

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 factor is the growing role of capital markets 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 United States, 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 2007:II (just before the current crisis), the assets of this latter group, the “market-based assets,” were substantially larger than bank assets.

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 government-sponsored enterprise (GSE) mortgage pools, private label mortgage pools, and the GSE holdings themselves. Market-based holdings now constitute two-thirds of the \$11 trillion total of home mortgages.

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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 to credit card loans and student loans.

The drying up of credit in the capital markets would have been missed, however, 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.

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 of 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 (forthcoming) 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).

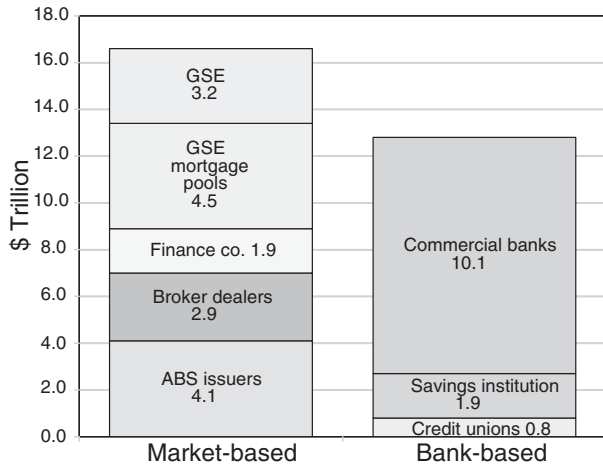


FIGURE 1. TOTAL ASSETS AT 2007:II

Source: US Flow of Funds, Federal Reserve.

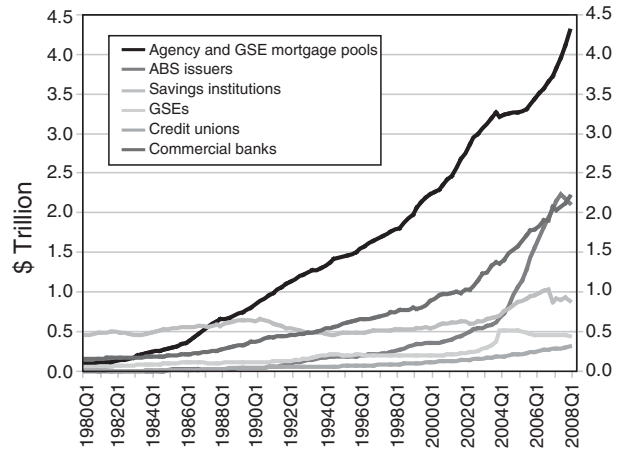


FIGURE 2. TOTAL HOLDINGS OF US HOME MORTGAGES BY TYPE OF FINANCIAL INSTITUTION

Source: US Flow of Funds, Federal Reserve.

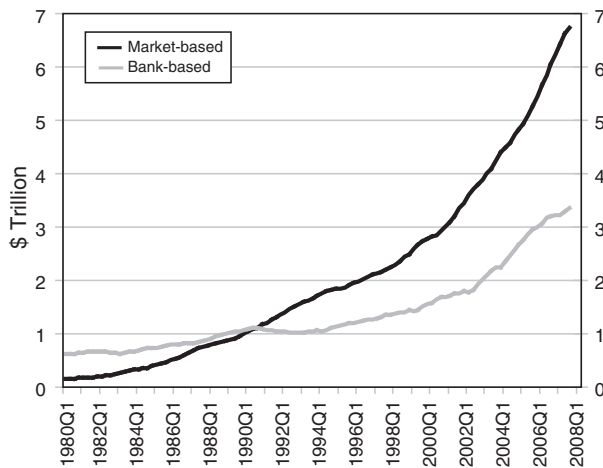


FIGURE 3. MARKET BASED AND BANK BASED HOLDING OF HOME MORTGAGES

Source: US Flow of Funds, Federal Reserve.

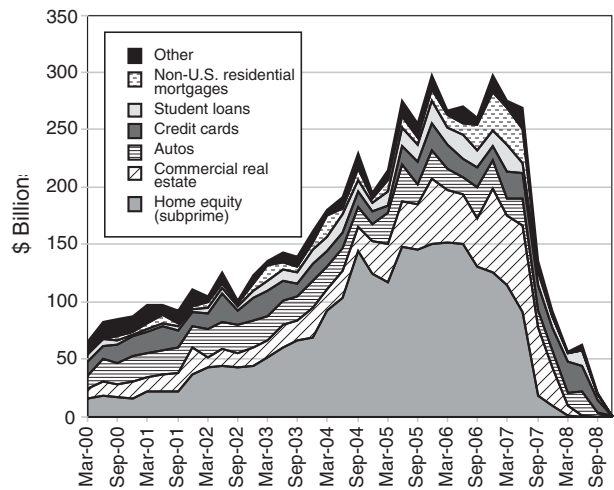


FIGURE 4. NEW ISSUANCE OF ASSET-BACKED SECURITIES IN PREVIOUS THREE MONTHS

Source: JPMorgan Chase and Company.

The striking feature is that leverage is procyclical in the sense that leverage is increasing when balance sheets are increasing, while leverage is decreasing when balance sheets are decreasing. 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.

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 one indicates constant growth of

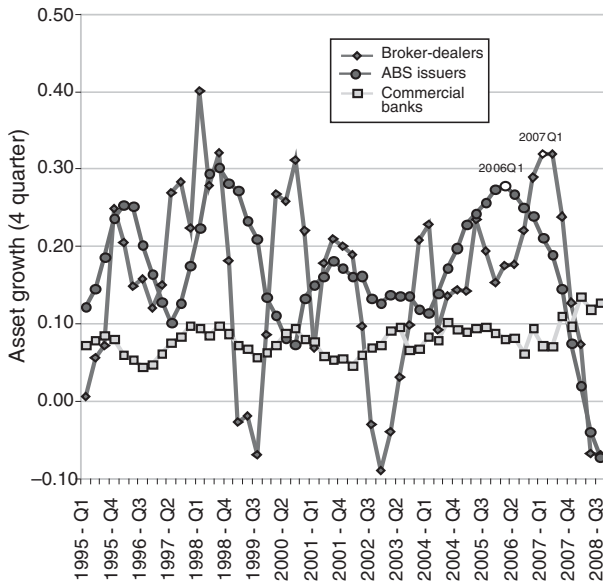


FIGURE 5. ANNUAL GROWTH RATES OF ASSETS

Source: US Flow of Funds, Federal Reserve.

equity, with the intercept giving the growth rate of equity.

In Figure 6 the slope of the scatter chart is close to one, 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 takes place primarily 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 Bengt Holmström and Jean 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 an 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 hair-

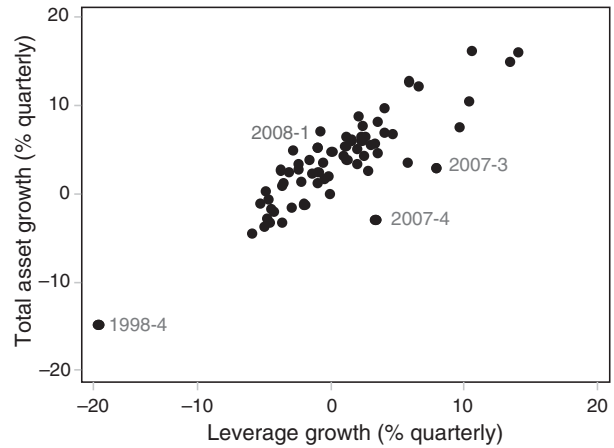


FIGURE 6. LEVERAGE GROWTH AND ASSET GROWTH OF US INVESTMENT BANKS

Sources: SEC; Adrian and Shin (2007).

cut is 2 percent, the borrower can borrow \$98 for \$100 worth of securities pledged. Then, to hold \$100 worth of securities, the borrower must come up with \$2 of equity. Thus, if the repo haircut is 2 percent, the maximum permissible leverage (ratio of assets to equity) is 50.

Suppose the borrower leverages up to 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 percent. 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 1 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 crises. Haircuts are substantially higher during the crisis than before.

The fluctuations in leverage resulting from shifts in funding conditions are closely associated with epochs of financial booms and busts. Figure 7 plots the leverage of US primary dealers—the set of banks that has a daily trading relationship with the Federal Reserve. They consist of US investment banks, US bank holding companies with large broker subsidiaries (such as Citigroup and JPMorgan Chase), and foreign dealers with a large US presence.

TABLE 1—HAIRCUTS ON REPO AGREEMENTS (PERCENT)

Securities	Apr-2007	Aug-2008
US 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
Mezzanine leveraged loans	18-25	35 +
Prime MBS	2-4	10-20
ABS	3-5	50-60

Source: IMF Global Financial Stability Report, October 2008.

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, forthcoming). Second, each of the peaks in leverage is associated with the onset of a financial crisis (the peaks are 1987:II, 1998:III, and 2008:III). Financial crises tend to be preceded by marked increases in 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 reallocated 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 percent level (standard errors are adjusted for autocorrelation). The time period covers 1986:I through 2008:III, but the forecast ability is also significant for shorter time periods, and also when we control for additional market variables, such as the term spread of interest rates, equity volatility, equity returns, and credit spreads:

$$(1) \quad \Delta HI_t = -1.15 - 0.05 HI_{t-1} + 0.06 AG_{t-1} + \varepsilon_t$$

(-2.15)
(-1.01)

(2.74)

Adrian and Shin (2008b) provide more detail, and also show that commercial bank assets have no such predictive feature, 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 2 from Adrian and Shin (2008b) reports a weekly regression of primary dealer repo growth.

Broker-dealers fund themselves with short-term debt (primarily repos 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 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

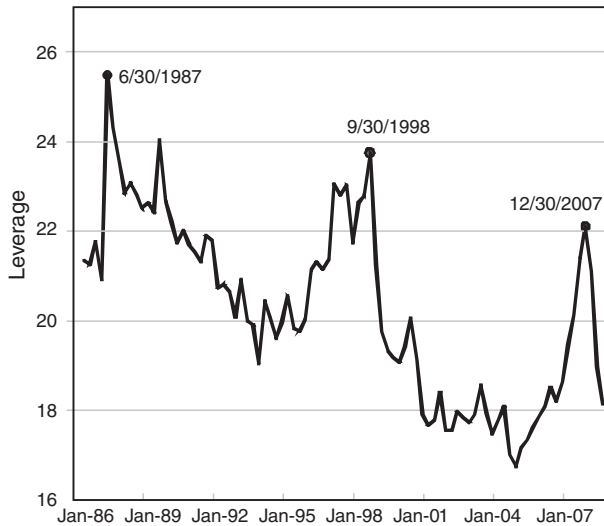


FIGURE 7. MEAN LEVERAGE OF US PRIMARY DEALERS
(June 1986 to September 2008)

Source: SEC 10-K and 10-Q filings.

through credit supply, short-term interest rates 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 of the aggregate size of the balance sheets of leveraged institutions. Instead, we have emphasized market-based liabilities such as repos and

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 that of Vasco Curdia and Michael Woodford (2008), who focus on the role of credit spreads, while we are focusing on balance sheet quantities. Michael Bordo and Olivier Jeanne (2002) argue that balance sheets should enter into monetary policy rules in a nonlinear fashion, with the aim of reducing the likelihood of financial crisis.

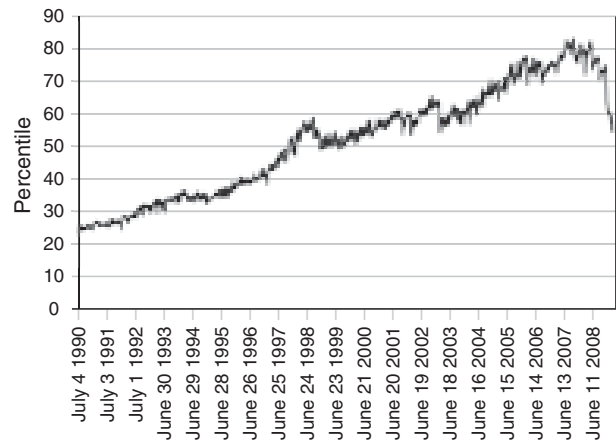


FIGURE 8. PRIMARY DEALER REPOS + FINANCIAL
COMMERCIAL PAPER AS A FRACTION OF M2

Source: Federal Reserve Board and Federal Reserve Bank of New York.

commercial paper as better indicators of credit conditions that influence the economy. Figure 8 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.

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 Benjamin 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 United States. 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 their balance sheets downward with flexibility, there will be some that cannot. These pinch points will be those institutions that are highly leveraged and that hold long-term illiquid assets financed with short-term debt. When the short-term funding dries up, they will face a liquidity crisis.

TABLE 2—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

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Balance sheet dynamics imply a role for monetary policy in ensuring financial stability. The waxing and waning of balance sheets have a monetary policy dimension in terms of regulating aggregate demand, but also 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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