, I don't agree with you at all on that one.

On the issue of core inflation, I really do agree with you in terms of central banks and what they should focus on. The case of the U.S. core versus headline inflation rate is an example. Core inflation in the United States provides the lowest possible reading on inflation of all possible readings—that is the core consumption deflator. If you follow that one you are going to get the lowest reading on inflation of all the possible measures that exist on inflation. This means that you are going to run a lower interest rate regime, if you focus on that as the key inflation barometer. We did run a very low interest rate regime based on that for quite a long time, and we see the consequences of that today in what's going on in the highly leveraged events off the housing boom and bust.

Second, Alan, you showed us three charts. The third one, to me, is the most relevant because crude oil prices on average have been rising now for seven years, so it's hardly a temporary spike or a transitory spike. I think we would all agree it's part of a global demand-supply situation.

Finally, in taking those charts and making conclusions that core inflation will be a good predictor of headline inflation may have been true in the past, but given the changed structure of inflation and the global component of it this time, the econometrics of the backward-looking approach that is implicit in looking at those charts and drawing conclusions are subject to some concern.

Mr. Hatzius: I'd like to address Willem's assertion the Fed eased far too much, given the inflation risks. From a forward-looking perspective, which I think is the perspective that matters, the Fed's influence on inflation primarily works via its ability to generate slack in the economy. Even with the 325 basis points of cumulative easing, the economy is already generating very significant amounts of slack and

that is most clearly visible in the increase in the unemployment rate, from 4.4 percent early last year to 5.7 percent now.

Most forecasters expect the unemployment rate to increase further to somewhere between 6 and 7 percent over the next six to 12 months. That would resemble the levels we saw at the end of the last two recessions. In other words, we are already generating the very disinflationary forces that higher interest rates are supposed to generate, despite 325 basis points of monetary easing.

My question to Willem is, What is wrong with that analysis in your view? Is it that you disagree with the basic view of how Fed policy affects inflation—namely, by generating slack? Or is it that you think the sustainable level of output has fallen so sharply that a 6 to 7 percent unemployment rate will be insufficient to combat inflationary pressures? Or is it that you think these expectations of a 6 or 7 percent unemployment rate are simply wrong and the economy is going to bounce back in a fairly major way?

Mr. Harris: I wanted to underscore the idea that we can't make this simple comparison between European and U.S. monetary policy—Willem said in the paper there are rather similar circumstances in Europe and the United States. However, the U.S. economy has gone into this downturn much faster than Europe. The shocks to the U.S. economy are greater. We know the economy would have been in even worse shape if the Fed hadn't eased interest rates, and we also know it is not over. It is not over in the United States, and it is not over in Europe.

It may turn out that what happens is that Europe just lags the Fed in terms of rate cuts going forward. I don't understand the idea there are rather similar circumstances in Europe and the United States.

I have the same question as Jan Hatzius. With the unemployment rate headed well above 6 percent, what level of the unemployment rate would restore the Fed's credibility here?

Mr. Kashyap: There is a sentence in your paper I encountered on the airplane, so I did not have the Internet to check this. It says, "Ben Bernanke, Don Kohn, Frederic Mishkin, Randall Kroszner,

and Charles Plosser all have made statements to the effect that credit, mortgage equity withdrawal, or collateral channel through which house prices affect consumer demand is on top of the normal (pure) wealth effect.”

I don't remember all of those speeches, but I have read the Mishkin one pretty recently. There is a long passage in it directly contradicting this statement. If you are going to have these really tough comments, you need to have footnotes where you quote them verbatim. You can't say he essentially said this. For instance, in Rick's paper there are a couple of pages where he has this analogy that going to the ATM may Granger-cause spending even if it is only an intermediate step between your income and spending. In the same way, mortgage equity withdrawal may only be an intermediate step between greater household wealth and higher consumer spending. Maybe there is some other part of his story that I forgot, but it just doesn't seem to be fair because this is Fed publication and people will assume that it must have been fact checked—I doubt people are going to go back to read the speeches themselves. If you are going to say something like that, given you are already at 140 pages, what's the cost of going 170 pages and documenting it so that we could see?

[Note: Following the symposium, the author added an extended footnote as requested by Professor Kashyap.]

Mr. Muehring: The panel certainly lived up to its billing. I particularly wanted to note Mr. Yamaguchi's heartfelt commentary, which was something to think about on the way home.

I wanted to ask a question that goes to the one theme that seems to run throughout this conference, namely, is the central role of asset-based repo financing in the current crisis that Peter Fisher mentioned? It was also in the Shin paper, and several of the others, and can be seen in the liquidity hoarding by banks, who wouldn't accept somebody else's collateral and vice versa and thus this central critical importance of the haircuts in this crisis.

One is to ask, so, one, do the panelists think there is a way to restrain the leverage generated through the repo financing during the upswing? And, two, if they could make just a general comment on

the merits of the various term facilities the central banks—the Fed in particular—have created, do they see limits in what can be achieved through the term liquidity facilities and how do they envision the future place of the facilities if the central banks are required to be market makers of last resort going forward?

Mr. Weber: I only have a comment on one section of the paper, which deals with the collateral framework: Willem and I have discussed this in the past. He appears to have the misperception that the price or value of an illiquid asset is zero. This is why he believes that there is a subsidy implied in our collateral framework. But here are the facts.

We value illiquid assets at transaction prices, and it could be the price of a distressed sales or a value taken from indices, such as the ABX index that was discussed yesterday. In addition, we then take a haircut from that price and we are in the legal position to issue margin calls and ask for a submission of additional collateral to cover the value of the repo.

In the euro system, for example, the Bundesbank has banks pledge a pool of assets to the repo window, which is usually used between 10 to 50 percent. To cover the value of the outstanding repos, the entire pool is pledged to the central bank, and we can seize all that collateral to cover the amount due. Thus, I disagree with the statement that there is an implicit subsidy implied because the repo is well-covered due to these institutional provisions.

Let me make a second point. If you have a pool of collateral pledged and the use of that pool moves between 10 to 50 percent in normal times to a much higher use of collateral, it is a very good indication that banks need more backup liquidity, in the sense of central bank liquidity, and the bank may be in distress. Thus, the endogenous increase in the percentage use of the pool for us is a very good early indicator of potential liquidity problems of that bank in refinancing in the market because, as a consequence, it switches from market liquidity to repo liquidity.

To sum up, Willem, some of the allegations you make do not really hold up.

Mr. Buiter: First of all, I want to address the culturally sensitive issue—which is the little boy with his finger in the dike. That story was, of course, written by an American. No Dutchman would have written it because it is based on a wrong model. That hole in the dike that you can plug with your finger, you can leave alone quietly. It will not cause a flood. There was no threat.

It is also good to know that, despite the length of the paper, some people want to lengthen it. All I can say is, it's only this long because I didn't have time to write a shorter paper.

Very briefly, my point is not that circumstances weren't unusual and exigent and difficult for central banks, but even at the time the choices were made there was knowledge and other choices that could have been made. They are options available that would have been superior to the methods chosen.

One of them obviously is the way in which—take the Fed as an example—the PDCF and TCLF securities are priced. That is just crazy. You don't let borrowers (or the agent of the borrowers) determine the value of the collateral they offer you especially if it is illiquid. There are other options.

In the case of Bear Stearns, one wonders why exigent and unusual circumstances weren't invoked to allow it to borrow directly at the discount window. There are options that were open. In the case of the Bank of England, of course, the list of why did they wait so long, for the first few months when there was no lender of last resort. The facility accepts ad hoc ones when there turned out to be no deposit insurance worth anything and there was no insolvency regime for banks. It is quite extraordinary. So there were options that should have been used at the time.

On risk management: I fully agree with Alan. You don't need risk management, or whatever it is, to justify cutting rates. However, risk management was used to provide justification for cutting rates and especially the nonlinearities' irreversibility soft or light version of risk management. We all have our nonlinearities. You can put it at zero for the normal interest rates. Gross investment can't be negative either. But that is not a nonlinearity. That bias goes the other way.

So the notion that plausible systemically important nonlinearities would create a bias in favor of putting extraordinary weight on preventing a shock collapse of output rather than safeguarding it against high and rising inflation is not at all obvious to me. If the arguments aren't really strong, one shouldn't arbitrage the words from serious science into social science.

Alan selectively ended his quote on the core inflation at a point it would have contradicted what he said: "Core inflation is relevant to the price stability leg of the Fed's mandate to the extent that it is a superior predictor of future headline inflation, over the horizon the Fed can influence headline inflation." And then it goes on: "a better predictor not only than headline inflation itself, but than any readily available set of predictors."

So whether or not core inflation is a better predictor of headline inflation, headline inflation itself is neither here nor there. It's the best or necessary condition for being relevant, not as a sufficient condition.

That anybody should use univariant predictors for future inflation to formulate policy is a mystery to me. So, I just find that framework doesn't make any sense.

On core inflation, the key message is to statisticians especially: "Get a life!"

Get away from the monitor. Get away from the keyboard. Open the window. See whether there might be a structural break in the global economy that is not in the data—2.5 billion Chinese and Indians entering the world economy systematically raising the relative price of non-core goods and services to core goods and services is not something that has been happening on a regular basis in samples that are at our disposal. You have to be very creative and intelligent, not bound by whatever time series your research assistant happens to have loaded into your machine.

Can the central bank get timely information about liquidity and solvency of individual institutions without being supervisor and regulator? That is a key question. If there is a way of getting the information, without the regulatory and supervisory powers, which make

an interesting subject for capture, then we are in the game. In the United Kingdom—it was supposed to work this way with the Bank of England—tagging along was the FSA. It didn't work. There are institutional obstacles to the free, unconstrained, and timely flow of relative information. So, this is a deep problem.

I would think, if the central bank were not subject to capture, then I would prefer the interest rate decision be with the central bank. It is only when the central bank has to perform market maker and lender-of-last-resort functions is there is a serious risk of the official policy rate being captured, as I think it was in the U.S. That would be reason for moving it out. It is the second-best argument of institutional design.

On the quotes, I cited all the papers that I quoted. They are in there. I have the individual quotes, if you want them. I can certainly put them in, but especially your representation of the Mishkin paper, which I assume is the Mishkin paper I cited at length in the paper, is a total misrepresentation of that paper. There are two sets of simulations. One is just a regular wealth effect and the other is part of the wealth effect or financial assets. It is doubled to allow for a credit channel effect. There is very clearly in that particular paper a liquidity effect, a credit channel, or collateral effect on top of the standard wealth effect. I will append the paper, if that makes you happy.

Mr. Blinder: I wanted to square something Jean-Claude Trichet said and then just react to a couple of questions.

The legal mandates of the ECB and the Federal Reserve are different. It follows from that, that even if the circumstances were identical, you would expect different decisions out of the ECB governing counsel and the Federal Reserve. I wanted to underscore that.

Secondly, about the little Dutch boy: Willem is correct. It is an American tale, but I can tell him that, if I ever see a leak in the Lincoln Tunnel, I call the cops.

John Makin asked if it was the Fed or whoever was supposed to put the finger in the dike. Yes, it was the Fed because the Fed can and did act fast. Waiting for help? Yes, the Fed could have used more

help from the U.S. Treasury, for example, and over a longer time lag from the U.S. Congress, which it is going to get—grudgingly and slowly—and I might say from the industry. Let's leave it at that.

John asked the question, If there were a recession, then what would happen? If I can paraphrase Andrew Mellon, this is my answer. Liquefy labor, liquefy stocks, liquefy the farmers, liquefy real estate. It will purge the recession out of the system. People will have work and live a better life.

Finally, on core versus headline inflation: I really want to disagree with Allen Sinai and implicitly again with Willem. At the end of this, I am going to propose a bet with 150 witnesses.

Core inflation is only below headline inflation when energy is rising fast. When energy is rising slowly, it is above. Over very long periods of time, there is no trend difference between the two. Now there was between 2002 and 2008, I think. It looks like it's over, but who really knows if it's over?

But I do want to cite the theorem that no relative price can go to infinity. So, we know Chart 3 that I sketched just can't go on forever, no matter whether there is China, India, or what. It just cannot happen.

The concrete bet that I would propose to either Willem or Allen is that over the next 12 months—and you can pick the inflation rate (I don't care if it's PC or CPI)—the headline will be below the core. If you'll give me even odds on that, I'll put up \$100 against each of you.

Concluding Remarks

Stanley Fischer

When we met at this conference a year ago the financial crisis was just beginning and it was far from clear how serious it would be. By now, it is generally described as the worst financial crisis in the United States since World War II, which is to say, since the Great Depression. Further, as Chairman Bernanke told us in his opening address, the financial storm is still with us, and its ultimate impact is not yet known.

As usual, the Kansas City Fed has put together an excellent and timely program, both in the choice of topics and authors, and also in the choice of discussants. Before getting to the substance of the discussions of the last two days, I would like to make a number of preliminary points.

First, although this is widely described as the worst financial crisis since World War II, the real economy in the United States is still growing, albeit at a modest rate.¹ The disconnect between the seriousness of the financial crisis and the impact—so far—on the real economy is striking. At least three possibilities suggest themselves: first, the worst of the real effects may yet lie ahead; second, the vigorous policy responses, both monetary and fiscal, may well have had an impact; and third, perhaps, that although all of us here are inclined to believe the financial system plays a critical role in the economy,

that may not have been true of some of the financial innovations of recent years, a point that was made by Willem Buiter.

Second, the losses from this crisis, as a share of GDP, to the financial system and the government are likely to be small relative to those suffered by some of the Asian countries during the 1990s.² That may make it clearer why those crises have left such a deep impact on the affected countries.

Third, about warnings of the crisis: At policy-related conferences in recent years, the most commonly discussed potential economic crisis related to the unwinding of the U.S. current account deficit. That crisis scenario was based on the unsustainability of the U.S. current account deficit and the corresponding surpluses of China and other Asian countries, and more recently also of the oil-producing countries. In such scenarios, the potential crisis would have come about had the dollar decline needed to restore equilibrium become disorderly or rapid, creating inflationary forces that the Fed would have to counteract by raising its interest rate.

But there were also those who described a scenario based on a financial sector crisis resulting from the reversal of the excessively low risk premia that prevailed in 2006 and 2007, and in the case of the United States and a few other countries from the collapse of the housing price bubble. Among those warning about all or parts of this scenario were the BIS, with Chief Economist Bill White and his colleagues taking the lead, Nouriel Roubini, Bob Shiller, Martin Feldstein, the late Ned Gramlich, Bill Rhodes, and Stephen Roach. As in the case of most crises and intelligence failures, the question was not why the crisis was not foreseen, but why warnings were not taken sufficiently seriously by the authorities—and, I should add, the bulk of policy economists.

In his opening address, Chairman Bernanke noted the Fed's three lines of response to the crisis: sharp reductions in the interest rate; liquidity support; and a range of activities in its role as financial regulator. In his lunchtime speech yesterday, Mario Draghi, Governor of the Banca d'Italia, mentioned briefly the six areas on which the Financial Stability Forum's report, published in April, focuses. They

are: capital requirements; liquidity; risk management; transparency; credit rating agencies; and asset valuation (including the difficult and contentious topic of mark-to-market accounting). All these topics received attention during the conference, and all of them are of course receiving attention from the authorities as they deal with the crisis, and begin to institute reforms intended to reduce the extent and frequency of similar crises in the future.

Rather than try to take up these topics one-by-one, it is easier to describe the conference by focusing on three broad questions, similar but not identical to those raised in the paper by Charles Calomiris:

- What are the origins of the crisis?
- What is likely to happen next, in the short run of a year or two, and when will growth return to potential?
- What structural changes should and are likely to be implemented to prevent the recurrence of a similar crisis, and to significantly reduce the frequency of financial crises in the advanced countries?

A fourth topic, the evaluation of central bank behavior in this crisis, was implicit in the discussion in much of the conference and explicit in the last paper of the conference, by Willem Buiter.

I. The Origins of the Crisis

The immediate causes of the financial crisis were an irrationally exuberant credit boom combined with financial engineering that (i) led to the creation of and reliance on complex financial instruments whose risk characteristics were either underestimated or not understood, and (ii) fueled a housing boom that became a housing price bubble, and (iii) led to a worldwide and unsustainable compression of risk premia. The bursting of the U.S. housing price bubble and the beginnings of the restoration of more normal risk premia set off a downward spiral in which a range of complex financial instruments rapidly lost value, causing difficulties for leading financial institutions and for the real economy. These developments gradually brought the Fed and the major central banks of Europe into action as providers

of liquidity to imploding financial institutions and markets, and later led to lender-of-last-resort type interventions to restructure and/or save financial institutions in deep trouble.

It has become conventional to blame a too easy monetary policy in the U.S. during the years 2004-2007 for the excessive global liquidity, but this issue was not much mentioned during the conference. The Fed may have taken a long time to raise the discount rate from its one percent level in June 2003 until it reached 5.25 percent three years later. But it should be remembered that the concern over deflation in 2003 was both real and justified.

More important in the development of the bubble in the housing market was the availability of financing that required very little—if any—cash down and provided low teaser rates on adjustable rate mortgages. As is well known, the system worked well as long as housing prices were rising and mortgages could be refinanced every few years. The fact that the housing finance system developed in this way reflects a major failure of regulation, a result in part of the absence of uniform regulation of mortgages in the United States, and in some parts of the system, the absence of practically any regulation of mortgage issuers. This was and is no small failure, whose correction is widely seen as one of the most pressing areas of reform needed as the U.S. financial regulatory system is restructured.

The first line of defense for the financial system should be internal risk management in banks and other financial institutions. These systems also failed, and their failure is even more worrisome than the failure of the regulators—for after all, it is very difficult to expect regulators, with their limited resources and inherent limits on how much they can master the details of each institution's risk exposure, to do better than internal risk management in fully understanding the risks facing an institution. Based on my limited personal experience—that is to say on just one data point—I do not believe the risk managers were technically deficient. Rather their ability to envisage extreme market conditions, such as those that emerged in the last year in which some sources of financing simply disappeared, was limited. Perhaps that is why we seem to have perfect storms, once in a century events, so regularly.

There is a delicate point here. If risk managers are required to assign high probabilities to extreme scenarios, such as those of the last year, the volume of lending and risk-taking more generally might be seriously and dangerously reduced. Thus it is neither wise nor efficient for the management of financial firms or their regulators to require financial institutions to become excessively risk averse in their lending. But if these institutions pay too little attention to adverse events that have a reasonable probability of occurring, they contribute to excesses of volatility and crises. The hope is that despite the moral hazard that will be enhanced by the authorities' justified reactions in this crisis, there is a rational expectations equilibrium that ensures a financial system that is both stable and less crisis prone—even though we all know we will not be able entirely to eliminate financial crises.

As Tobias Adrian and Hyun Song Shin stated in their paper, this is the first post-securitization financial crisis. With so much of the financial distress related to securitization, the “originate to distribute” model of mortgage finance has come under close scrutiny. Views are divided. Some see the loss of the incentive to scrutinize mortgages (or whatever assets are being securitized) closely as a major factor in the crisis, suggesting that the crisis would not have been so severe had the originators of the mortgages expected to hold them to maturity. This is clearly true. Others pointed out that securitization has been very successful in other areas, especially the securitization of credit card receivables, and that it would be a mistake to reform the system in ways that make it harder to continue the successful forms of securitization—another view that has merit.

A few years ago Warren Buffett described derivatives as financial weapons of mass destruction, at the same time as Alan Greenspan explained that new developments in the financial system, including ever-more sophisticated derivatives and securitization, enabled a better allocation of risks. It seems clear that in this crisis financial engineers invented instruments that were too sophisticated—at this point it is obligatory to refer to “CDOs squared”—for both their own risk managers and their customers to understand fully, and that this is part of the explanation for the depth and complexity of the

crisis. That is to say that the Buffett view is a better guide to the role of financial super-sophistication, at least in this crisis. But as with securitization, it would be a mistake to overreact and try to regulate extremely useful techniques out of existence.

The role of the rating agencies in this crisis has received a great deal of criticism, including in this conference. However, in considering reforms of the system, we should focus on the particular conflicts of interest that the rating agencies faced in rating the complex financial instruments whose nature was not well understood by many who bought them, and try to deal with those conflicts, while recognizing that external ratings by an independent agency will continue to be necessary for risk management purposes despite all the difficulties associated with that fact.

Let me turn now to leverage and liquidity, the latter the topic of the paper by Franklin Allen and Elena Carletti. It has repeatedly been said that this crisis was in large measure due to financial firms becoming excessively leveraged. This must have been said in one way or another about every financial crisis for centuries—and it was certainly said during the financial crises of the 1990s, including the LTCM crisis. Most financial institutions, notably including banks, make a living off leverage. Nonetheless, there should be leverage constraints—required capital ratios—for any financial institutions that receive or are likely to receive protection from the public sector. Of course, one element of the regulatory game is that regulators impose regulations and the private sector seeks ways around them. So regulators have to be on their toes.

Perhaps the worst breach in the regulation of bank leverage comes from the existence of off-balance sheet financing. There is no good reason to permit off-balance sheet financing, particularly when, as in the current crisis, items that many thought were off-balance sheet return to the balance sheet when they become problematic.

Liquidity shortages have been a central feature of this crisis, but that too is typically the case in financial crises. In their paper Allen and Carletti focus on the role of liquidity—particularly the hoarding of liquidity—in explaining several features of market behavior during the

crisis: the phenomenon that the prices of many AAA-rated tranches of securitized products other than subprime mortgages fell; that inter-bank markets for even relatively short-term maturities dried up; and the fear of contagion.

There is little doubt that required liquidity ratios will be imposed on financial institutions following this crisis, but it also has to be recognized that instruments that appear liquid during good times become illiquid during crises. Thus few instruments other than short-term government paper should be eligible as liquid for purposes of the liquidity ratio.

Several speakers and discussants raised the issue of compensation systems for traders and managers in the financial system. There is little doubt that the heads I win, tails you lose, nature of bonus payments contributes to excessive risk taking by traders. It remains to be seen whether it will be possible to change the compensation system to provide incentives that will more closely align private and social benefits and costs.

II. What Next?

As Chairman Bernanke noted in his opening remarks, the financial crisis is not yet over. At the time of the conference the most immediate problem on the agenda was the future of the GSEs, particularly Fannie Mae and Freddie Mac. As the financial crisis has deepened, as the housing market has deteriorated and housing prices have fallen, and as risk aversion has increased, the situation of these two massive housing sector financial institutions has worsened, to the point where the widespread belief that the government would stand behind them if they ever got into trouble was essentially confirmed by the authorities in July.

Because of a lack of clarity of the plan announced in July, the U.S. Treasury issued a more far-reaching plan in the first half of September. The two GSEs had become too big to fail, not only because of their role in the U.S. housing market, not only because of their political power in Washington, but also because their bonds constituted a significant share of the reserves of China, Japan and other countries.

A default on the liabilities of the GSEs would have had a major immediate impact on the exchange rate of the dollar, and long-lasting effects on market confidence in the dollar and its role as a reserve currency, and those were risks that the U.S. authorities rightly were not willing to take.

The GSE rescues in July and September followed the Bear Stearns intervention in March, and raised the question of what more it would take to stabilize the U.S. financial system, as well as the financial systems of Switzerland and the U.K., and possibly other countries. The special liquidity operations of the major central banks are part of the answer. Beyond that, there were suggestions to give more help to mortgage borrowers who now have negative equity in their houses. And more than one speaker referred to the need for a new Reconstruction Finance Corporation, without specifying what such an organization would be expected to do—probably if established it would be expected to help recapitalize the financial system.

Capital raising by stressed financial institutions is another component, though several speakers expressed doubts about the banks' capacity to raise capital at an affordable price at this time. Anil Kashyap, Raghuram Rajan and Jeremy Stein suggested a scheme whereby banks would buy insurance that would provide capital in downturns or crises, with the insurance policy being one that makes a given amount of capital available to a bank in a well-defined event in which the overall condition of the banking system—for moral hazard reasons, not the condition of the bank itself—deteriorates. This is an interesting proposal, whose institutional details need to be worked out, but it is probably not relevant to the resolution of the current crisis.

The end of the housing price bubble and its impact on the financial system marked the start of the financial crisis, and the contraction of house-building activity was the main factor reducing the growth rate of the economy as the financial sector difficulties mounted. Martin Feldstein in his introductory remarks suggested that U.S. house prices still have 10-15 percent to fall to reach their equilibrium level, but that they may well overshoot on the downside, and thus prolong the crisis. He emphasized the negative effect of the decline in housing wealth on consumption and aggregate demand. Willem

Buiter argued that to a first approximation there is no wealth effect from a rise or decline in the price of housing for people who expect to continue to live in their house—or to put the issue another way, that the perfect hedge against a change in the cost of housing is to own a house. Nonetheless Buiter agreed that the availability of financing based on the owners' equity in the house would have an effect on aggregate demand.

A year after the start of the crisis, with the financial situation not yet stabilized, many ventured guesses as to how severe the downturn would be and how long it would continue. There seemed to be near unanimity that the recovery would not begin this year, and a majority view that growth in the U.S. would resume after mid-year 2009. The dynamics of recovery are complicated, for so long as the financial system continues to deteriorate, it will negatively affect the real economy, and the real economic deterioration in turn will have a negative effect on the financial crisis. That is why some conference participants believed that recovery in the U.S. would not take place until 2010.

III. Longer-term Reforms

The agenda for longer-term reform of the financial system to reduce the frequency and intensity of financial crises was laid out in the speech by Mario Draghi, which drew on the excellent report of the Financial Stability Forum which he chairs, published in April.³ Several other noteworthy reports, including the Treasury's report on the reorganization of financial sector supervision in the United States,⁴ two reports by the private sector Countercyclical Risk Management group, headed by Gerry Corrigan,⁵ and the report of the IIF, the Institute of International Finance,⁶ have also been published in the last several months.

The reform agenda suggested by the Financial Stability Forum has already been described, to reform capital requirements; liquidity; risk management; transparency; credit rating agencies; and asset valuation. In presenting a summary of the FSF Report, Mario Draghi emphasized the role that poor risk management, fueled by inappropriate incentives, had played in generating the crisis. He argued

that the strengthening and implementation of the Basel II approach would significantly align capital requirements with banks' risks. He also discussed ways of reducing the pro-cyclicality of the behavior of the banking system, and the need in formulating monetary policy to take account of financial sector developments—the latter a point developed in the persuasive paper by Adrian and Shin.

The reports of the Counterparty Risk Management Group have presented a set of recommendations to improve the plumbing of the financial system, particularly in trading and dealing with sophisticated and by their nature closely interlinked derivative contracts. Among the recommendations are to attempt to move more contracts to organized markets, and to impose some form of regulation. Further, in light of the huge volume of outstanding derivative contracts, the unwinding of a major financial company is bound to be extremely difficult and costly, despite the existence of netting contracts that in principle could make that process much less difficult. Hence there can be little doubt about the need for further work on market infrastructure.

In addition, this crisis has led to a rethinking of the structure of financial market regulation, centered on the role of the central bank in regulation. The apparent failure of coordination in the United Kingdom among the Treasury, the Bank of England, and the FSA in dealing with the Northern Rock case at a time when the central bank was called upon to act as lender of last resort, has led to a reexamination of the FSA model, that of a single independent regulator over the entire financial system, separate from and independent of the central bank. The Fed's role in the rescue of Bear Stearns, and the apparent extension of the lender of last resort safety net to investment banks has led many to argue that the Fed should supervise all financial institutions for whom it might act as lender of last resort—and the Fed has already reached an agreement with the SEC on cooperation in supervising the major investment banks, which have not until now been under the Fed's supervision.⁷

Historically supervision has been structured along *sectoral* lines—a supervisor of the banks, a supervisor of the insurance companies, and so forth. More recently the approach has been *functional*, in particular distinguishing between prudential and conduct-of-business supervision.

In the *twin-peaks* Dutch model, prudential supervision of the entire financial system is located in the central bank, and conduct of business supervision in a separate organization, outside the central bank. In the Irish model, both functions are located in the central bank.⁸ In Australia, prudential and conduct-of-business supervision are located in separate organizations, both separate from the central bank. As is well known, in the UK the FSA—the Financial Services Authority—is responsible for supervision of the entire financial system, and is located outside the central bank. Sometimes a third function is added—that of supervision of (stability of) the entire financial system, a responsibility that is typically assigned to the central bank.⁹ It is absolutely certain that the structure of supervisory systems will be revisited as a result of this crisis. One conclusion, I strongly believe, will be that prudential supervision should be located within the central bank.

Another issue that will be reexamined is the role of the lender of last resort, and how far the central bank's safety net should extend. The analytic distinction between problems of liquidity and solvency is helpful in thinking through the role of the lender of last resort, but the judgment of whether an institution faces a liquidity or a solvency problem is rarely clear in the heat of the moment. Traditionally it has been thought that the central bank should operate as lender of last resort only for banks,¹⁰ but as the Bear Stearns case showed, the failure of other types of institutions may also have serious consequences for the stability of the financial system.¹¹ And of course, the moral hazard issue has always to be borne in mind in discussing the depth and breadth of the security blanket provided by the lender of last resort.

In the financial crises of the 1990s, particularly those in Asia in 1997-98, the IMF argued that countries could avoid financial crises by (i) ensuring that their macroeconomic framework was sound and sustainable, and (ii) that the financial system was strong. To what extent does the current crisis validate or contradict that conclusion? The macroeconomic *situation* of the United States in recent years has not been sustainable, in that the current account deficit clearly had to be corrected at some point; similarly longer-run budget projections point to the need for a substantial correction in future. This does not necessarily mean that the U.S. macroeconomic *framework*

was not sustainable. It is clear however that the financial system was not strong, and that in particular, the supervisory system was not a system, but a collection of separate and not well coordinated authorities, with substantial gaps and shortcomings in its coverage.

The question of the connection between the unsustainability of the macroeconomic situation and the financial crisis remains a key question for research.

IV. Evaluating Policy Performance So Far

In his interesting and provocative paper, Willem Buiter criticizes, among other things, the Fed's "rescue" of Bear Stearns, and its failure to control inflation.¹² The Bear Stearns rescue still looks sensible, in light of the fragile state of the financial system when it took place, and in light of the fact that the existing owners were not protected but rather saw the value of their shares massively marked down.

As to the inflation point, Buiter in part argues that the Fed was too slow in raising interest rates in the period 2003-2006, and in addition that it was obvious that the entry of Chinese and Indian producers and consumers into the world economy would be inflationary, and should have been anticipated by the Fed. With regard to the latter point, we should remember that until about a year ago the predominant view about the entry of China and India into the global economy, was that it was a deflationary force, pushing down on wages in the industrialized countries.

Why the changed view? That must be a result of the overall balance of macroeconomic forces in the global economy, which switched from deflationary to inflationary as the rapid global growth of the last four years continued. It remains to be analyzed where the inflationary impulses were centered, and what role was played by China's exchange rate policy.

More generally, whether the ongoing integration of China and India into the global economy will lead to deflation or ongoing inflation as the relative prices of goods consumed directly or indirectly by them—middle class goods—rise will also be determined by the overall balance of global macroeconomic policy.

V. Concluding Comment

Typically, the question the returning traveler is asked after attending an international conference as well known as this one is “Were they optimistic or pessimistic?” This time the answer for the short run of up to a year is obvious: “pessimistic.” But if the authorities in the U.S. and abroad move rapidly and well to stabilize the financial situation, growth could be beginning to resume by the time we meet here again next year.

Author’s note: This is an edited version of concluding comments delivered at the Federal Reserve Bank of Kansas City conference, “Maintaining Stability in a Changing Financial System,” Jackson Hole, Wyoming, August 21-23, 2008. In light of their importance, I have had to mention some of the financial developments that occurred after the Jackson Hole conference. However I have tried to minimize the use of hindsight in preparing the written version of the comments and have tried to keep them close to the concluding comments delivered on August 23, 2008.

Endnotes

¹This comment was made before the upward revision (in late August, after the Kansas City Fed conference) of second quarter GDP.

²Whether this statement turns out to be true depends on the ultimate cost to the public of the many rescue measures announced after the Jackson Hole conference.

³“Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience,” Financial Stability Forum, April 2008.

⁴“The Department of the Treasury Blueprint for a Modernized Financial Regulatory Structure,” U.S. Treasury, March 2008.

⁵“Containing Systemic Risk: The Road to Reform,” Counterparty Risk Management Policy Group III (CRMPG III), August 6, 2008. “Toward Greater Financial Stability: A Private Sector Perspective,” Counterparty Risk Management Policy Group II (CRMPG II), July 27, 2005.

⁶“IIF Final Report of the Committee on Market Best Practices: Principles of Conduct and Best Practice Recommendations,” Institute of International Finance, July 2008.

⁷This was written before the disappearance of the major investment banks in the U.S.

⁸More accurately, the organization is known as the “Central Bank and Financial Services Authority of Ireland.”

⁹The U.S. Treasury’s March 2008 report on the reform of the supervisory system, *op. cit.* adopts this tri-functional approach.

¹⁰The current Bank of Israel law (passed in 1954) allows the central bank to lend only to banks. In cases of liquidity, the central bank can do that on its own authority; in solvency cases, it needs the approval of the government.

¹¹This point is reinforced by the Fed’s decision in September to extend a loan to AIG, to prevent its immediate collapse.

¹²Alan Blinder’s discussion of Willem Buiter’s paper provides a more comprehensive analysis of the major points raised by Buiter.

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