Money, Liquidity and Monetary Policy*

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Before the current financial crisis, the global economy was often described as being "awash with liquidity", meaning that the supply of credit was plentiful. The financial crisis has led to a drying up of this particular metaphor. Understanding the nature of liquidity in this sense leads us to the importance of financial intermediaries in a financial system built around capital markets, and the critical role played by monetary policy in regulating credit supply.

An important background 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 US, Figure 1 compares total assets held by banks with the assets of securitization pools or at institutions that fund themselves mainly by issuing securities. By 2007Q2 (just before the current crisis), the assets of this latter group, the "market-based assets," were substantially larger than bank assets.

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Figure 1. Total Assets at 2007Q2 (Source: US Flow of Funds, Federal Reserve)

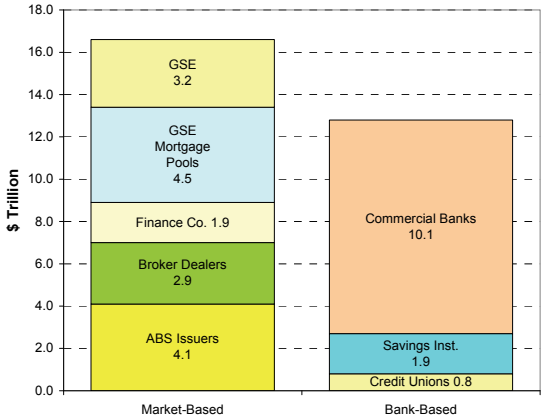


Figure 2. Total Holdings of US Home Mortgages by Type of Financial Institution (Source: US Flow of Funds, Federal Reserve)

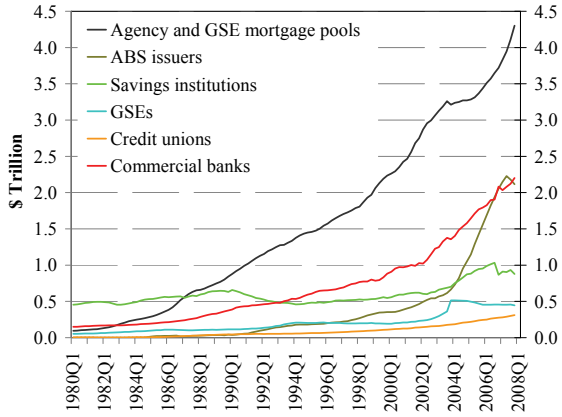
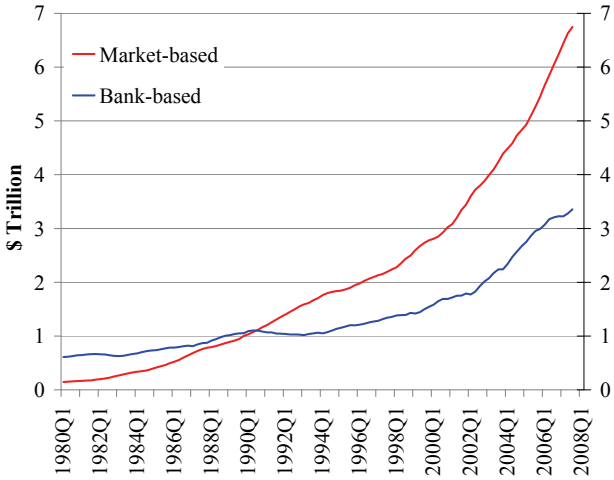


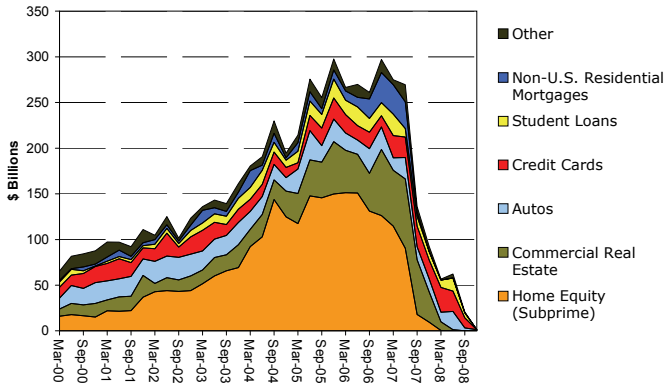
Figure 3. Market Based and Bank Based Holding of Home Mortgages (Source: US Flow of Funds, Federal Reserve)



A similar picture holds for residential mortgage lending. 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 2). In Figure 3, "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.

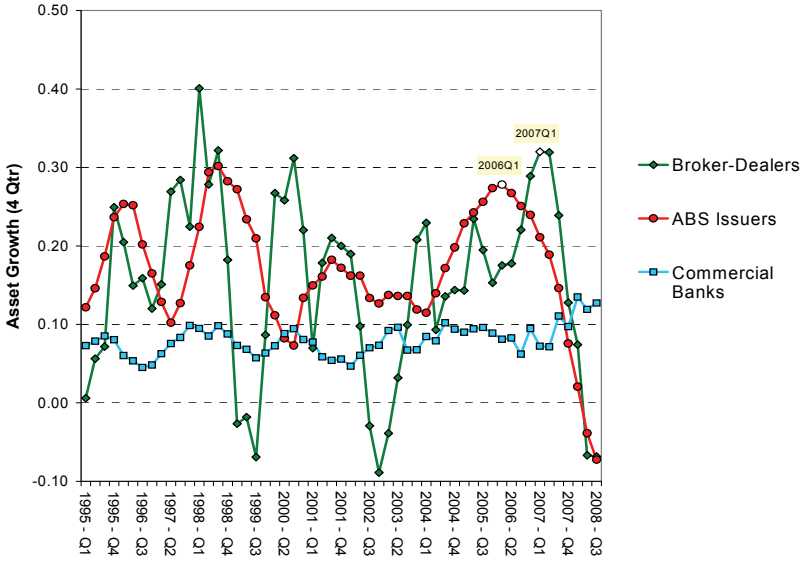
Market-based credit has seen the most dramatic contraction in the current financial crisis. Figure 4 plots the flow of new credit from the issuance of new asset-backed securities. The most dramatic fall is in the subprime category, but credit supply of all categories has collapsed, ranging from auto loans, credit card loans and student loans.

Figure 4. 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 5, 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 5. Annual Growth Rates of Assets
(Source: US Flow of Funds, Federal Reserve)



I. Market-Based Intermediaries

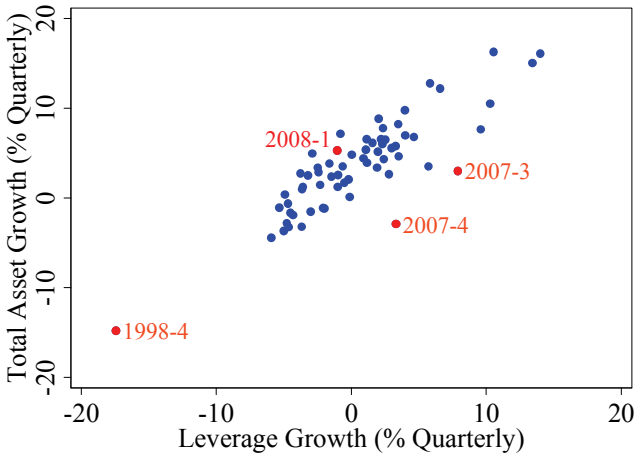
At the margin, all financial intermediaries (including commercial banks) have to borrow in capital markets, since deposits are insufficiently responsive to funding needs. But for a commercial bank, its large balance sheet masks the effects operating at the margin.

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 barometer of overall funding conditions in a market-based financial system.

Figure 6 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 (Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley).

The 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 faster rate than assets.

Figure 6. Leverage Growth and Asset Growth of US Investment Banks (Source SEC; Adrian and Shin (2007))



Procyclical leverage offers a window on financial system liquidity. The horizontal axis measures the (quarterly) growth 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 (log) 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 6 the slope of the scatter chart is close to 1, implying that equity is increasing at a constant rate on average. Thus, equity plays the role of the forcing variable, and the adjustment in leverage primarily takes place through expansions and contractions of the balance sheet rather than through the raising or paying out of equity. Adrian and Shin (2008a) derive micro-foundations for this type of behavior based on Holmstrom and Tirole (1997), and Adrian, Erkko

Etula, Shin (2009) and Adrian, Emanuel Moench, and Shin (2009) study its asset pricing consequences.

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.

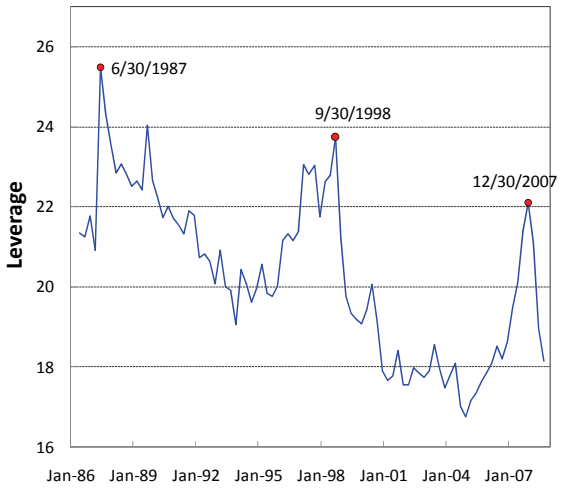
Suppose the borrower leverages up the maximum permitted level, consistent with maximizing the return on equity. The borrower then has leverage of 50. If a shock raises the haircut, then the borrower must either sell assets, or raise equity. Suppose that the haircut rises to 4%. Then, permitted leverage halves from 50 to 25. 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. Table 7 is taken from IMF (2008), 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 7. Haircuts on Repo Agreements (percent)
(Source: IMF Global Financial Stability Report, April 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 8 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).

Figure 8. Mean Leverage of US Primary Dealers
(June 86 to Sept 08. Source: SEC 10-K and 10-Q filings)



The plot shows two main features. First, leverage has tended to decrease 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 declining trend in leverage (see Adrian and Shin, 2007). Secondly, each of the peaks in leverage is associated with the onset of a financial crisis (the

peaks are 1987Q2, 1998Q3, 2008Q3). Financial crises tend to be preceeded by marked increases of leverage.

The fluctuations of credit in the context of secured lending expose 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.

Fluctuations in funding conditions have an impact on macroeconomic variables. For instance, dealer asset growth AG_{t-1} explains changes in housing investment ΔHI_t one quarter later. The t-statistic of 2.74 indicates significance at the 1% level (standard errors are adjusted for autocorrelation). The time period covers 1986Q1 through 2008Q3, but the forecast ability also significant for shorter time periods, and when we control for additional market variables such as the term spread of interest rates, equity volatility, equity returns, and credit spreads.

$$\Delta HI_t = \underset{(-2.15)}{-1.15} - \underset{(-1.01)}{0.05} \bullet HI_{t-1} + \underset{(2.74)}{0.06} \bullet AG_{t-1} + \varepsilon_t \qquad (1)$$

Adrian and Shin (2008b) provide more detail, and also show that commercial bank assets have no such predictive feature as consistent with the earlier literature which found little relationship between commercial bank asset growth and macroeconomic variables.

Adrian and Shin (2008b) show that monetary policy has a direct impact on broker dealer asset growth via short-term interest rates, yield spread and risk measures. Table 8 from Adrian and Shin (2008b) reports a weekly regression of primary dealer repo growth.

Table 8: Primary Dealer Repo Growth Expands when the Term Spread is Large

	Primary Dealer Repo Growth	
Fed Funds (13 week change)	-0.037	**
Fed Funds (13 week lag)	0.037	***
S&P500 Return (13 week)	0.000	*
S&P500 (13 week lag)	0.000	***
VIX (13 week change)	-0.001	
VIX (13 week lag)	-0.007	***
10-year / 3-month Treasury spread (13 week change)	0.049	**
10-year / 3-month Treasury spread (13 week lag)	0.087	***
Baa / 10-year credit spread (13 week change)	0.150	***
Baa / 10-year credit spread (13 week lag)	0.017	
Repo Growth (13 week lag)	-0.242	***
Constant	-0.163	

Broker-dealers fund themselves with short term debt (primarily repurchase agreements and other forms of collateralized borrowing). Part of this funding is directly passed on to other leveraged institutions such as hedge funds in the form of reverse repos. Another part is invested in longer term, less liquid securities. The cost of borrowing is therefore tightly linked to short term interest rates in general, and the Federal funds target rate in particular. Broker-dealers hold longer term assets, so that proxies for expected returns of broker-dealers are spreads – either credit spreads, or term spreads. Leverage is constrained by risk; in more volatile markets, leverage is more risky and credit supply can be expected to be more constrained.

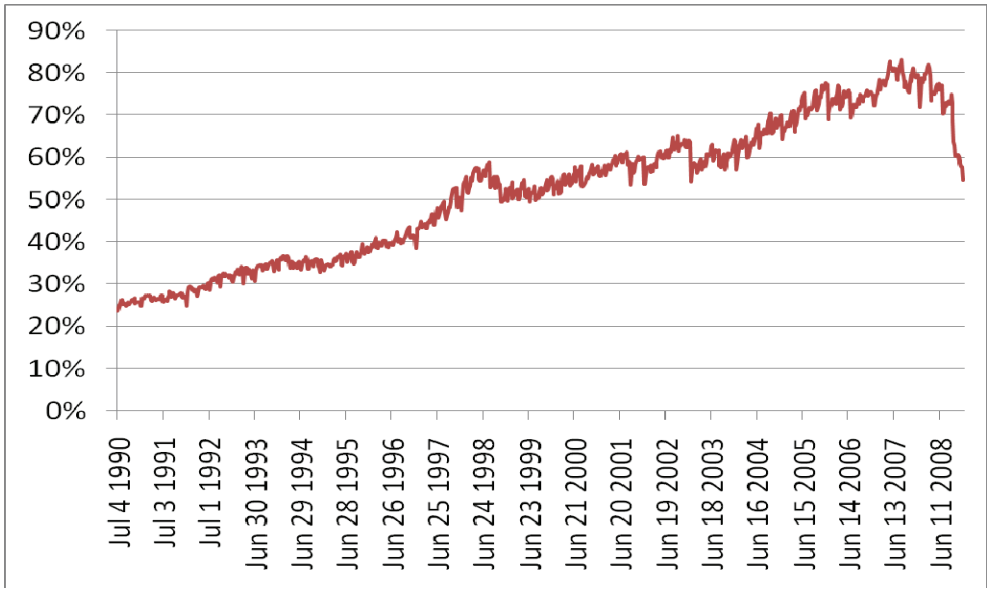
To the extent that financial intermediaries play a role in monetary policy transmission through credit supply, short term interest rates appear matter directly for monetary policy. This perspective on the importance of the short rate as a price variable is in contrast to current monetary thinking at many central banks, where short term rates matter only to the extent that

they determine long term interest rates, which are seen as being risk-adjusted expectations of future short rates.[1]

II. Lessons for Monetary Policy

In a hypothetical world where deposit-taking banks are the only financial intermediaries, their liabilities as measured by traditional monetary aggregates—such as M2—would be good indicators the aggregate size of the balance sheets of leveraged institutions. Instead, we have emphasized market-based liabilities such as repos and commercial paper as better indicators of credit conditions that influence the economy. Figure 9 shows that tracking primary dealer repos and financial commercial paper as a fraction of M2 shows the current credit crunch beyond just the traditional notion of broad money.

Figure 9. Primary Dealer Repos + Financial Commercial Paper as a Fraction of M2. (Source: Federal Reserve).



[1] The credit supply channel sketched here differs from the financial amplification mechanisms of Ben Bernanke and Mark Gertler (1989), and Nobuhiro Kiyotaki and John Moore (1997). These papers focus on amplification due to financing frictions in the *borrowing* sector, while we focus on amplification due to financing frictions in the *lending* sector. Our approach also differs from Vasco Curdia and Michael Woodford (2008), who focus on credit spreads, while we are focusing on balance sheet quantities.

We conclude that there is a case for rehabilitating a role for balance sheet quantities for the conduct of monetary policy. Ironically, our call comes even as monetary aggregates have fallen from favor in the conduct of monetary policy (see Friedman (1988)). The money stock is a measure of the liabilities of deposit-taking banks, and so may have been useful before the advent of the market-based financial system. However, the money stock will be of less use in a financial system such as that in the US. More useful may be measures of collateralized borrowing, such as the weekly series of primary dealer repos.

Our results highlight the way that monetary policy and policies toward financial stability are linked. When the financial system as a whole holds long-term, illiquid assets financed by short-term liabilities, any tensions resulting from a sharp pullback in leverage will show up somewhere in the system. Even if some institutions can adjust down their balance sheets flexibly, there will be some who cannot. These pinch points will be those institutions that are highly leveraged, but who hold long-term illiquid assets financed with short-term debt. When the short-term funding runs away, they will face a liquidity crisis.

Balance sheet dynamics imply a role for monetary policy in ensuring financial stability. The waxing and waning of balance sheets have both a monetary policy dimension in terms of regulating aggregate demand, but it has the crucial dimension of ensuring the stability of the financial system. Contrary to the common view that monetary policy and policies toward financial stability should be seen separately, they are inseparable. At the very least, there is a strong case for better coordination of monetary policy and policies toward financial stability.

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