

HONG KONG INSTITUTE FOR MONETARY RESEARCH

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## **Leverage, Securitization and Global Imbalances**

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# Leverage, Securitization and Global Imbalances<sup>1</sup>

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<sup>1</sup> Preliminary draft of paper intended as Occasional Paper of the Hong Kong Institute for Monetary Research.

## Chapter 1. Executive Summary

A widespread opinion before the credit crisis of 2007-8 was that securitization enhances financial stability by dispersing credit risk. After the credit crisis, securitization was blamed for allowing the “hot potato” of bad loans to be passed to unsuspecting investors. Both views miss the endogeneity of credit supply.

One attribute of securitization is crucial in understanding the leverage of the financial system as a whole. By tapping new sources of funding, securitization enables credit expansion through higher leverage of the financial system as a whole even if the leverage of individual financial intermediaries are unchanged.

If the expansion of assets entailed by the growth in financial system leverage drives down lending standards, securitization may end up undermining financial stability rather than promoting it. As balance sheets expand, the “hot potato” of bad loans sits in the financial system on the balance sheets of large banks or the off-balance sheet vehicles sponsored by them rather than being sold on to final investors. This is because a consequence of the increased leverage of the financial system as a whole is to expand lending in order to utilize slack in aggregate balance sheet capacity. When prime borrowers already have mortgages, lending standards must be lowered in order to create new assets that fill up the expanding balloon of financial sector balance sheets. Subprime borrowers thus begin to receive credit.

The expanding balloon of the aggregate financial sector balance sheet also has implications for external adjustment, since it sucks in savings from abroad, especially from foreign central banks. The most rapid increase in foreign capital flows into the United States has been for debt securities associated with residential mortgage lending.

Lending by foreigners to non-financial companies in the US has not seen a similar increase. Thus, the increased foreign claims on U.S. debt securities has the hallmarks of a “supply push” adjustment of debt portfolios rather than a “demand pull” adjustment. The large current account deficit sustained by the United States can thus be seen as a consequence of the loosening of credit conditions in the U.S. entailed by financial innovation and the increased leverage of the U.S. financial system.

Going forward, the mechanism that blew up the balloon is likely to go into reverse. Thus, one consequence of the housing crash in the United States and the associated contraction of residential mortgage lending will be to reduce the U.S. current account deficit, possibly quite sharply.

## Chapter 2. Introduction

The global financial crisis of 2007-8 has the distinction of being the first post-securitization crisis in which the traditional distinctions between banking and capital markets have been pushed aside. Indeed, capital market developments have been key to understanding banking sector distress and the progression of the financial crisis through its various stages. The balance sheet adjustments that have been set in motion by the crisis have profound implications for the external adjustment of the major economies.

Indeed, the playing out of the crisis in the last 18 months have laid bare some of the underlying mechanisms that led to the build-up of financial sector imbalances. One mechanism examined in this Occasional Paper is the role played by the securitization of residential mortgages in the United States.

In a nutshell, the hypothesis explored in this Occasional Paper is that the large current account deficits sustained by the United States in the years preceding the current financial crisis was the outcome of the loosening of credit standards entailed by the increased leverage of the U.S. financial system as a whole and that the housing boom that amplified the financial cycle.

Understanding the role of securitization allows us to understand better the origins of the current financial crisis and the global imbalances that preceded it. It also allows us to understand better how the global imbalances will be unwound in the months ahead. Not least, it allows us to assess the policy prescriptions that have been offered to remedy the global imbalances.

Although financial booms and busts are as old as finance itself, two elements have figured prominently in recent developments. The first is the increased supply of credit through securitization and the second is the emergence of market-based financial intermediaries that have grown in importance on the back of securitization.

There are two pieces of received wisdom concerning securitization – one old and one new. The old view (prevalent before outbreak of the current financial crisis) emphasized the positive role played by securitization in dispersing credit risk, thereby enhancing the resilience of the financial system to defaults by borrowers. However, the subsequent credit crisis has somewhat tarnished this positive image, which has given way to a less sympathetic view of securitization that emphasizes the multi-layered agency problems at every stage of the securitization process.<sup>2</sup>

We could dub this less charitable view the “hot potato” hypothesis, and it has figured frequently in speeches given by central bankers and other policy makers on the credit crisis. The motto would be that there is always a greater fool in the chain who will buy the bad loan. At the end of the chain, according to this view, is the hapless final investor who ends up holding the hot potato and suffering the eventual loss. A celebrated anonymous cartoon strip has circulated widely on the internet<sup>3</sup> depicting a hapless official from a Norwegian municipality in conversation with a broker after suffering losses on subprime mortgage securities. There is also mounting empirical evidence that lending standards had been lowered progressively in the run-up to the credit crisis of 2007 (See Demyanyk and van Hemert (2007), Mian and Sufi (2007) and Keys *et al.* (2007))

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<sup>2</sup> See Ashcraft and Schuermann (2008) who detail the specific agency problems at seven points in the securitization chain.

<sup>3</sup> e.g. <http://bigpicture.typepad.com/comments/2008/02/how-subprime-re.html>

It is clear that final investors who buy claims backed by bad assets will suffer losses. However, it is important to draw a distinction between selling a bad loan down the chain and issuing liabilities backed by bad loans. By selling a bad loan, you get rid of the bad loan from your balance sheet. In this sense, the hot potato is passed down the chain to the greater fool next in the chain. However, the second action has a different consequence. By issuing liabilities against bad loans, you do not get rid of the bad loan. The hot potato is sitting in the financial system, such as on the books of the special purpose vehicles (SPVs). Although the special purpose vehicles are separate legal entities from the large financial intermediaries that sponsor them, the financial intermediaries have exposures to them from liquidity enhancements and various forms of retained interest. Thus, far from passing the hot potato down the chain to the greater fool next in the chain, the large financial intermediaries end up keeping the hot potato. In effect, the large financial intermediaries are the last in the chain. They are the greatest fool. While the final investors such as the famed Norwegian municipality will end up losing money, the financial intermediaries that hold the bad loans are in danger of larger losses. Since the intermediaries are leveraged, they are in danger of having their equity wiped out.

Indeed, Greenlaw *et al.* (2008) report that of the approximately 1.4 trillion dollar total exposure to subprime mortgages, around half of the potential losses are borne by US leveraged financial institutions, such as commercial banks, securities firms and hedge funds. When foreign leveraged institutions are included, the total rises to two thirds. Gary Gorton, in his paper delivered at the 2008 Jackson Hole conference (Gorton (2008)), also argues against the hot potato hypothesis by noting that financial intermediaries have borne a large share of the total losses. Hence, we are faced with the following important question. Why did apparently sophisticated banks act as the “greatest fool”?

Although both views of securitization (old and new, positive and negative) are appealing at a superficial level, they both neglect the endogeneity of credit supply. Financial intermediaries manage their balance sheets actively in response to shifts in measured risks. The supply of credit is the outcome of such decisions, and depends sensitively on key attributes of intermediaries’ balance sheets. Three attributes merit special mention – equity, leverage and funding source. The equity of a financial intermediary is its risk capital that can absorb potential losses. Leverage is the ratio of total assets to equity, and is a reflection of the constraints placed on the financial intermediary by its creditors on the level of exposure for each dollar of its equity. Finally, the funding source matters for the total credit supplied by the financial intermediary sector as a whole to the ultimate borrowers.

At the aggregate sector level (i.e. once the claims and obligations between leveraged entities have been netted out), the lending to ultimate borrowers must be funded either from the equity of the intermediary sector or by borrowing from creditors outside the intermediary sector. Aggregate lending to end-user borrowers by the banking system must be financed either by the equity in the banking system or by borrowing from creditors outside the banking system. For any fixed profile of equity and leverage across individual banks, the total supply of credit to ultimate borrowers is larger when the banks borrow more from creditors outside the banking system.

In a traditional banking system that intermediates between retail depositors and ultimate borrowers, the total quantity of deposits represents the obligation of the banking system to creditors outside the banking system. However, securitization opens up potentially new sources of funding for the banking system by tapping new creditors. The new creditors who buy the securitized claims include pension funds, mutual funds and insurance companies, as well as foreign



investors such as foreign central banks. Foreign central banks have been a particularly important funding source for residential mortgage lending in the United States.

As balance sheets expand, new borrowers must be found. When all prime borrowers have a mortgage, but still balance sheets need to expand, then banks have to lower their lending standards in order to lend to subprime borrowers. The seeds of the subsequent downturn in the credit cycle are thus sown.

When the downturn arrives, the bad loans are either sitting on the balance sheets of the large financial intermediaries, or they are in special purpose vehicles (SPVs) that are sponsored by them. This is so, since the bad loans were taken on precisely in order to utilize the slack on their balance sheets. Although final investors such as pension funds and insurance companies will suffer losses, too, the large financial intermediaries are more exposed in the sense that they face the danger of seeing their capital wiped out. The severity of the credit crisis of 2007-8 lies precisely in the fact that the bad loans were not all passed on to final investors. Instead, the “hot potato” sits inside the financial system, on the balance sheet of the largest, and most sophisticated financial intermediaries.

According to the picture painted here, the subprime crisis has its origin in the increased supply of loans – or equivalently, in the imperative to find new assets to fill the expanding balance sheets. In this way, it is possible to explain two features of the subprime crisis - first, why apparently sophisticated financial intermediaries continued to lend to borrowers of dubious creditworthiness, and second, why such sophisticated financial intermediaries held the bad loans on their own balance sheets, rather than passing them on to other unsuspecting investors. Both facts are explained by the imperative to use up slack in balance sheet capacity during an upturn in the credit cycle.

The hypothesis for global imbalances explored in this paper differs in important ways from other well known approaches to the problem. For instance, it has a different emphasis from the “savings glut” hypothesis advanced by Ben Bernanke in his speech in March 2005 (Bernanke (2005)). In this well-known speech, Bernanke highlights the desire by savers in emerging market countries who demand U.S. assets as a vehicle for their saving. In a similar vein, Cabellero, Farhi and Gourinchas (2008) have argued that the shortage of high quality assets in emerging market countries has increased the demand for US securities as a vehicle for saving. For both Bernanke and Caballero *et al.*, the increased foreign holdings of US debt securities is seen from a “demand pull” perspective. The greater demand for US securities pulls US securities out of the US and into foreign hands.

However, there is a need to complement such a story with a supply response from US debtors. As we will see below, the fastest growing component of U.S. debt securities in recent years has been the “capital market” component, consisting of securities issued by private-label asset backed security issuers. It is not obvious why foreigners should express such a strong preference for securities issued by private label ABS issuers when the largest component of ABS issuers have been securities issued by subprime mortgage pools. Indeed, there is an alternative “supply push” perspective in which greater holding of US debt securities is explained by the momentum of rapidly growing balance sheets in the residential mortgage sector which searches for funding sources. Under this alternative story, the US current account deficit is explained by the U.S. housing boom.

The study by Gete (2008) is the closest in spirit to the hypothesis explained here, although for Gete, the housing boom is explained by a preference shift toward housing, rather than being a financial market phenomenon. However, Gete (2008) documents cross-country evidence that suggests



that countries experiencing housing booms are those that have experienced largest current account deficits.

The outline for the rest of the paper is as follows. I begin by reviewing the development of the U.S. financial system from a bank-based system to a market-based system and how the securitization of residential mortgages fit into the picture.

## Chapter 3. Market-Based Financial System

An important background to this study is the growing importance of the capital market in the supply of credit. Traditionally, banks were the dominant suppliers of credit, but their role has increasingly been supplanted by market-based institutions – especially those involved in the securitization process. For the U.S., Figure 3.1

compares the total assets held by banks with the assets of securitization pools or at institutions that fund themselves mainly by issuing securities. By 2007Q2 (on the eve of the crisis), the assets of this latter group, the “market-based assets”, were substantially larger than bank assets.

**Figure 3.1 Total Assets at 2007Q2 (Source: Flow of Funds, Federal Reserve)**

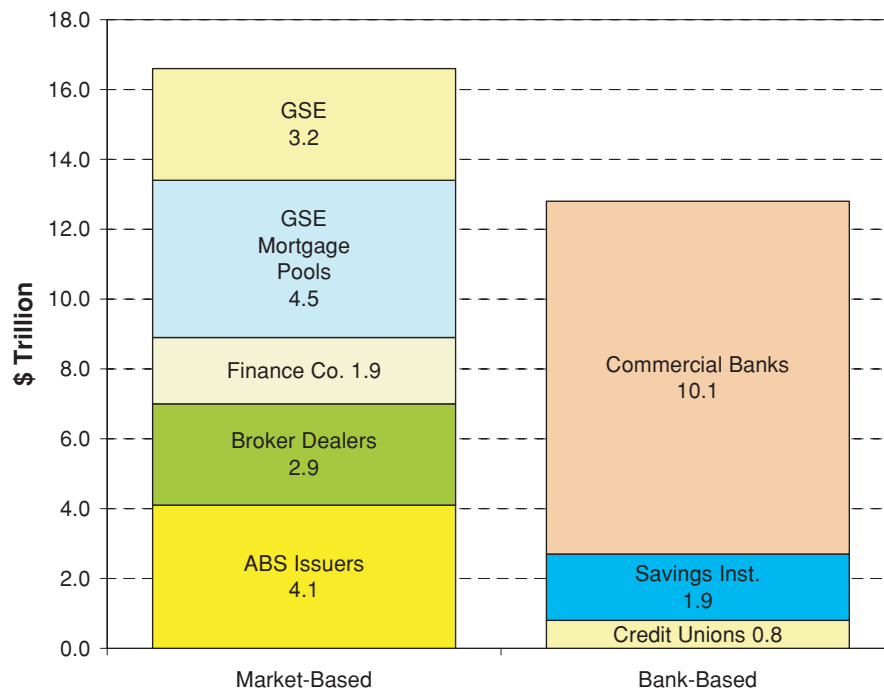
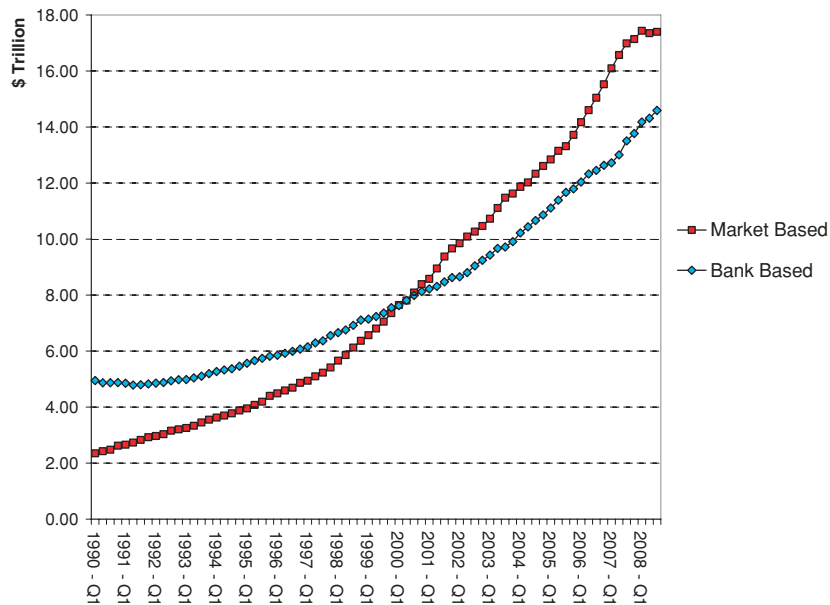


Figure 3.2 plots the relative sizes of the market-based and bank-based assets for the U.S. from the Flow of Funds data. Even as recently as the early 1990s, the bank-based assets were around twice as large as the market-based assets. However, the market-based asset series overtakes the bank-based asset series in 2000, and has become substantially larger since.

Of course, the total assets summed across financial intermediaries will give a misleading picture of the total supply to credit to the ultimate end-users of the credit (the firms and households), since a part

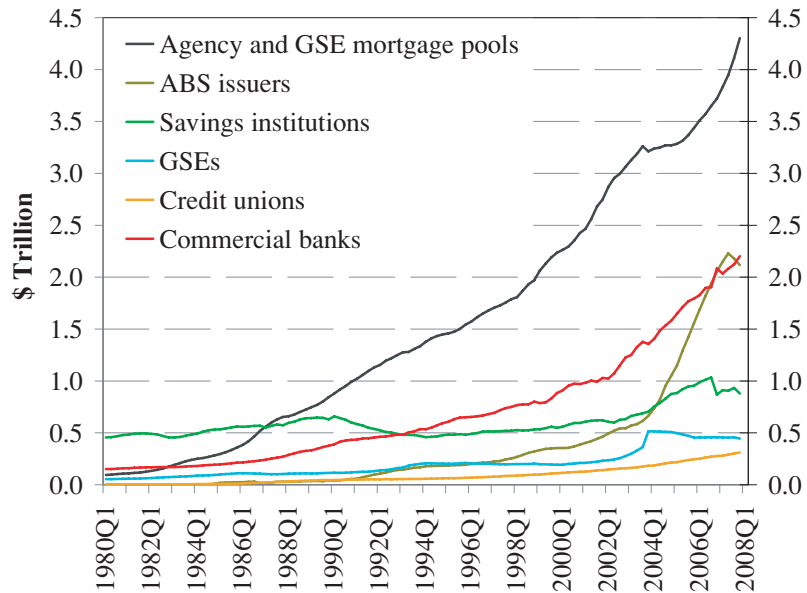
of the credit will be claims against other financial intermediaries. For instance, if a commercial bank holds bonds issued by Fannie Mae, they are counted as assets of the commercial bank, but is a liability on Fannie Mae’s balance sheet. The asset-side counterpart to this liability will be double-counted in the total asset figure for the financial system for the purpose of calculating the total supply of credit to household borrowers. We return to this issue shortly.

**Figure 3.2 Market-Based Assets and Bank-Based Assets (1990Q1 – 2008Q3)**  
 (Source: Flow of Funds, Federal Reserve)

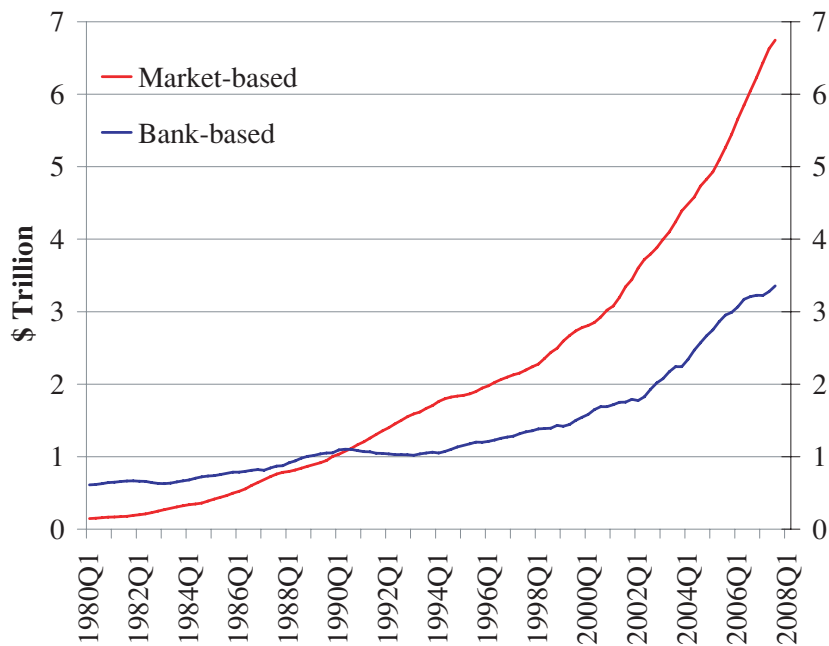


The increased importance of market-based financial intermediation can be seen particularly clearly for residential mortgage lending. Figures 3.3 and 3.4 charts the key developments. As recently as the early 1980s, banks were the dominant holders of home mortgages, but bank-based holdings were overtaken by market-based holders (Figure 3.3). In Figure 3.4, “bank-based holdings” add up the holdings of commercial banks, savings institutions and credit unions. Market-based holdings are the remainder – the GSE mortgage pools, private label mortgage pools and the GSE holdings themselves. Market-based holdings now constitute two thirds of the 11 trillion dollar total of home mortgages.

**Figure 3.3 Total Holdings of US Home Mortgages by Type of Financial Institution**  
 (Source: US Flow of Funds, Federal Reserve)



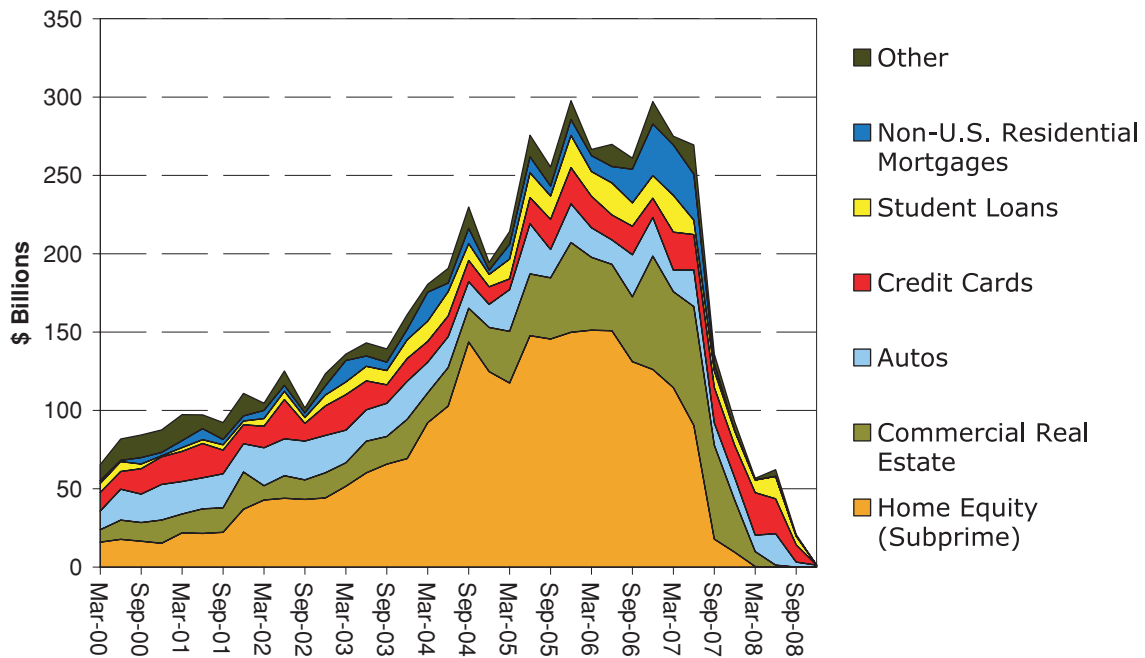
**Figure 3.4 Market Based and Bank Based Holding of Home Mortgages**  
 (Source: US Flow of Funds, Federal Reserve)



In the current financial crisis, it has been some key components of the market-based credit that has seen the most dramatic contraction in the current financial crisis. Figure 3.5 plots the flow of new credit from the issuance of new asset-backed

securities (ABS). The most dramatic fall is in the subprime home equity category, but credit supply of all categories have collapsed, ranging from auto loans, credit card loans and student loans.

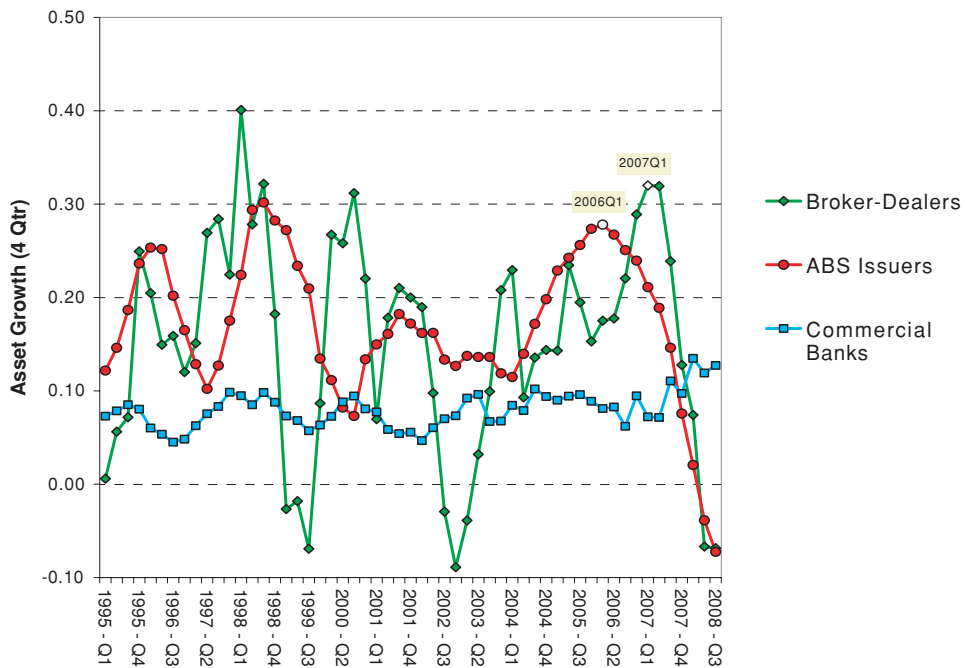
**Figure 3.5 New Issuance of Asset Backed Securities in Previous Three Months**  
 (Source: JP Morgan Chase)



However, the drying up of credit in the capital markets would have been missed if one paid attention to bank-based lending only. As can be seen from Figure 3.6, commercial bank lending has picked up pace after the start of the financial crisis, even as market-based providers of credit have

contracted rapidly. Banks have traditionally played the role of a buffer for their borrowers in the face of deteriorating market conditions (as during the 1998 crisis) and appear to be playing a similar role in the current crisis.

**Figure 3.6 Annual Growth Rates of Assets**  
 (Source: Flow of Funds, Federal Reserve)



## Chapter 4. Market-Based Financial Intermediaries

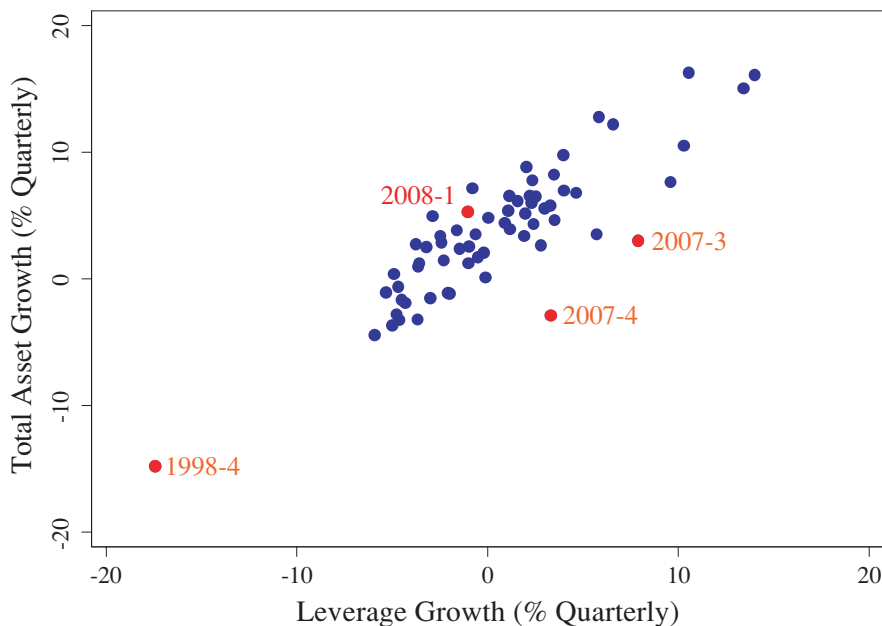
At the margin, all financial intermediaries (including commercial banks) have to borrow in capital markets since deposit funding is insufficiently responsive to the demand for funding. But for a commercial bank, its large balance sheet masks the effects operating at the margin.

In contrast, broker dealers (securities firms) have balance sheets consisting of marketable claims or short-term items that are marked to market. Broker-dealers have traditionally played market-making and underwriting roles in securities markets but their importance in the supply of credit has increased in step with securitization. For this reason, broker dealers may be seen as a good barometer of overall funding conditions in a market-based financial system.

Figure 4.1 is taken from Adrian and Shin (2007) and shows the scatter chart of the weighted average of the quarterly change in assets against the quarterly change in leverage of the (then) five stand-alone US investment banks.<sup>4</sup>

The first striking feature is that leverage is procyclical in the sense that leverage is high when balance sheets are large, while leverage is low when balance sheets are small. This is exactly the opposite finding compared to households, whose leverage is high when balance sheets are *small*. For instance, if a household owns a house that is financed by a mortgage, leverage falls when the house price increases, since the equity of the household is increasing at a much faster rate than assets.

**Figure 4.1 Leverage Growth and Asset Growth of US Investment Banks**  
(Source SEC; Adrian and Shin (2007))



<sup>4</sup> Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley



Procyclical leverage offers a window on financial system liquidity. Before the current financial crisis, it was common hear market commentary on how the financial system was “awash with liquidity” in the sense that credit was easily obtained. Such metaphors have dried up since the beginning of the financial crisis. Understanding leverage dynamics offers a window on the waxing and waning of liquidity.

The horizontal axis measures the (quarterly) change in leverage, as measured by the change in log assets minus the change in log equity. The vertical axis measures the change in log assets. Hence, the 45-degree line indicates the set of points where equity is unchanged. Above the 45-degree line equity is increasing, while below the 45-degree line, equity is decreasing. Any straight line with slope equal to 1 indicates constant growth of equity, with the intercept giving the growth rate of equity.

In Figure 4.1 the slope of the scatter chart is close to 1, implying that equity is increasing at a constant rate on average. Thus, equity seems to play the role of the forcing variable, and all the adjustment in leverage takes place through expansions and contractions of the balance sheet rather than through the raising or paying out of equity.<sup>5</sup>

There is a useful perspective on this feature that comes from the risk management policies of financial intermediaries. Banks aim to keep enough equity capital to meet its overall value at risk (VaR). If we denote by  $V$  the value at risk per dollar of assets, and  $A$  is total assets, then equity capital  $E$  must satisfy  $E = V \times A$ , implying that leverage  $L$  satisfies

$$L = A/E = 1/V$$

If value at risk is low in expansions and high in contractions, leverage is high in expansions and low in contractions – leverage is procyclical.

We can understand the fluctuations in leverage in terms of the implicit maximum leverage permitted by creditors in collateralized borrowing transactions such as repurchase agreements (repos). In a repo, the borrower sells a security today for a price below the current market price on the understanding that it will buy it back in the future at a pre-agreed price. The difference between the current market price of the security and the price at which it is sold is called the “haircut” in the repo. The fluctuations in the haircut largely determine the degree of funding available to a leveraged institution, since the haircut determines the maximum permissible leverage achieved by the borrower. If the haircut is 2%, the borrower can borrow 98 dollars for 100 dollars worth of securities pledged. Then, to hold 100 dollars worth of securities, the borrower must come up with 2 dollars of equity. Thus, if the repo haircut is 2%, the maximum permissible leverage (ratio of assets to equity) is 50.

Suppose the borrower leverages up the maximum permitted level, consistent with maximizing the return on equity. The borrower then has leverage of 50. If then a shock raises the haircut, then the borrower must either cut assets or raise equity. Suppose that the haircut rises to 4%. Then, the permitted leverage halves to 25, from 50. Either the borrower must double equity or sell half its assets, or some combination of both. Times of financial stress are associated with sharply higher haircuts, necessitating substantial reductions in leverage through asset disposals or raising of new equity.

<sup>5</sup> Adrian and Shin (2008b) provides a theoretical basis for this type of behavior, from a contracting framework. See Adrian, Erkko Etula, Shin, 2009 and Adrian, Emanuel Moench, Shin 2009 for asset pricing consequences of liquidity in our sense.

Table 4.1 is taken from IMF (2008a), and shows the haircuts in secured lending transactions at two dates - in April 2007 before the financial crisis and

in August 2008 in the midst of the crisis. Haircuts are substantially higher during the crises than before.

**Table 4.1 Haircuts on Repo Agreements (percent)**

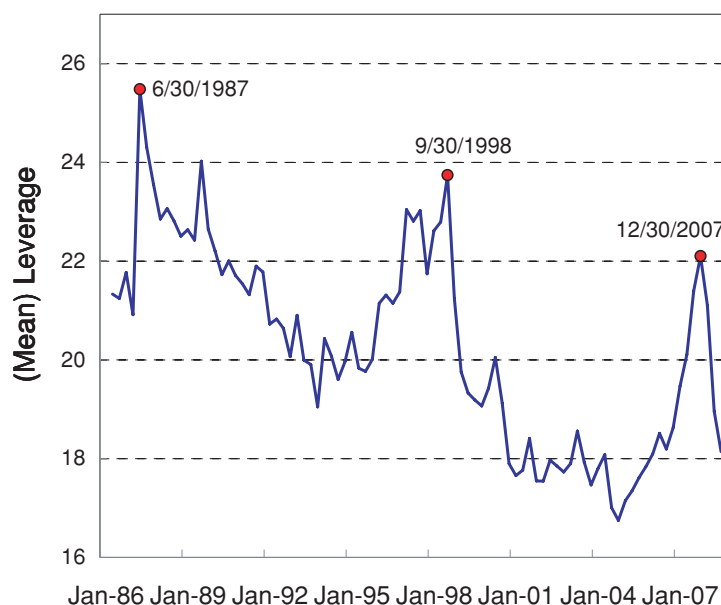
**Source: IMF Global Financial Stability Report, October 2008**

Securities	April-07	August-08
U.S. treasuries	0.25	3
Investment-grade bonds	0–3	8–12
High-yield bonds	10–15	25–40
Equities	15	20
Senior leveraged loans	10–12	15–20
Mezzanine leveraged loans	18–25	35+
Prime MBS	2–4	10–20
ABS	3–5	50–60

The fluctuations in leverage resulting from shifts in funding conditions are closely associated with epochs of financial booms and busts. Figure 4.2 plots the leverage US primary dealers – the set of 18 banks that has a daily trading relationship with the Fed. They consist of US investment banks and US bank holding companies with large broker subsidiaries (such as Citigroup and JP Morgan Chase).

The plot shows two main features. First, leverage tends to decrease overall since 1986. This decline in leverage is due to the bank holding companies in the sample—a sample consisting only of investment banks shows no such trend in leverage (see Adrian and Shin, 2007). Secondly, each of the peaks in leverage was immediately followed by a financial crisis (the peaks are 1987Q2, 1998Q3, 2008Q3). Financial crisis tend to be preceded by marked increases of leverage.

**Figure 4.2 Mean Leverage of US Primary Dealers**  
(June 86 to Sept 08. Source: SEC 10-K and 10-Q filings)



The fluctuations in leverage in the context of secured lending exposes the fallacy of the “lump of liquidity” in the financial system. The language of “liquidity” suggests a stock of available funding in the financial system which is redistributed as needed. However, when liquidity dries up, it disappears altogether rather than being re-allocated elsewhere. When haircuts rise, all balance sheets shrink in unison, resulting in a generalized decline in the willingness to lend. In this sense, liquidity should be understood in terms of the growth of balance sheets (i.e. as a flow), rather than as a stock.

## Chapter 5. Financial System Perspective

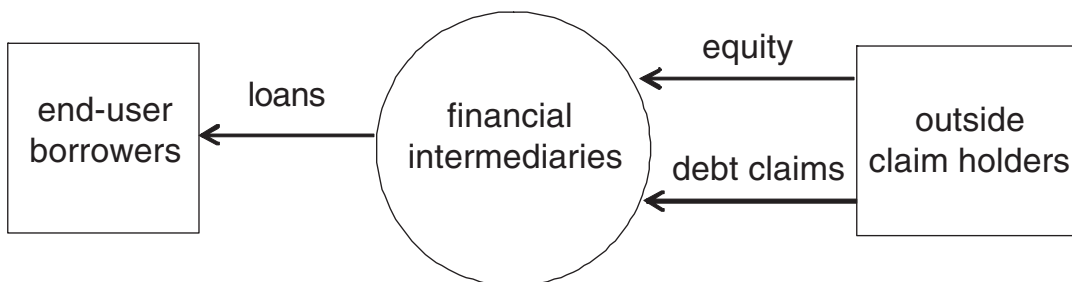
We now turn to the consequences of fluctuations of leverage for total supply of credit from the perspective of the financial system as a whole. When discussing total credit supply, we need to take account of the interlinkages between financial intermediaries.

A simplified analytical framework for our analysis can be given in the diagram below. The financial intermediary sector channels funding from equity holders and ultimate lenders (“outside claim

holders”) to the ultimate users of those funds (“end-user borrowers”).

The end-user borrowers that receive emphasis will change depending on the particular case studied. In the US mortgage boom and bust, the end-user borrowers will be households who have borrowed to buy residential property. In the case of the 1980s bubble in Japan, the group of borrowers who figure in the story will be mainly corporate borrowers.

**Figure 5.1 A Stylized Financial System**



The constituents of the financial intermediary sector itself will depend on the context. For the US mortgage boom and subsequent crisis, the intermediary sector includes the originating banks, but also includes the entities such as the GSEs and GSE mortgage pools that were involved in the securitization process.

Irrespective of the context, at the aggregate sector level (i.e. once the claims and obligations between leveraged entities have been netted out), the lending to ultimate borrowers must be funded either from the equity of the intermediary sector or by borrowing from creditors outside the intermediary sector. To see this, consider a simplified balance sheet of an individual bank, as follows

Assets	Liabilities
Loans to firms, households	Liabilities to non-banks (e.g. deposits)
Claims on other banks	Liabilities to other banks
	Equity

**Individual bank**

By “bank” we mean any leveraged institution that could be construed as part of the financial intermediary sector. In the US context, the “banking system” therefore denotes the whole of the leveraged financial sector, which includes the traditional commercial banking sector, but also encompasses leveraged institutions such as

investment banks, hedge funds and (in the US especially) the government sponsored enterprises (GSEs) such as Fannie Mae and Freddie Mac. When we aggregate across banks, all the claims and obligations across banks cancel out. So, the aggregate balance sheet for the banking sector as a whole looks as follows.

Assets	Liabilities
<p>↑ Total lending to Firms and households</p>	<p>↑ Liabilities to non-banks (<b>deposits + securitized debt</b>)</p> <p>Total equity</p>

### Banking Sector

In other words, aggregate lending to end-user borrowers by the banking system must be financed either by the equity in the banking system or by borrowing from creditors outside the banking system. For any fixed profile of equity and leverage across individual banks, the total supply of credit to ultimate borrowers is larger when the banks borrow more from creditors outside the banking system. Put differently, the leverage of the financial sector is increasing as banks increase the proportion of their funding that comes from creditors outside the banking sector.

Indeed, it is possible to derive a formula based on accounting identities alone (see Shin (2008)) in which the total lending to ultimate borrowers can be written as a function of the profile of equity, leverage and funding source of the individual financial intermediaries. In particular, when we denote:

$y_i$ : lending of bank  $i$  to ultimate borrowers, plus holding of real assets

$e_i$ : equity of bank  $i$

$\lambda_i$ : leverage of bank  $i$  (ratio of total assets to equity)

$z_i$ : proportion of bank  $i$ 's funding that comes from outside the banking system

Then, the sum of all  $y_i$  across all banks (i.e. total lending to ultimate borrowers) can be written as:

$$\sum_i y_i = \sum_i e_i (1 + z_i (\lambda_i - 1))$$

Thus, total lending can increase through a variety of channels.

- An increase in equity resulting from an increase in bank profits will result in increase in lending, keeping leverage and funding source constant.
- Conversely, for fixed levels of equity and composition of funding source, an increase in leverage will increase total supply of credit.
- Most importantly, for our purposes in this paper, total lending will increase if the proportion of funding that comes from outside the banking system were to increase.

In understanding the US mortgage boom, the composition of liabilities is crucial. In a traditional banking system that intermediates between retail depositors and ultimate borrowers, the total quantity of deposits represents the obligation of the banking system to creditors outside the banking system.

However, securitization opens up potentially new sources of funding for the banking system by tapping new creditors. The new creditors are those who buy mortgage-backed securities (MBSs), claims that are written on MBSs such as collateralized debt obligations (CDOs), and (one step removed) those who buy the asset-backed commercial paper (ABCP) that are ultimately backed by CDOs and MBSs. The new creditors who buy the securitized claims include pension funds, mutual funds and insurance companies, as well as foreign investors such as foreign central banks. Foreign central banks have been a particularly important funding source for residential mortgage lending in the United States.

Although securitization may facilitate greater credit supply to ultimate borrowers at the aggregate level, the choice to supply credit is taken by the constituents of the banking system taken as a whole. For a financial intermediary, its return on equity is magnified by leverage. To the extent that it wishes to maximize its return on equity, it will attempt to maintain the highest level of leverage consistent with limits set by creditors (for instance, through the “haircuts” on repurchase agreements). As measured risk fluctuates, so will leverage itself. In benign financial market conditions when measured risks are low, financial intermediaries expand balance sheets as they increase leverage. Securitization enables the tapping of new creditors,

thereby increasing the proportion of the banks’ funding that comes from creditors outside the banking sector. In this way, the leverage of the banking sector as a whole increases.

Although the intermediary could increase leverage in other ways - for instance, returning equity to shareholders, buying back equity by issuing long-term debt - the evidence suggests that they tend to keep equity intact and adjust the size of total assets. We saw from the scatter charts in Figure 4.1 earlier that leverage is adjusted by changes in total balance sheet size, rather than shifts in equity.<sup>6</sup>

As balance sheets expand, new borrowers must be found. When all prime borrowers have a mortgage, but still balance sheets need to expand, then banks have to lower their lending standards in order to lend to subprime borrowers. The seeds of the subsequent downturn in the credit cycle are thus sown.

When the downturn arrives, the bad loans are either sitting on the balance sheets of the large financial intermediaries, or they are in special purpose vehicles (SPVs) that are sponsored by them. This is so, since the bad loans were taken on precisely in order to utilize the slack on their balance sheets. Although final investors such as pension funds and insurance companies will suffer losses, too, the large financial intermediaries are more exposed in the sense that they face the danger of seeing their capital wiped out. The severity of the credit crisis of 2007-8 lies precisely in the fact that the bad loans were not all passed on to final investors. Instead, the “hot potato” sits inside the financial system, on the balance sheet of the largest, and most sophisticated financial intermediaries.

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<sup>6</sup> Adrian and Shin (2007, 2008) discuss the microfoundations of this feature, and why it may be a consequence of financial intermediaries that maximize return on equity subject to the constraints placed by creditors in the capital markets.





**Figure 6.2 Foreign Holding of GSE-Backed Securities**  
 (Source: U.S. Flow of Funds, Federal Reserve, Table L.210)

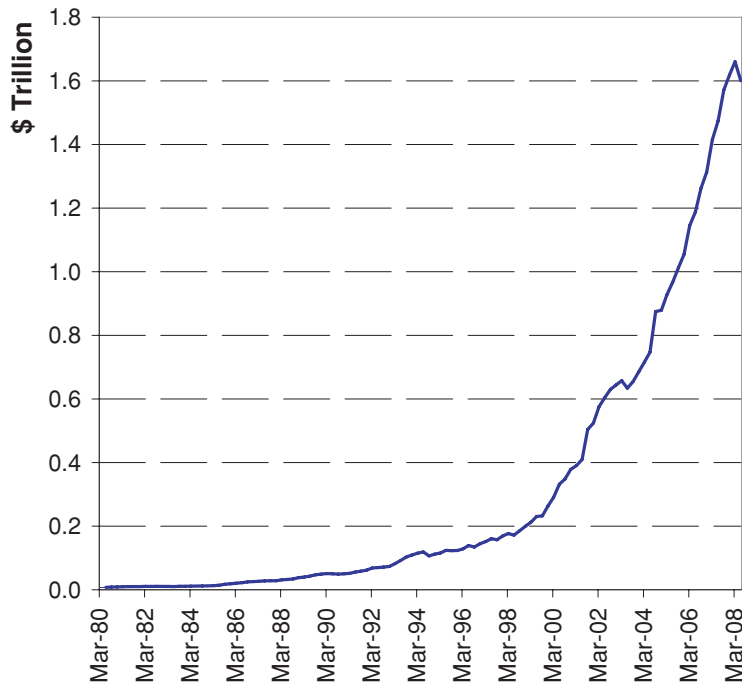
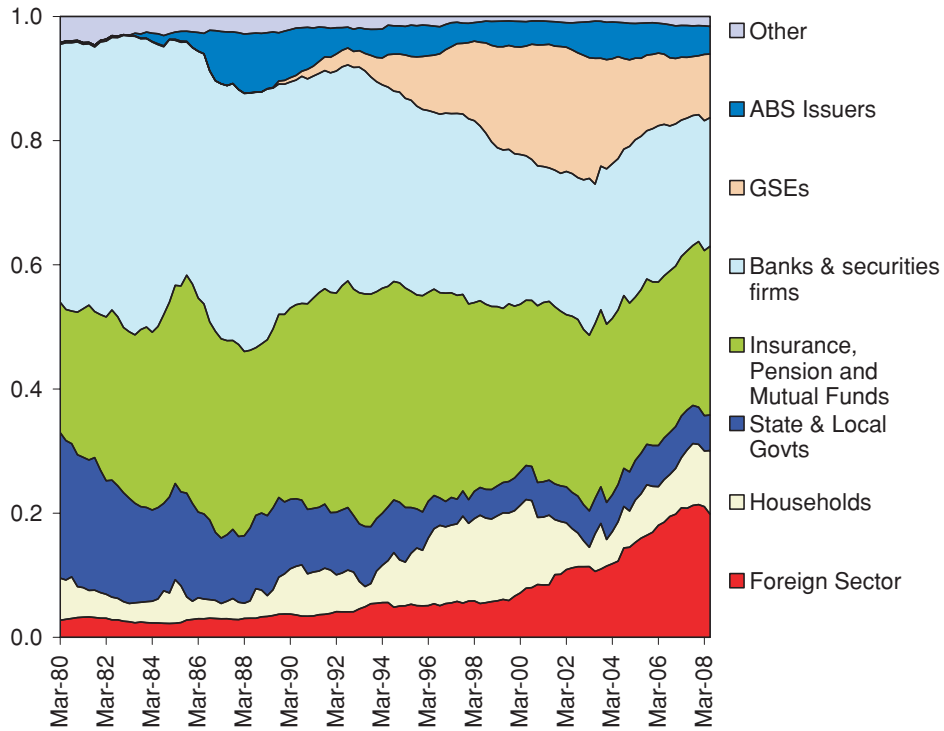


Figure 6.1 plots the total holding of US agency and GSE-backed securities broken down according to the identity of the creditor. The data are from the U.S. Flow of Funds accounts (Table L.210). Figure 6.2 plots the total amount of GSE-backed securities held by foreigners. The total reached a peak of \$1.66 trillion in the second quarter of 2008, but has begun to decline in 2008Q3, falling to \$1.60 trillion. As deleveraging progresses in the financial crisis, we expect the total held by foreigners to decline further. It is this decline that provides a window on the future course of the unwinding of global imbalances.

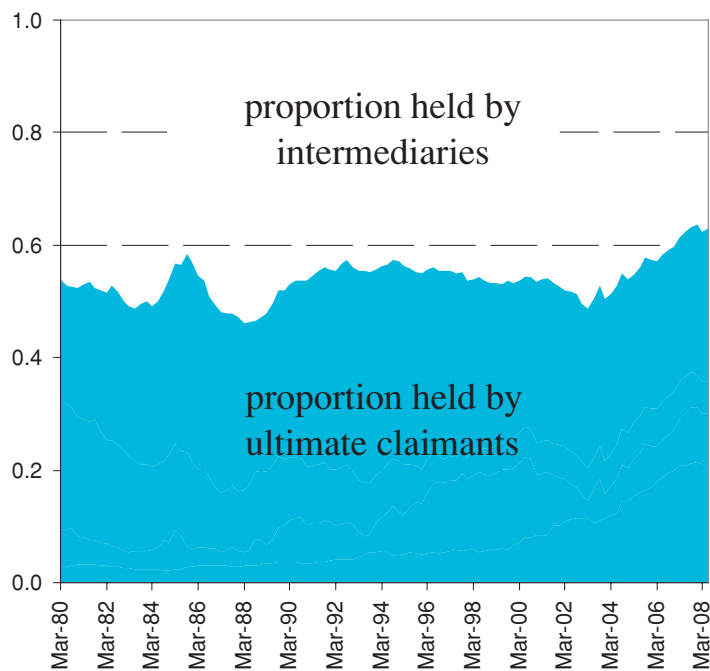
As discussed in the previous section, one of the key determinants of the total supply of credit is the funding source for the leveraged sector. The more funding is obtained from entities outside the leveraged sector, the greater is the supply of credit.

Figure 6.3 is obtained from Figure 6.1 by showing the percentage holdings of GSE-backed securities. Of the holders, leveraged financial institutions include commercial banks, broker dealers, the GSEs themselves and the securities held in ABS pools. The non-leveraged financial institutions include mutual funds, insurance companies and pension funds. The “non-financial sector” includes household, corporate and government sectors. Finally, the “rest of the world” category indicates foreign creditors, especially foreign central banks or other official sector holders. Figure 6.4 depicts the proportion of funding that is obtained from the ultimate claim holders, rather than from financial intermediaries.

**Figure 6.3 Composition of Funding Source for GSE-Backed Securities**  
 Source: Flow of Funds, Federal Reserve, L.210



**Figure 6.4 Composition of Funding Source for GSE-Backed Securities between Intermediaries and Ultimate Claimants**  
 Source: Flow of Funds, Federal Reserve, L.210



The key series for our purpose is the proportion held by the ultimate claim holders. The proportion held by the ultimate claim holders (the non-leveraged holders) has fluctuated between 40% to 60% over the years, but the most recent few years from around 2002 shows a very rapid increase in the series.

The holding of GSE-backed securities by U.S. leveraged institutions have shown a corresponding decrease. At the end of 2002, U.S. leveraged financial institutions held 48.4% of the total, but by the end of 2007, that percentage had dropped to 36.7%. Much of this decrease has been accompanied by the increased holding by the foreign sector. Notably, the holdings of the “rest of the world” category (which itself is mostly accounted for by foreign central banks) has more than tripled from \$504 billion at the end of 2001 to \$1,540 billion at the end of 2007. In this sense, foreign creditors have been an increasingly important funding source for residential mortgage lending in the United States.

The implications for the total supply of credit to the economy as a whole can be seen from the equation:

$$\sum_i y_i = \sum_i e_i (1 + z_i (\lambda_i - 1))$$

Even if the leverage of the individual financial intermediaries (given by the  $\lambda_i$  terms) remains fixed, the total credit to end-user borrowers will increase when the proportion of funding obtained from outside the financial intermediary sector (given by the  $z_i$  terms) increases. What we see from Figure 6.4 is that the funding from outside the traditional U.S. leveraged sector has increased rapidly. In turn, much of this increase is accounted for by the holding of foreign investors.

Another perspective on the issue is to think about the leverage of the financial intermediary sector as a whole. As argued earlier, the aggregate balance sheet of the financial intermediary sector as a whole can be depicted as follows.

Assets	Liabilities
<p>↑ Total lending to Firms and households</p>	<p>↑ <span style="border: 1px solid red; padding: 2px;">Liabilities to non-banks (deposits + securitized debt)</span></p> <p>Total equity</p>

**Banking Sector Balance Sheet**

Thus, the total leverage of the financial intermediary sector can be expressed as the ratio of the total lending to the ultimate borrowers (the firms and households) to the total equity of the financial intermediary sector. From our earlier equation:

$$\sum_i y_i = \sum_i e_i (1 + z_i (\lambda_i - 1))$$

We can obtain the following formula for the total leverage  $L$  of the financial system as a whole.

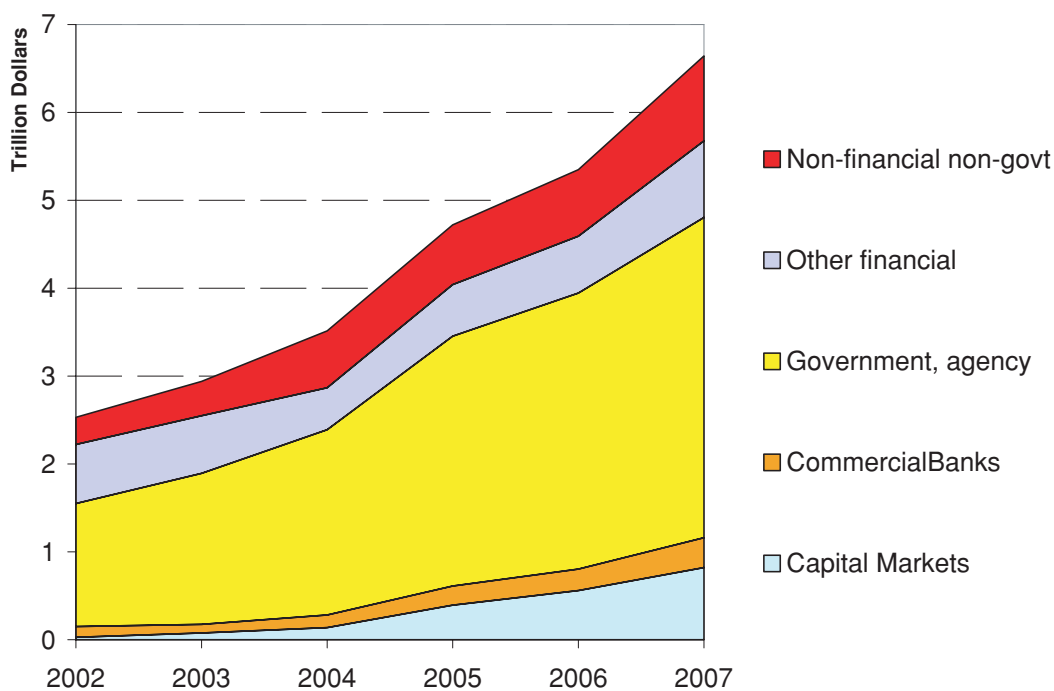
$$L = \frac{\sum_i y_i}{\sum_i e_i} = 1 + \frac{\sum_i e_i z_i (\lambda_i - 1)}{\sum_i e_i}$$

As the funding source shifts to entities outside the banking system, the leverage of the financial system itself increases. This is so even if the leverage of individual institutions were to remain unchanged.

The foreign holdings of U.S. debt securities in general (rather than just the GSE-backed securities) can be obtained from the U.S. Treasury website<sup>7</sup> from the annual survey of securities holdings by foreigners.

**Figure 6.5 Foreign Holding of U.S. Debt Securities**

Source: U.S. Treasury TIC database



The survey takes a snapshot of the foreign holdings of securities as at the end of June each year, and then is published in April of the following year. The latest observation therefore relates to the foreign holdings as at June 2007. Although the survey first started in the 1970s, a breakdown of the identity of the borrowing sector is available only from 2002. Figure 6.5 shows the total holding of U.S. debt securities broken down by the identity of the borrowing sector of the U.S. economy. As can be seen in Figure 6.5, the largest component is the holding of U.S. Treasury securities and Agency debt securities.

The non-financial non-government series aggregates the debt securities issued by manufacturing, retail, mining and other non-financial sectors. We can see that the size of the non-financial, non-government component is somewhat small. The financial sectors account for the bulk of the private-sector debt held by non-U.S. holders.

To get a better picture of the relative speeds at which each of these sectors have grown, Figure 6.6 charts the normalized series where the value at 2002 is set equal to 1. The vertical axis is in log scale.

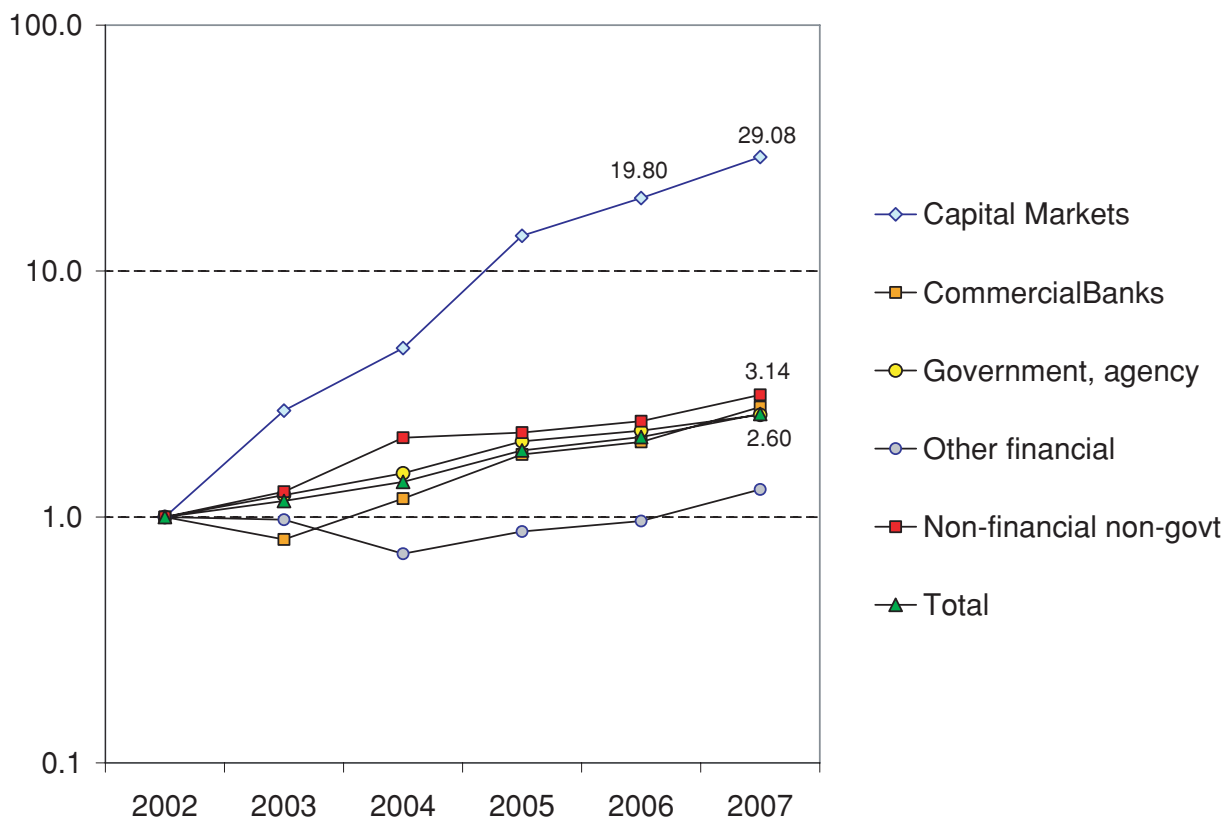
<sup>7</sup> <http://www.ustreas.gov/tic/>

The noteworthy series in Figure 6.6 is the “capital market” series, which has increased by a factor close to 30 in the five years from 2002 to 2007. Such a growth rate is very large compared to the total (which increased 2.6 times). Even other financial sectors, such as the commercial bank sector saw their foreign debt liabilities increase at a similar pace to the total (rising 3.14 times in the five year interval from 2002 to 2007). The “other financials” sector<sup>8</sup> saw much more modest increases in foreign debt liabilities.

Since the GSE-backed securities are included in the “government and agency” category, the capital market series includes mainly the liabilities of the private label securitization vehicles. In other words, the capital market series includes the asset-backed securities issued by the ABS issuer sector of the economy. As seen in an earlier section (Figure 3.5), the largest component of the asset-backed securities series in recent years before the crisis was the securities backed by subprime mortgage assets (such as the collateralized debt obligations (CDOs) based on subprime mortgages).

**Figure 6.6 Growth of Foreign Holding of U.S. Debt Securities**

Source: U.S. Treasury TIC database



<sup>8</sup> The “other financials sector” consists of debt issued by the insurance sector, consumer finance sector and the “diversified financial services” sector, which includes broker dealers.

Another perspective on this phenomenon is the increased size of the private label mortgage pools seen in Figure 3.3. There, we saw that private label mortgage pools increased very rapidly from 2003. Much of the increase is accounted for by subprime mortgages.

These findings suggest the need to complement the “savings glut” hypothesis advanced by Bernanke (2005), Caballero *et al.* (2008) and others. According to the savings glut view, it is the shortage of high quality assets in emerging market countries that has increased the demand for US securities as a vehicle for saving. For both Bernanke and Caballero *et al.*, the increased foreign holdings of US debt securities is seen from a “demand pull” perspective. The greater demand for US securities pulls US securities out of the US and into foreign hands.

However, we see from Figure 6.6 that the greatest increase in foreign holdings of U.S. debt securities has been the asset-backed securities issued by private label securitization vehicles. As seen already, the bulk of these securities were asset-backed securities built on subprime mortgages. It is difficult to see why foreigners in search of high quality assets were expressing such a strong preference for securities backed by subprime mortgages – enough that the “capital market” series in Figure 6.6 increased almost 30 times in the space of five years.

Instead, Figure 6.6 points to the need to complement the “savings glut” hypothesis with a supply response from US debtors. The “savings glut” hypothesis is built around an accounting identity, and so does not do a good job of indicating the underlying economic mechanism that explains the changes in aggregate quantities. However, the way that the savings glut hypothesis has been expounded by some commentators is to portray it as a “demand pull”

phenomenon in which the greater demand for U.S. debt securities by foreigners pull U.S. securities out of the U.S. and into foreign hands. In the popular press, such an account can easily turn into a blame game in which foreign investors are blamed for causing the asset price bubble in the U.S.<sup>9</sup>

The trade surpluses of the Asian emerging market economies and the oil producing countries provide a potential source of funding for U.S. debt securities, but it is difficult to extract the economic mechanisms from the accounting identities alone. Indeed, as argued by Genberg, McCauley, Park and Persaud (2005), the caricature of the “Asian mercantilist” economic policy where Asian exporters manipulate their exchange rates in order to build up reserves is not a persuasive story when the sources of the build-up reserves are examined more carefully.

Our discussion suggests that the “savings glut” hypothesis for the global imbalances must be complemented with a supply response on the part of the debtor sectors in the U.S. Any account of the global imbalances must account for the fact that largest increase in debt securities held by foreigners are for securities issued by private label mortgage pools the bulk of which contain low quality subprime assets.

Indeed, there is an alternative “supply push” perspective in which greater holding of US debt securities is explained by the momentum of rapidly growing balance sheets in the residential mortgage sector which searches for funding sources. Under this alternative story, the US current account deficit is explained by the US housing boom and the imperative to increase leverage of the financial system as a whole.

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<sup>9</sup> See for instance, “The Reckoning: Chinese Savings Helped Inflate American Bubble” New York Times, December 26<sup>th</sup> 2008, <http://www.nytimes.com/2008/12/26/world/asia/26addiction.html>

## Chapter 7. Conclusions

In this paper, I have explored the role played by securitization in increasing the leverage of the financial system as a whole, and the loosening of credit standards that such a development may generate in the face of benign capital market conditions.

In a market-based financial system where the supply of credit is determined by capital market conditions, the response of monetary policy emerges as a key consideration. Although there has been a long-running debate on how far monetary policy should take account of financial stability goals, the debate has been framed as one about whether the central bank should be targeting asset prices. The case against central banks reacting to asset price bubbles is a familiar one, and rests on the following arguments.

- Identifying a bubble is difficult
- Even if there were a bubble, monetary policy is not the right policy tool in addressing the problem. An asset price bubble will not respond to small changes in interest rates. Only a drastic increase in interest rates will prick the bubble.
- However, such a drastic increase in interest rates will cause more harm than good to the economy in terms of future output and output volatility.

The claim that an asset price bubble will not respond to a small change in interest rates has mostly been argued in the context of the stock market, where the proposition is indeed plausible.

However, the stock market is not the best context in which to discuss the financial stability role of monetary policy, as stocks are held mostly by

unlevered investors. Much more central is the credit market, especially when backed by residential or commercial real estate. For debt securities, a difference of a quarter or half percentage in the funding cost may make all the difference between a profitable venture and a loss-making one for leveraged financial intermediaries. Indeed, the growth in off-balance sheet vehicles such as Structure Investment Vehicles (SIVs) and conduits would not have been possible without the low funding costs associated with very short-term borrowing in terms of asset-backed commercial paper (ABCP).

As argued in Adrian and Shin (2008), focusing on the conduct of financial intermediaries is a better way to think about financial stability since it helps us to ask the right questions. Concretely, consider the following pair of questions.

Question 1. Do you know for sure there is a bubble in real estate prices?

Question 2. Could the current benign funding conditions reverse abruptly with adverse consequences for the economy?

One can answer “yes” to the second question even if one answers “no” to the first. This is because we know more about the script followed by financial intermediaries and how they react to changes in the economic environment than we do about what the “fundamental” value of a house is, and whether the current market price exceeds that value.

In any case, for a policy maker, it is the second question which is more immediately relevant. Even if a policy maker were convinced that the higher price of housing is fully justified by long-run secular trends in population, household size, rising living standards, and so on, policy intervention would be



justified if the policy maker also believed that, if left unchecked, the virtuous circle of benign funding conditions and higher housing prices will go too far, and reverse abruptly with adverse consequences for the economy.

Securitization represents a fundamental innovation to the financial system that entails greater credit supply to end-user borrowers. Moreover, since a market-based financial system based on securitization reacts sensitively to market conditions, the role of monetary policy emerges even more pivotal in determining overall funding conditions.

In this Occasional Paper, I have explored an alternative to the “savings glut” hypothesis for global imbalances that rest on a “demand pull” account of how U.S. claims are acquired by foreign investors in search of high quality financial assets that can serve as a vehicle for their savings. The “supply push” story puts at center stage the imperative of the financial system to increase leverage, and to fund the increase in leverage by tapping new sources of funding. Among the new sources of funding will be foreign investors.

Whether the “demand pull” or “supply push” mechanism is the correct one will soon become clear. If the US current account deficit is indeed accounted for by the housing boom in the US until 2007, then one prediction is that the US current account deficit will reverse sharply with the decline in housing activity in the US after 2007. Given the downward trajectory in US housing activity at the moment, it will soon be possible to put this prediction to test.

The “supply push” mechanism examined here has the virtue that it is consistent with the foreigners holding increasing quantities of apparently lower quality assets built on subprime mortgages. The greater risk-taking capacity of the shadow banking system leads to an increased demand for new

assets to fill the expanding balance sheets, and an increase in leverage. The picture is of an inflating balloon which fills up with new assets. As the balloon expands, the banks search for new assets to fill the balloon. They look for borrowers that they can lend to. However, once they have exhausted all the good borrowers, they need to scour for other borrowers - even subprime ones. The seeds of the subsequent downturn in the credit cycle are thus sown.

According to the picture painted here, the subprime crisis has its origin in the increased supply of loans - or equivalently, in the imperative to find new assets to fill the expanding balance sheets. In this way, it is possible to explain two features of the subprime crisis - first, why apparently sophisticated financial intermediaries continued to lend to borrowers of dubious creditworthiness, and second, why such sophisticated financial intermediaries held the bad loans on their own balance sheets, rather than passing them on to other unsuspecting investors. Both facts are explained by the imperative to use up slack in balance sheet capacity during an upturn in the credit cycle.

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