

# Money, Liquidity and Financial Cycles<sup>1</sup>

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Asset price booms are sometimes attributed to excess liquidity in the financial system. Financial commentators are fond of using associated metaphors, such as the financial markets being “awash with liquidity”, or liquidity “sloshing around”.<sup>2</sup> These comments typically attempt to link the liquidity in the financial system to the stance of monetary policy and the evolution of asset prices such as stock market indices or housing prices. However, the precise economic mechanisms underlying such arguments are less clear.

In this *Current Issue*, we attempt to shed light on such arguments by addressing two, more narrowly defined questions. First, can we interpret "excess liquidity" to mean excessive growth of the money stock? Second, what is the relationship between the growth in the money stock and asset prices?

Monetarist economists such as Tim Congdon (2005) argue that asset price booms and busts are caused by the fluctuations in the stock of broad money. Broad money includes not only cash and demand deposits, but the wide range of other short term claims on banks. The mechanism behind Congdon's argument is the desire by non-bank financial institutions (in particular, insurance companies) to target a fixed proportion of money holdings as a proportion of total assets in their portfolio. When the money stock increases, insurance companies end up holding too much money relative to other assets. As they attempt to diversify out of money, they bid up the prices of other assets.

An alternative perspective, and one that we will explore here, is to focus on the actions of the banks themselves. Suppose (for the moment) that we can identify the

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<sup>2</sup>See "Still gushing forth," *The Economist*, February 3, 2005, and "Bubbles caused by cheap Cash menace World Economy," Reuters, July 24, 2006.

money stock with the sum of all bank liabilities, including inter-bank liabilities. Then, asking what the relationship is between the growth in the money stock and asset prices is tantamount to asking what the relationship is between the total sum of the liabilities of the banking sector and asset prices.

A bank is a leveraged institution; it has liabilities to depositors and other lenders in the financial system. Thus, when the value of its assets rises, its net worth rises at a much faster rate. Equivalently, when the value of its assets rises, the bank's leverage falls -- its net worth as a proportion of its liabilities falls. How does the bank react to such an erosion of its leverage? The empirical evidence on the behavior of banks suggests that they are conscious of changes in overall leverage, and will act so as to manage their leverage actively.

Let us first consider some aggregate numbers. Figure 1 shows the changes in the assets and liabilities of bank holding companies in the United States, drawn from the Federal Reserve's Flow of Funds data. It is apparent that liabilities are more volatile than the assets, implying that the overall book leverage of bank holding companies is high during booms and low during troughs. In other words, bank leverage (as measured by book values) is pro-cyclical. During booms, banks increase their liabilities more than the increases in their assets, resulting in higher leverage. During the troughs, they reduce their liabilities more drastically than the fall in their assets, resulting in lower leverage during downturns.

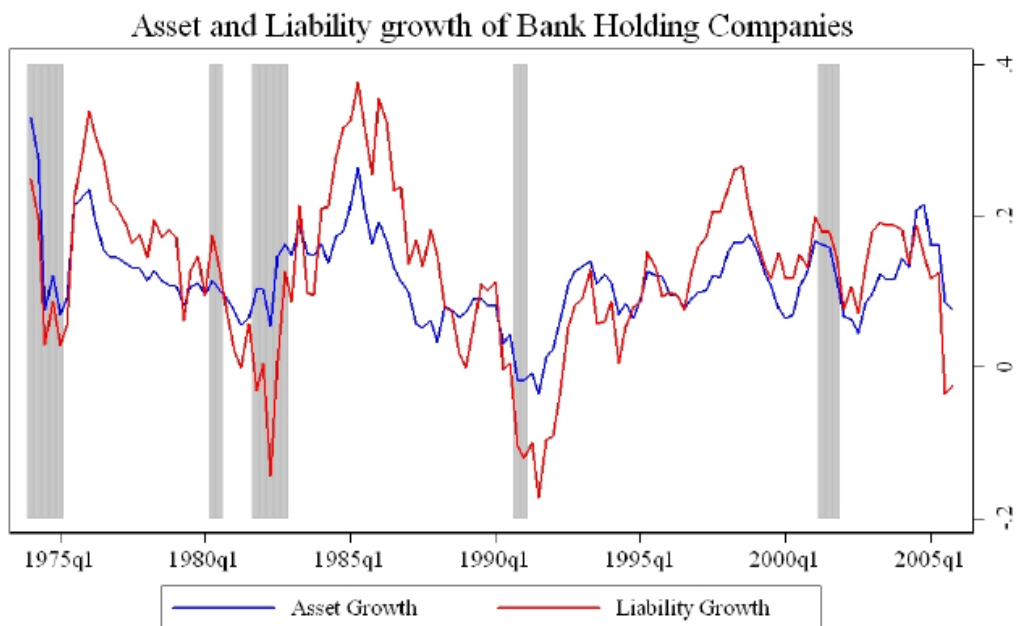


Figure 1: Asset and Liability Growth of U.S. Bank Holding Companies

For bank holding companies, a large proportion of their assets are loans that are carried at book value. During booms, the book value of loans will understate the market value of such loans, while during troughs in the financial cycle, the book value will *overstate* the market value of such loans. Thus, figure 1 is likely to overstate the fluctuations in leverage by failing to adjust the book value of loans to market values.

Much more striking is figure 2, again showing aggregate data, but this time for investment banks (including brokerage firms). For investment banks and brokerage firms, their assets consist largely of claims that are either marketable or can be priced reliably, and hence the accounting value of their assets would closely mirror the marked-to-market value of such claims.

What is striking about figure 2 is that the changes in assets and liabilities are almost one-for-one. Some items on the liabilities side of an investment bank's balance

sheet (such as short sales of some assets to fund long positions in other assets) would tend to move in tandem with shifts in value of its assets, and so we could expect some co-movement in the asset and liabilities series. However, much of an investment bank's liabilities consist of short term borrowing (e.g. through repurchase agreements), and so the fact that the asset and liabilities series move together so closely is evidence of active management of leverage by the banks themselves. In other words, it appears that investment banks have a target leverage ratio, and they will adjust their balance sheets so as to hit this target leverage.

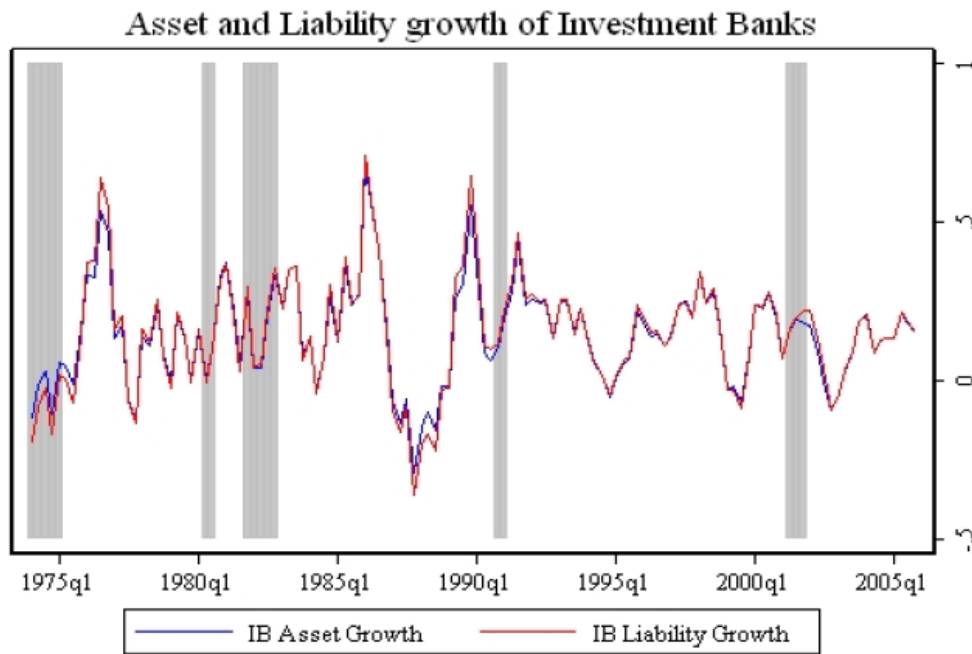


Figure 2: Asset and Liability Growth of U. S. Investment Banks

### Consequences of Targeting Leverage

Before delving deeper and looking at the behavior of individual banks, it is worth pausing to consider the consequences for the financial cycle of a target leverage ratio. When there is a target leverage ratio, the demand and supply response to asset price

changes can be perverse. Contrary to the textbook norm, demand curves can become *upward-sloping*, and supply curves can become *downward-sloping*.

To see this, consider an increase in the price of assets held widely by the banks that are targeting leverage. The increase in the price of assets strengthens the banks' balance sheets. In other words, the banks' net worth increases as a proportion of their total assets. When banks' balance sheets become stronger, their leverage falls. If the banks have a target leverage, they must respond to the erosion of leverage.

How can they restore leverage? One way that they can do so is by borrowing more, and using the proceeds to buy more of the assets they already hold. In other words, when asset price rises, the banks demand more of the asset. The demand curve is upward-sloping.

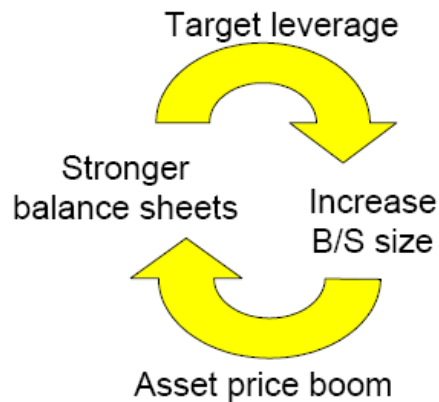


Figure 3: Target Leverage in Booms

If we further hypothesize that greater demand for the asset tends to put upward pressure on its price (a plausible hypothesis, it would seem), then there is the potential for a feedback effect in which stronger balance sheets feed greater demand for the asset, which in turn raises the asset's price and lead to stronger balance sheets. Having come

full circle, the feedback process goes through another turn. Figure 3 illustrates the feedback during a boom. Note the critical role played by the behavior of targeting leverage.

The mechanism works exactly in reverse in downturns. Consider a fall in the price of an asset held widely by all the banks. Then, the net worth of the bank falls faster than the rate at which asset falls in value. The leverage of the bank thus increases. If a bank is targeting leverage, it must attempt to reduce leverage in some way. How can it do so? One way it can accomplish this is to sell some of its assets, and use the proceeds to pay down its debt. Thus, a *fall* in the price of the asset can lead to an *increase* in the supply of the asset. The supply curve of the asset can thus be downward-sloping.

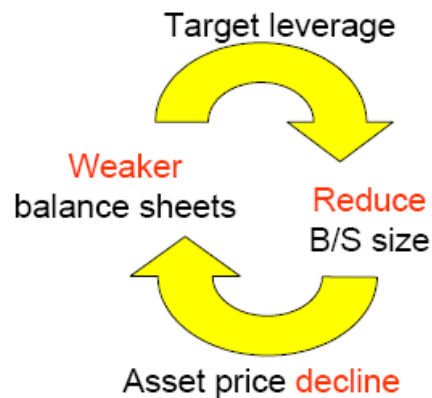


Figure 4: Target Leverage in Busts

If we further hypothesize that greater supply of the asset tends to put downward pressure on its price, then there is the potential for a feedback effect in which weaker balance sheets lead to greater sales of the asset, which depresses the asset's price and lead to even weaker balance sheets. But weaker balance sheets will kick off another cycle of

selling and price falls. Figure 4 illustrates the feedback during a bust. Again, note the critical role played by the behavior of targeting leverage. The scenarios painted in figures 3 and 4 can be formalized once the apparatus for analyzing balance sheet effects of asset price changes is put in place, for instance, as in Shin (2005).

### **Evidence from Individual Bank Behavior**

More detailed micro evidence on the behavior of individual banks reveals that the close tracking of the asset and liability changes holds at the individual bank level, too. The evidence comes from the banks' published quarterly accounts (as compiled in the Compustat database).

Figure 5 charts the growth in assets and liabilities of Investment Bank 1 at a quarterly frequency. The striking feature of the chart is how closely the two series move together - so close in fact that it is hard to separate out the two series at first glance. As noted already, short sales are counted as a liability on the balance sheet, and so would tend to move in tandem with shifts in value of assets. However, not all liabilities fluctuate one for one with assets. The fact that the asset and liabilities series move together so closely is evidence of active management of leverage in the face of asset price fluctuations.

Figure 6 charts the ratio of net worth to total liabilities. The ratio has been on a downward trend, falling from over 10% to below 3% in the late 1990s, but has risen in recent years back above 5%. The close co-movement of assets and liabilities is reflected in the relative stability of the net worth to liability ratio.

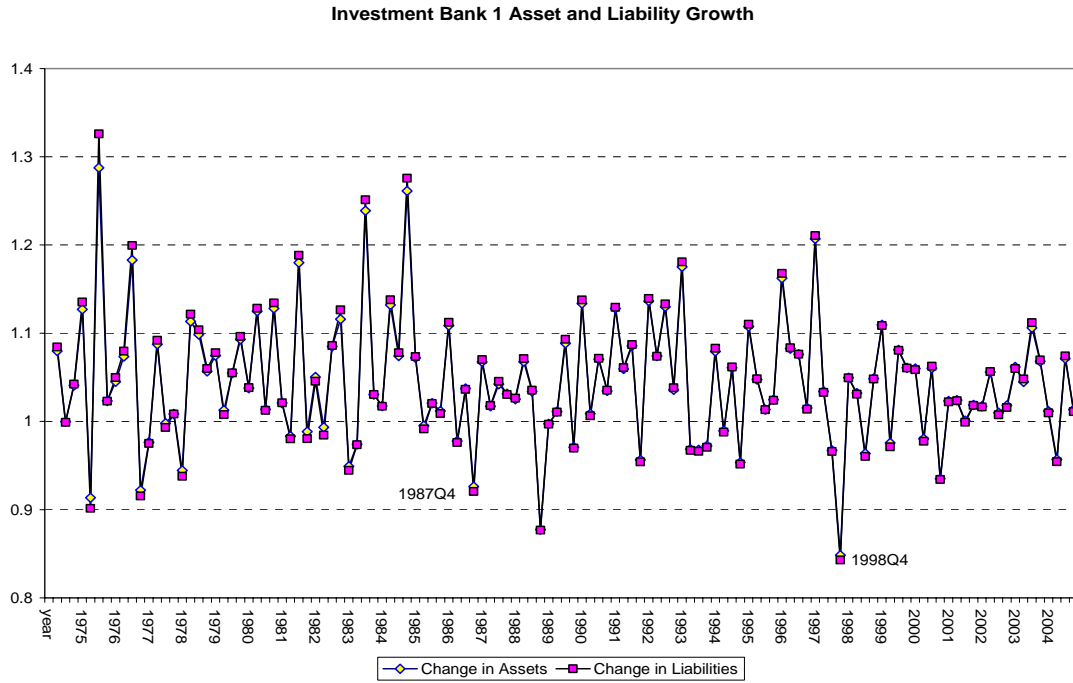


Figure 5: Investment Bank 1 Asset and Liability Growth

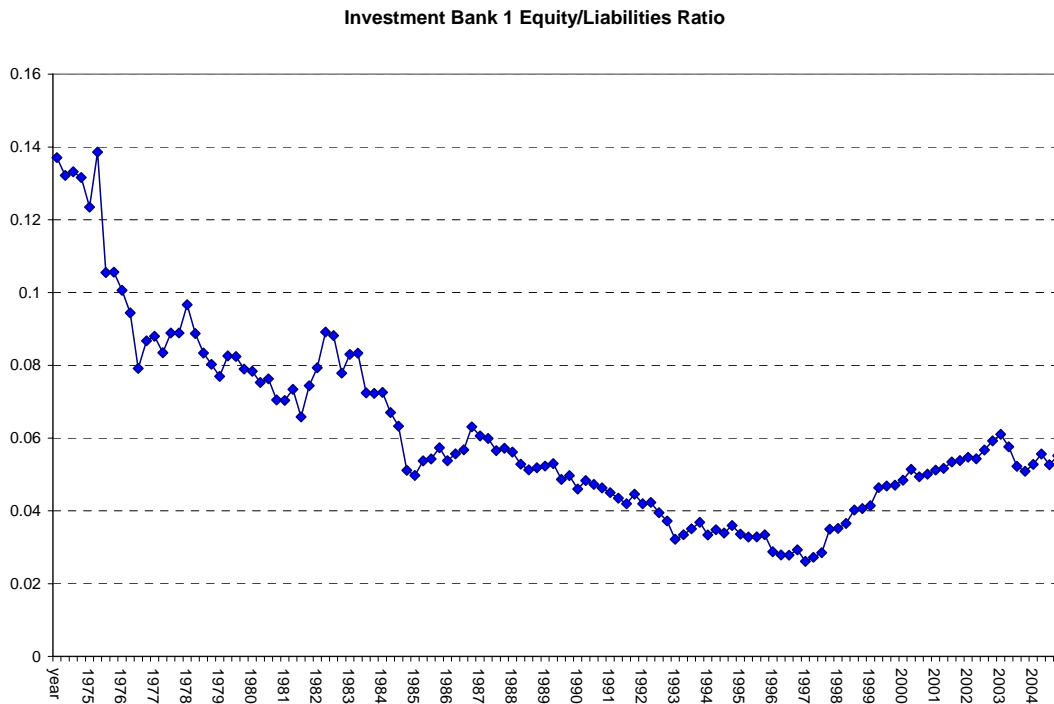


Figure 6: Investment Bank 1 Net Worth to Liabilities Ratio

Perhaps most striking is the scatter plot, given in figure 7. The horizontal axis measures the change in the ratio of net worth to total liabilities. For a leveraged institution, the ratio of net worth to total liabilities can be regarded as its equity cushion, and so we have labeled the horizontal axis as change in equity cushion. The vertical axis measures the change in total assets. The growth rates are measured at quarterly frequency.

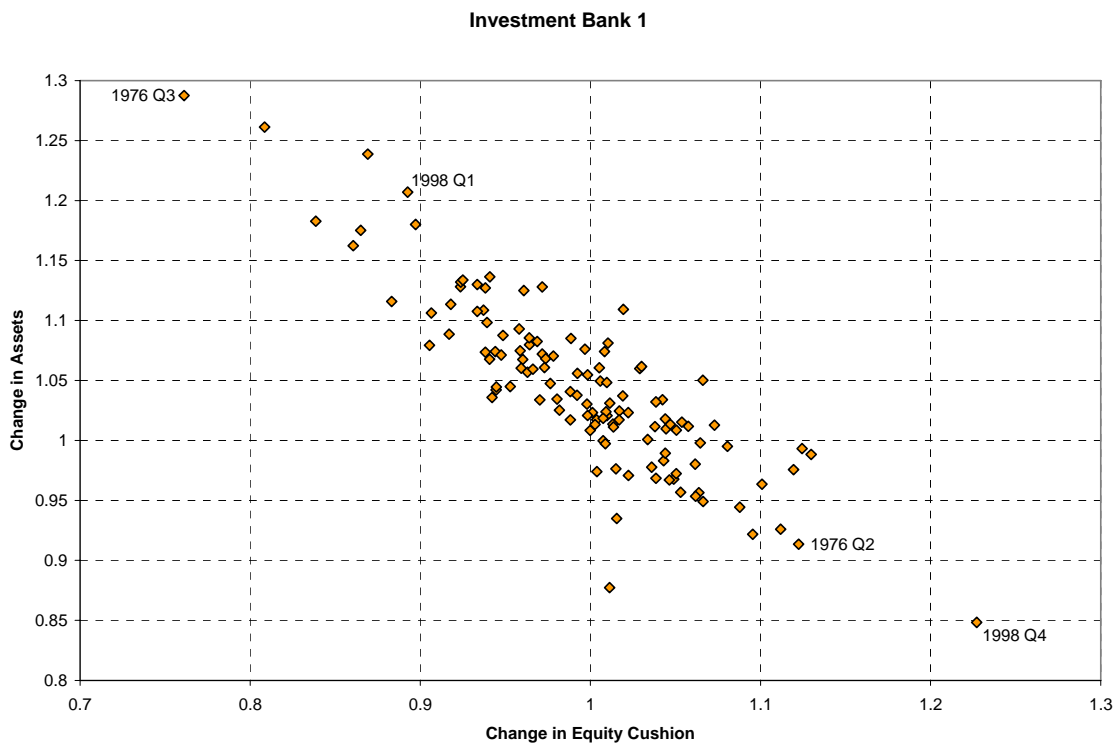


Figure 7: Investment Bank 1: Scatter Plot of Asset Growth against Growth in Ratio of Net Worth to Liabilities (Quarterly)

What should we expect from such a plot? If the bank were passive to some degree, then asset growth should lead to an increase in the equity cushion. If the bank were targeting constant leverage, then asset growth would be exactly undone by liability growth to leave the net worth cushion unaffected. Such behavior would tend to amplify

financial cycles, as suggested above.

In fact, the evidence shows something even stronger. The scatter plot shows a *negative relation*. The equity cushion *falls* when total assets *rise*. Leverage is adjusted even more than is enough to keep leverage constant. In other words, leverage is managed so actively that the equity cushion is increased during bad times. Some of the outliers in the scatter plot are predictable. The events of the summer and early autumn of 1998 account for the outlier in the bottom right hand corner of the scatter plot. Note that the equity cushion *increases* (by 23%) even as total assets fall by a large amount (a fall in excess of 15%).

Perhaps we should not be too surprised at the negative relationship between asset growth and growth in the equity cushion. Risk management systems would recommend the cutting back of exposures when financial markets are in distress mode. So, it would be natural to see the negative relationship. For an individual bank, such behavior in the face of market turbulence may be an entirely natural, and prudent response. However, if large swathes of the financial system behave in this way, the spillover effects will be considerable. The relevant question is this. If everyone is selling, then who is buying? The answer to this must be the unleveraged institutions, such as pension funds, mutual funds, insurance companies and university endowments. They would be the “purchasers of last resort”, so to speak.

Investment Bank 1 was chosen for illustration due its relatively long presence as a publicly traded bank, and hence the ready availability of publicly disclosed accounting information. For some other investment banks, the available data series is shorter, but a similar picture emerges. We have chosen a second investment bank (Investment Bank 2)

in order to illustrate our argument. Figure 8 plots the growth of assets and liabilities of Investment Bank 2 at a quarterly frequency. As with Investment Bank 1, the two series move very close together - so close, in fact, that it is hard to distinguish the two series at a casual glance.

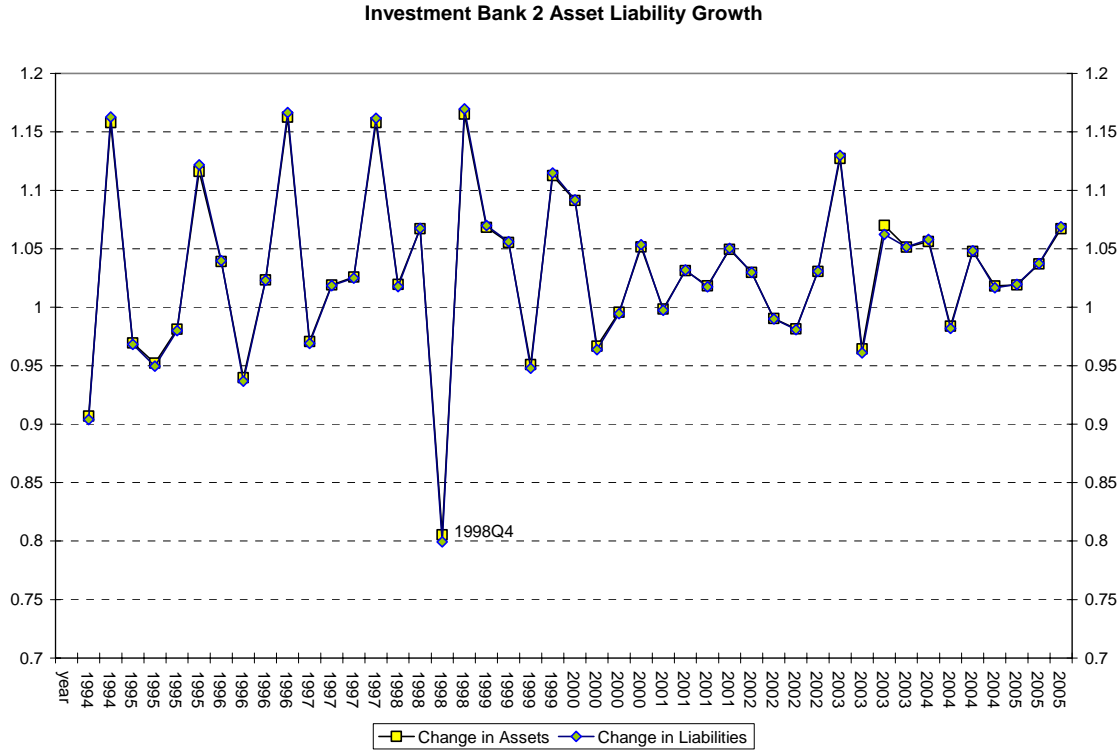


Figure 8: Investment Bank 2: Growth in Assets and Liabilities

Figure 9 plots the ratio of net worth to total liabilities for Investment Bank 2. In the mid 1990s, the target equity cushion hovers around 3%, but jumps at the time of the LTCM crisis in 1998. Lately, the net worth to total liability ratio as been just over 4%.

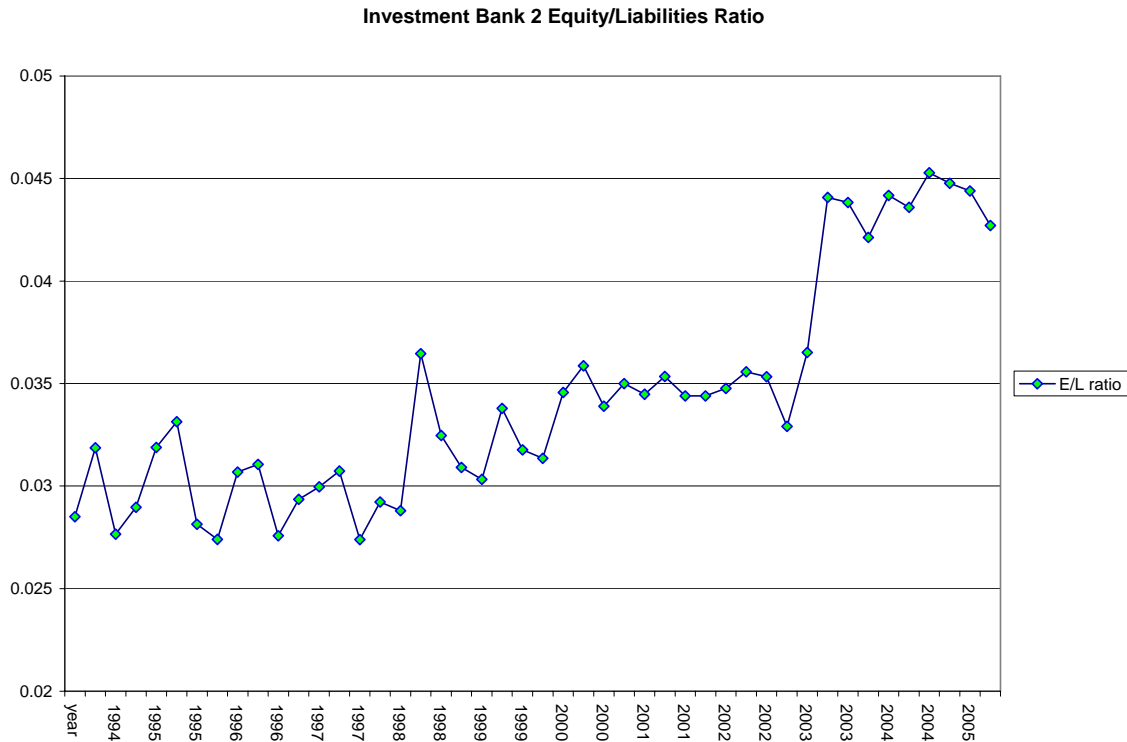


Figure 9: Investment Bank 2: Ratio of Net Worth to Total Liabilities

Just as with Investment Bank 1, the behavior of Investment Bank 2's equity cushion with changes in assets shows the striking negative relation (see figure 10). The equity cushion goes up when asset prices fall. Conversely, during asset price booms, the equity cushion goes down. Such behavior would be easy to explain in terms of banks that adjust their exposures according some value at risk (VaR) model that determine internal capital allocation. However, the broader issues concerning aggregate financial cycles and the fluctuations in asset prices remain to be addressed.

### Investment Bank 2

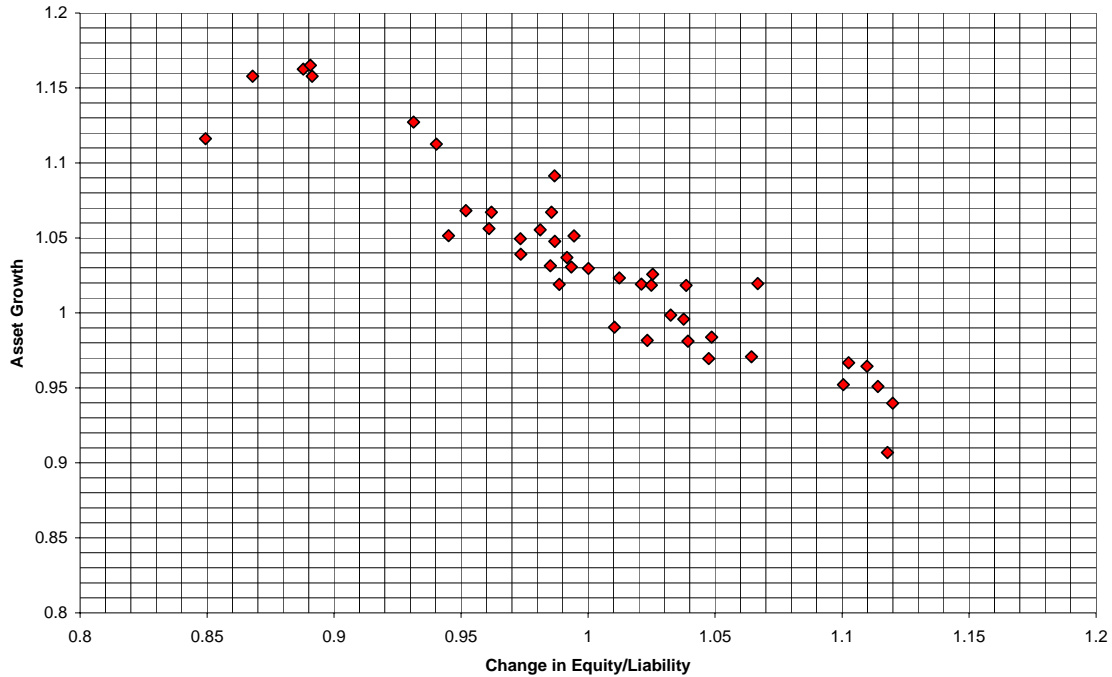


Figure 10: Investment Bank 2: Scatter Plot of Change in Ratio of Net Worth to Liabilities against Growth in Assets

### Role of Money

In a hypothetical world where banks are the only financial intermediaries and their liabilities can be identified with the various components of money, then the money stock would be a good indicator of the aggregate size of the balance sheets of leveraged institutions. To this extent, the growth of the money stock would play a useful role in signaling changes in the size of the aggregate balance sheet of the leveraged sector.

However, it is not so clear that we can so readily identify the money stock with the aggregate size of the liabilities of leveraged institutions. This is so for two reasons.

- Many of the leveraged institutions (investment banks, hedge funds, and others) do

not conform to the textbook ideal of the deposit-funded bank. Hence, their liabilities are not counted as money.

- Even for banks, not all items of liabilities qualify as money.

The first bullet point seems important for financial systems that rely on the capital market, rather than on the banking system. Perhaps we could speculate that the divergent empirical results for the United States and some European countries on the role of money in financial cycles can be attributed to the fact that the capital markets play a much bigger role in the former.

The second bullet point also seems important, when we consider the components of a bank's liability that fluctuates over time. The holding of deposits tends to be rather stable over time, and in any case, it is unclear how much the deposit liabilities are under the control of the banks themselves. However, for other types of bank liabilities from the wholesale market - such as repurchase agreements, certificates of deposits, Eurodollars, etc., we could regard them as being closer to discretionary variables under the control of the banks themselves. It is these other borrowing items that tend to be most volatile over time.

Figure 11 plots the growth of deposits and other bank liabilities for US commercial banks. Although the borrowing category constitutes only around 20 - 25% of total bank liabilities, it is apparent that they are much more volatile. Also, to the extent that this borrowing category is most likely to be under the discretion of the banks themselves, they would be the best indicator of the bank's intentions concerning its ideal leverage. Tracking this series would be a good way to track the way that banks' target

leverage is moving around.

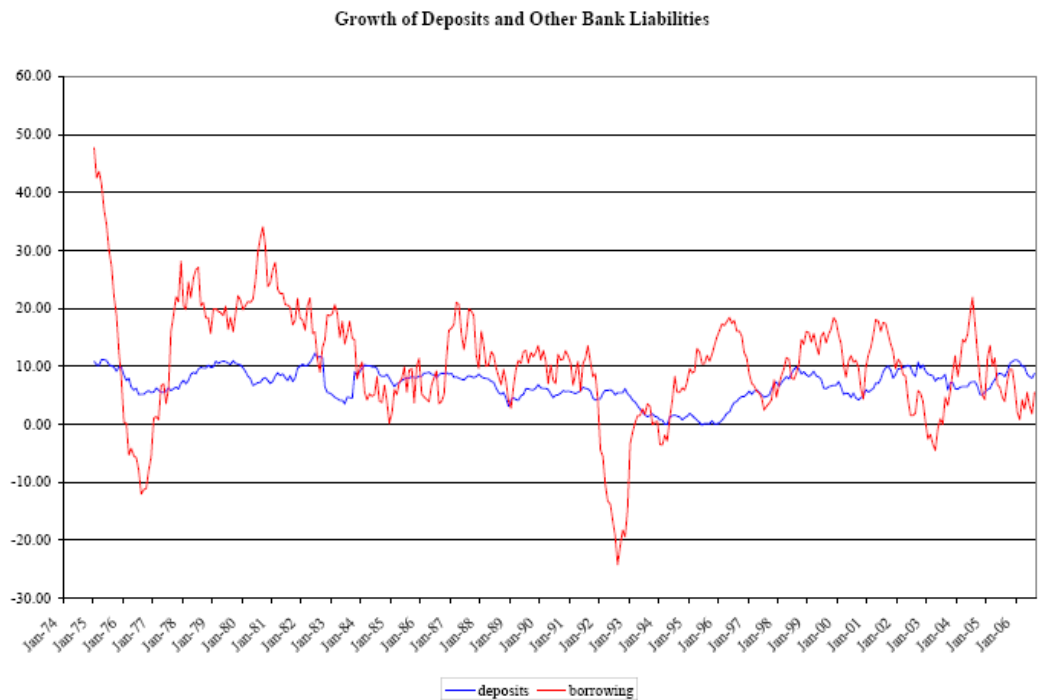


Figure 11: US Commercial Banks: Growth in Deposits and “Borrowing” (annual growth rates plotted monthly)

At the outset, we posed two questions. Can we interpret “excess liquidity” to mean excessive growth of the money stock? What is the relationship between the growth in the money stock and asset prices?

When banks target leverage, “liquidity” could be given a less mysterious meaning in terms of the ready availability of funding for the purchase of assets. When banks are constrained by their capital, liquidity corresponds to the (inverse) of the Lagrange multiplier associated with the capital constraint. Interpreted in this way, the answer to the first question would be a qualified “yes” for a bank-dominated financial system where the liabilities of the banking sector can be identified with the various components of money.

Similarly, the answer to the second question depends on the degree to which banks constitute the bulk of the leveraged sector, and money is a good measure of the aggregate size of the balance sheet of the leveraged sector. If the financial system is organized around the capital market, conventional measures of money represent only a small proportion of aggregate size of the leveraged sector. Money is less useful as a measure of liquidity in such a financial system. We must look at other institutions – such as investment banks and hedge funds – as well as the implicit leverage associated with off-balance sheet items such as over-the-counter (OTC) derivatives.

Nevertheless, in a bank-dominated economy where money captures all elements of banking sector liabilities, money growth would be a superior measure of financial conditions than, say, the growth of credit. This is so for two reasons. First, the components of money have short maturity, and hence the book value corresponds better to market value. Second, credit (i.e. loans granted by banks) is only one class of assets held by banks. If the banking sector holds other assets such as property or stocks directly on its balance sheets, then money is a better counterpart for the total size of the banks' balance sheet. There is indeed some evidence that money growth does a better job of explaining residential property price booms than the growth of private credit (Adalid and Detken 2005).

### **Open Questions**

There are many questions that come to mind when confronted with evidence that banks' leverage fluctuates in synchrony with the financial cycle.

- Why do banks target leverage?
- Does improved corporate governance through the use of high-powered incentive schemes mitigate financial cycles, or amplify them?
- Can individually prudent risk management have the perverse effect of amplifying the financial cycle?
- How will the financial cycle change when insurance companies are constrained by accounting rules, such as those on marking their liabilities to market?
- What are the consequences for financial cycles of the greater adoption of mark-to-market accounting rules?

We cannot do justice to all these important questions in our short piece. However, much rides on the answers to these questions. The targeting of leverage seems intimately tied to the bank's attempt to target a particular credit rating. To the extent that the "passive" credit rating should fluctuate with the financial cycle, the fact that a bank's credit rating remains constant through the cycle suggests that banks manage their leverage actively, so as to shed exposures during downturns. Kashyap and Stein (2003) draw implications from such behavior for the pro-cyclical impact of the Basel II bank capital requirements.

The impact of remuneration schemes on the amplifications of the financial cycle have been addressed recently by Rajan (2005). The possibility that a market populated with value at risk (VaR) constrained traders may have more pronounced fluctuations has been examined by Danielsson, Shin and Zigrand (2004). The last two questions concerning mark-to-market accounting appear more esoteric, but have potentially important

implications for financial cycles when considering that insurance companies are the natural counterparties for purchases and sales made by leverage institutions. The discretion that the insurance companies could exercise in playing the role of the “purchasers of last resort” may be impaired if their actions are constrained by accounting rules. Plantin, Sapra and Shin (2005) examine some possible macroeconomic implications of marking insurance liabilities to market.

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