Securitization, Subprime Mortgages and Global Imbalances*

Hyun Song Shin
Princeton University

November 26th 2008

*Text of public of lecture hosted by the Hong Kong Institute for Monetary Research, 26th November 2008.

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. Securitization enables credit expansion through higher leverage of the financial system as a whole. Securitization by itself may not enhance financial stability if the imperative to expand assets drives down lending standards. The "hot potato" of bad loans sits in the financial system on the balance sheets of large banks rather than being sold on to final investors, since the aim of financial intermediaries is to expand lending in order to utilize slack in 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. The expanding balloon also sucks in savings from abroad, especially from foreign central banks. The most rapid increase in foreign capital flows into the US has been for residential mortgage lending. Lending by foreigners to non-financial companies in the US has not seen a similar increase.

Securitization has played a key role in the growth of residential mortgage lending in the United States. Figure 1 below plots the total outstanding US home mortgage assets held by various classes of financial institutions from 1980. Even as recently as the early 1980s, banks and savings institutions held the bulk of home mortgages. Since then, the mortgage pools of the government sponsored enterprises (GSEs) such as Fannie Mae and Freddie Mac have become the largest holder of residential mortgages. Also noticeable are the securitization vehicles classified under asset backed securities (ABS) issuers. The ABS issuers hold non-conforming mortgages such as subprime and "jumbo" mortgages.

Figure 2 below is an aggregate series that distinguishes the "bank-based" holdings of residential mortgages from the "market-based" holdings. The latter is the sum of the holdings of the government sponsored enterprises, the GSE mortgage pools and the private label ABS issuers. The bank-based series is the sum of the remaining three categories. We can see that the market-based series overtook the bank-based series in 1990, and now accounts for two thirds of the approximately 11 trillion dollars' worth of residential mortgages outstanding.

There are two pieces of received wisdom concerning securitization - one old and one new. The old view (prevalent before outbreak of the credit crisis of 2007/8) 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 secu-

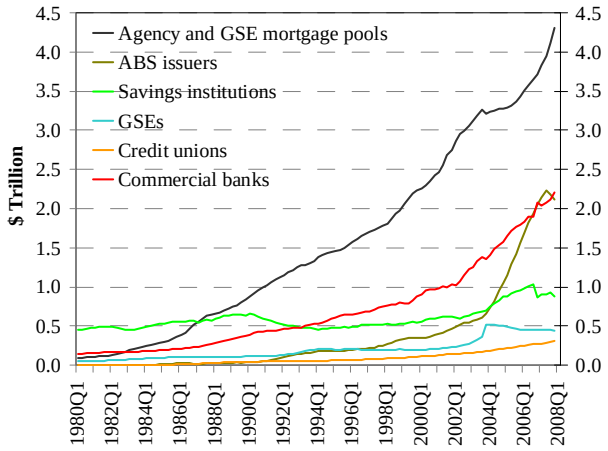

Figure 1: US Home Mortgage Assets (1980Q1 - 2008Q1): Flow of Funds, US Federal Reserve.

ritization process.[1] We could dub this less charitable view the "hot potato" hypothesis, and it has figured frequently in speeches given by 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[2] 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.[3]

It is clear that final investors who buy claims backed by bad assets will

[1]See Ashcraft and Schuermann (2008) who detail the specific agency problems at seven points in the securitization chain.

[2]e.g. http://bigpicture.typepad.com/comments/2008/02/how-subprime-re.html

[3]See Demyanyk and van Hemert (2007), Mian and Sufi (2007) and Keys et al. (2007).

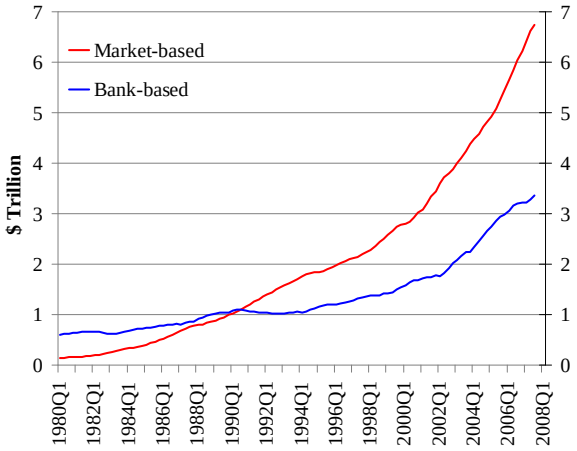

Figure 2: Bank-Based and Market-Based Home Mortgage Holdings (1980Q1 - 2008Q1): Flow of Funds, US Federal Reserve

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 finanical 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, investment banks and hedge funds. When foreign leveraged institutions are included, the total rises to two thirds. Gary Gorton, in his Jackson Hole paper this year (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 bor-

rowing 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 and households claims on other banks	debt to outside lenders obligations to other banks equity

By "bank" we mean any leveraged institution. So, the "banking system" 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
total loans to firms and households	total debt to outside lenders total equity

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.[4]

[4]The leverage of the banking sector as a whole is given by $1 + \frac{\sum_{i=1}^{n} e_i z_i (\lambda_i - 1)}{\sum_{i=1}^{n} e_i}$, where e_i is bank i's equity, λ_i is bank i's leverage, and z_i is the proportion of bank i's funding that comes from creditors *outside* the banking sector (see Shin (2008)).

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.[5] 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.

Evidence from GSE debt holdings

A complete disaggregation of the funding source for the banking sector is not possible due to the lack of detailed breakdowns in the data between funding from leveraged and unleveraged creditors. However, we can gain glimpses from different perspectives.

One way is to examine the identity of the holders of US agency and GSE-backed securities. Figure 3 plots the total holding of US agency and

[5]See Adrian and Shin (2007, 2008).

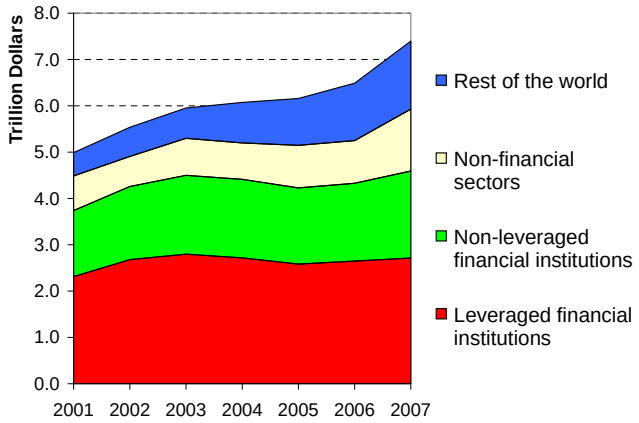

Figure 3: Holding of GSE-backed securities (source: US Flow of Funds)

GSE-backed securities broken down according to the identity of the creditor. The data are from the Flow of Funds accounts (table L.210). Leveraged financial institutions include commercial banks, broker dealers and other securitization vehicles. 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 4 charts the holders by percentage holdings.

The key series for our purposes is the proportion held by other leveraged financial institutions. We see that US leveraged institutions have been holding a declining proportion of the total. At the end of 2002, leveraged financial institutions held 48.4% of the total, but by the end of 2007, that percentage had dropped to 36.7%. There has been a consequent increase in the funding provided by the non-leveraged sector. Notably, the holdings

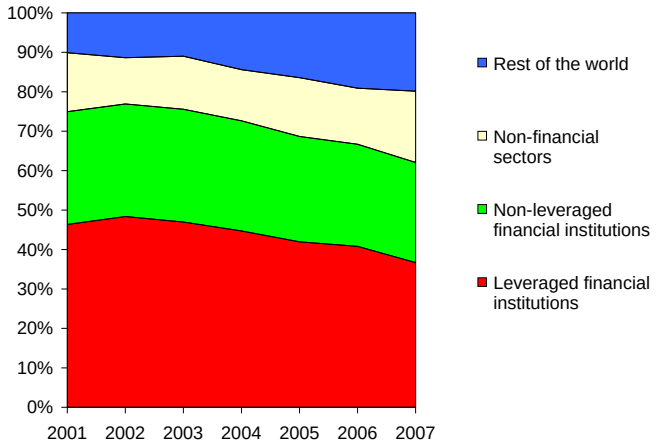

Figure 4: Holding of GSE-backed securities (percentages)

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 central banks have been an increasingly important funding source for residential mortgage lending in the United States.

Evidence from Foreign Holding of US Securities

Another vantage point is the size of foreign holdings of US debt securities, disaggregated by the borrowing sector. The US Treasury publishes an annual survey of foreign holdings of US securities, giving a snapshot of the foreign holdings as at the end of June of a particular year.[6] For the snapshots dating from June 2002, disaggregated estimate for each borrowing sector is available. Figure 5 charts the series for each borrowing sector. The largest component is the government and agency sector, which sums the foreign holdings of US Treasury and agency debt securities. Also plotted are the

[6]http://www.ustreas.gov/tic/

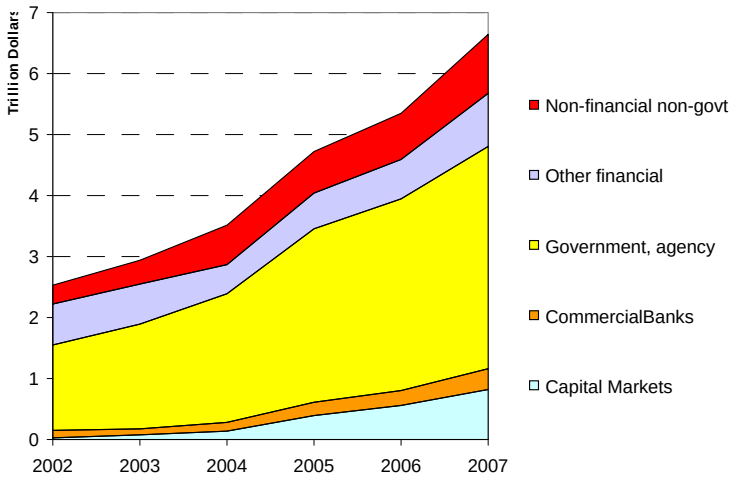

Figure 5: Total foreign holding of US debt securities by borrowing sector (source: US Treasury)

foreign holdings issued by the commercial banks, the other financial sectors, and the non-financial and non-government sectors, which include the debt issued by manufacturing, retail, service and primary sectors.

The noteworthy series for the discussion in this paper is the "capital market" series, which includes the mortgage backed securities issued by the private label mortgage pools. As we saw at the outset of this paper the private label mortgage pools increased very rapidly from 2003. In figure 5, the increased weight of the private label mortgage pools is reflected in the rapid increase in the foreign holding of securities backed (directly or indirectly) by the private label mortgage pools.

Figure 6 shows more dramatically the pace at which foreigners have been sold securities backed by private label mortgage pools. Note that the vertical axis is in log scale. All series have been normalized to 1 as at June 2002.

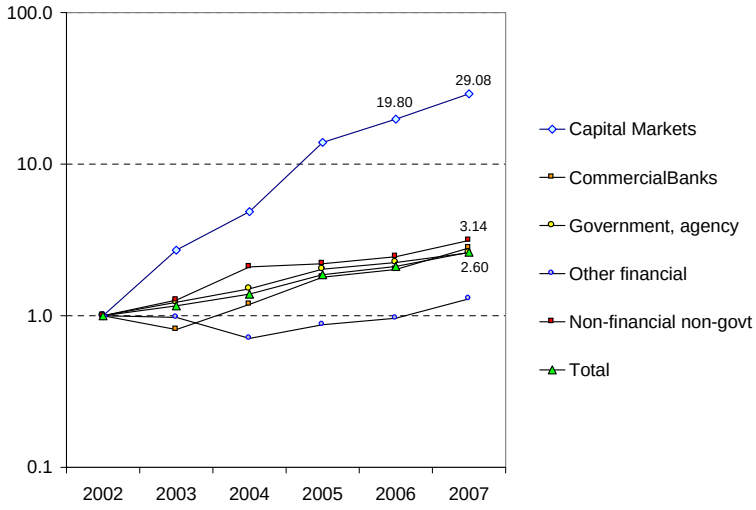

Figure 6: Relative growth of US debt securities by borrowing sector (source: US Treasury)

Total foreign holdings (green triangles) has increased 2.6 times from 2002 to 2007, which is roughly in line with the government and non-financial sector debt sold to foreigners (yellow circles and red squares, respectively). However, the "capital market" series has increased almost 30 times in the same time period.

These findings complement the "savings glut" hypothesis advanced by Ben Bernanke in his speech in April 2005.[7] In this well-known speech, Bernanke highlights the role of capital flows into the US from emerging market countries in perpetuating the large and growing US current account deficit at the time. 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

[7] http://www.federalreserve.gov/boarddocs/speeches/2005/200503102/default.htm

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, figure 6 points to the need to complement such a story with a supply response from US debtors. It is not obvious why foreigners should express such a strong preference for securities issued by private label mortgage pools over other sectors, especially since the private label mortgage pools 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.

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 rapidly 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.

Explaining Emergence of Subprime Lending

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.

References

Adrian, T. and H. S. Shin (2007) "Liquidity and Leverage" working paper, Federal Reserve Bank of New York and Princeton University

Adrian, T. and H. S. Shin (2008) "Financial Intermediaries, Financial Stability and Monetary Policy" paper for the Federal Reserve Bank of Kansas City Symposium at Jackson Hole, 2008

Ashcraft, A. and T. Schuermann (2008) "Understanding the Securitization of Subprime Mortgage Credit" Staff Report 318, Federal Reserve Bank of New York
http://www.newyorkfed.org/research/staff_reports/sr318.pdf

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas (2008) "An Equilibrium Model of "Global Imbalances" and Low Interest Rates" American Economic Review, 98, 358-393.

Demyanyk, Y. and O. van Hemert (2007) "Understanding the Subprime Mortgage Crisis" working paper, New York University, Stern School of Business.

Gorton, G (2008) "The Panic of 2007" paper for the Federal Reserve Bank of Kansas City Symposium at Jackson Hole, 2008

Greenlaw, D., J. Hatzius, A. Kashyap and H. S. Shin (2008) "Leveraged Losses: Lessons from the Mortgage Market Meltdown" Report of the US Monetary Monetary Form, number 2.
http://www.chicagogsb.edu/usmpf/docs/usmpf2008confdraft.pdf

Keys, Benjamin, Tanmoy Mukherjee, Amit Seru and Vikrant Vig (2007) "Did Securitization Lead to Lax Screening? Evidence From Subprime Loans" working paper, University of Chicago GSB.

Mian, Atif and Amir Sufi (2007) "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis" working paper, University of Chicago GSB

Shin, H. S. (2008) "Securitization and Financial Stability" working paper, Princeton University