# Crises, Liquidity Shocks, and Fire Sales at Financial Institutions[*]

Nicole Boyson[a]
*Northeastern University*

Jean Helwege[b]
*University of South Carolina*

and

Jan Jindra[c]
*Menlo College*

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[a] Nicole Boyson, Northeastern University, Boston, MA 02115; email: n.boyson@neu.edu; phone: 617.373.4775.
[b] Jean Helwege, University of South Carolina, Columbia, SC 29208; email: jean.helwege@moore.sc.edu; phone: 803.777.4926. Corresponding author.
[c] Jan Jindra, Menlo College, Atherton, CA 94026; email: jj@janjindra.com; phone: 650.489.6807.

# Crises, Liquidity Shocks, and Fire Sales at Financial Institutions


## ABSTRACT

We investigate commercial banks, investment banks, and hedge funds during financial crises to test liquidity shock amplification models. In these models, widespread funding problems force banks into fire sales, which reduce capital and trigger loss spirals. We find that most banks maintain funding levels during downturns and that the few banks that do face funding shortfalls are the least creditworthy. Further, banks rarely sell toxic assets at fire sale prices, instead relying on deposits, issuing equity, and cherry picking as alternative funding sources. Similarly, hedge funds' asset sales do not owe to redemptions that force them to sell into a falling market. Our evidence suggests that shocks to fundamentals, not illiquidity-induced fire sales, are central to financial crises.

Financial crises seem to impact the economy in exceptionally harsh ways, leading to the conclusion that a sound banking system is crucial to avoiding a sharp economic downturn (e.g., Bernanke and Gertler (1989), Bernanke and Lown (1991)).[1] One explanation for the connection between financial crises and recessions is that an exogenous liquidity shock affects all banks and causes them to reduce their lending (Ivashina and Scharfstein (2010)). As financial institutions face debt shortages, which are greatest at banks that rely heavily on short-term capital markets, some are forced to sell assets at fire sale prices (Shleifer and Vishny (1992)). Recent theoretical research on amplification models of crises further posits that such fire sales leave banks with even less cash, inducing them to sell more assets. The resulting loss spiral erodes bank capital and ultimately causes a financial crisis.[2] Hence, illiquidity could lead to insolvency and a credit crunch, resulting in a full blown recession (Korinek (2011)). An alternative explanation for the connection between financial crises and recessions is that shocks to fundamentals cause both a decline in the value of risky financial assets and reduced investment opportunities (Kane (2009) and Kashyap and Stein (2004)).[3] Thus, what was often described as a liquidity crisis in 2007 and 2008 may actually have owed to a severe decline in the creditworthiness of several large and visible financial institutions (Eisenbeis (2009) and Kane (2009)).

In this research, we use a sample of commercial banks, investment banks, and hedge funds to evaluate these explanations of financial crises. Using data from 1980-2008, a period spanning several boom and crisis periods, we find that the majority of commercial banks do not experience declines in funding during crises. We show that the banks most reliant on capital markets issue new debt during crises, although less so than during booms. The few banks that do

[1] Bordo and Haubrich (2009) find that recessions are more severe when accompanied by credit crunches. Berger and Bouwman (2010) show that loose monetary policy does not spur bank lending very well during a crisis.
[2] See Adrian and Shin (2008, 2010), Brunnermeier and Pedersen (2009), Diamond and Rajan (2010), Krishnamurthy (2009), Geanakoplos (2010), Froot (2009), Allen and Carletti (2006), Gromb and Vayanos (2002), and Uhlig (2010).
[3] Perotti and Suarez (2011) assume shocks to fundamentals trigger liquidity problems that then cause fire sales.

face funding shortfalls are the least creditworthy. Moreover, difficulties in rolling over debt do not lead to fire sales. Instead, banks rely more on deposits, issue equity, cut dividends, cease repurchases, and sell off non-core assets at fairly favorable prices. Similar to commercial banks, investment banks issue less debt during crises than booms, but average net debt issuance is still positive, and their assets also do not typically decline. We find no connection between investment bank asset growth and reliance on capital market funding.

Our analysis of hedge funds likewise shows scant evidence of fire sales in crises. On average, hedge funds sell similar quantities of stock during booms and crises. While hedge funds with short lock-up periods and large redemption requests ("constrained" hedge funds) do sell significantly more stock during crises than unconstrained hedge funds, these same funds also buy new shares of stock. These purchases indicate that constrained hedge funds do not use all of their sales proceeds to meet redemption requests, as one would expect of firms forced to sell assets at unfavorable prices. Moreover, the stocks they sell in crises have similar liquidity to the stocks they sell in booms, and the sale of these stocks does not significantly drive down the prices of these stocks, providing further evidence that they are not engaging in widespread fire sales.

Overall, we conclude that shocks to fundamentals, not exogenous liquidity shocks, trigger financial crises. Firms that have trouble rolling over short-term debt in a crisis are often close to insolvency. Even these banks rarely fail due to their inability to fund assets, likely because of explicit and implicit government guarantees. We do not find evidence of declining asset prices due to costly fire sales (Shleifer and Vishny (1992)) that create loss spirals. Rather, we link asset price declines to worsening fundamentals and find that outright sales of toxic assets are uncommon. Our conclusions hold for the 2007-2008 period as well as for earlier crises.

In the next section we discuss the literature and develop in more detail the implications of the theories for empirical tests. Section II summarizes our data, Section III presents empirical results, and Section IV concludes.

## I. Literature and Analytical Framework

### *A. Empirical Literature on Liquidity Shock Theories*

Existing empirical research on the nature of financial crises reports evidence that is both consistent and inconsistent with liquidity shock theories. For example, Adrian and Shin (2010) show that banks actively adjust their balance sheets by increasing leverage during booms and reducing it during busts, supporting the amplification models' prediction of fire sales in crises. By contrast, Demsetz (1993) shows that commercial banks reduced asset sales during the 1990-1991 credit crunch. In studies of the recent crisis Chari, Christiano, and Kehoe (2008) point out that bank lending did not decline, and He, Khang, and Krishnamurthy (2010) find that banks actually increased MBS holdings. Several explanations for asset growth during the recent crisis have been proposed, and none are consistent with the funding shortages that are central to the liquidity shock theories. For example, Acharya and Richardson (2009) argue that asset growth results from banks taking securitized assets back onto their balance sheets, while Ivashina and Scharfstein (2010) attribute it to borrowers drawing down lines of credit to avoid being shut out of debt markets. However, the precise interpretation of this line of research is difficult because asset growth may reflect ease of funding or it may be driven by investment opportunities in the real economy.

A specific prediction of amplification models is that liquidity shocks should have a larger impact on firms that borrow in short-term capital markets. Again, the empirical evidence here is mixed. Acharya and Merrouche (2010) find a strong role for liquidity shocks facing U.K. banks

in the recent crisis. Brunnermeier (2009) links investment banks' reliance on repurchase agreement (repo) funding to increased liquidity risk, which Gorton and Metrick (2009) support with evidence on repo haircuts. Acharya, Schafer, and Zhang (2008) conclude that funding pressures facing corporate bond dealers amplified the effects of the Ford and GM downgrades in 2005. However, Kashyap and Stein (1995) show that lending at large banks is less sensitive to monetary shocks, which they attribute to *greater* reliance on capital market funding. Cohen-Cole, Montorial-Garriga, Suarez, and Wu (2010) find that the cost of issuing commercial paper (CP) at high credit-quality firms was unaffected in the subprime crisis, and Afonso, Kovner, and Schoar (2011) show that following the Lehman bankruptcy, lenders in the Fed Funds market rationed credit away from large banks with poor fundamentals and favored small banks with good fundamentals. Nevertheless, the interpretation of the findings is impeded by the fact that firms that rely heavily on short-term borrowing may lose access to these markets because of solvency concerns rather than the general failure of capital markets caused by liquidity shocks.

Research on hedge funds offers evidence that is generally consistent with amplification models. For example, Ben-David, Franzoni, and Moussawi (2011) and He, Khang, and Krishnamurthy (2010) document severe asset sales in the subprime crisis. Boyson, Stahel, and Stulz (2010) link contagion in hedge fund returns to liquidity shocks, and Kang, Hameed, and Viswanathan (2010) argue that funding problems lead to decreases in liquidity and stock prices. Billio, Getmansky, and Pellizon (2010) and Sadka (2010) tie aggregate liquidity risk to underperformance during crises. Aragon and Strahan (2011) conclude that Lehman's bankruptcy led to funding problems for its hedge fund clients. While the findings in these studies are consistent with liquidity shock theories, such problems at hedge funds might also reflect outflows in response to poor investment results.

In summary, while the existing literature provides substantial evidence in favor of the liquidity shock amplification models, much of the evidence is also consistent with shocks to fundamentals. In the following section, we lay out the design of our empirical tests and how they will help separate out these competing hypotheses.

*B. Analytical Framework*

We test the credit risk and exogenous liquidity shock explanations of financial crises by examining three elements of the theories: funding problems, strategies for replacing lost funding, and fire sales. In particular, we first investigate the extent to which debt funding declines at financial institutions during crises and whether such declines reflect liquidity shocks or concerns about solvency. Second, we consider whether liquidity shocks cause financial firms to sell off assets or if firms instead rely on alternative sources of funds such as equity issuance and deposits. Lastly, we investigate whether asset sales involve fire sales that cause loss spirals and amplify the liquidity shocks. We next discuss these three aspects of the analysis in detail.

We first consider the generality of funding problems. Liquidity shock models predict that funding dries up for most banks whereas shocks to fundamentals models predict that bad banks will suffer more than sound banks. Further, liquidity shock theory emphasizes disruptions to capital markets, positing that banks with high reliance on capital market funding will be more exposed to the shocks. To separate liquidity from fundamental shocks, we consider whether funding problems are related to the bank's reliance on capital market funding or whether the problems are more closely tied to the size of its capital cushion.[4] Since amplification theories predict that aggregate liquidity shocks will have a greater impact on firms that rely more heavily

[4] Theoretically, a liquidity shock should cause the capital base to decline as banks sell assets at distressed prices. To avoid conflating such solvency problems with shocks to fundamentals, we consider the size of the bank's capital cushion before the crisis started. If shocks to fundamentals are widespread, the banks that entered the crisis with the least amount of equity should be closest to insolvency. In contrast, liquidity shock theory predicts that the banks that are closest to insolvency are those with the most short-term debt.

on short-term funding, commercial banks with weak deposit networks and more dependence on wholesale funding should suffer more from these shocks. Of course, aggregate liquidity shocks should impact investment banks more severely than commercial banks that rely on insured deposits. Finally, hedge funds, unlike investment banks and commercial banks, must refund equity capital to investors on demand. Thus, they are even more susceptible to capital market liquidity shocks.[5]

Second, we consider how financial firms deal with funding problems. Liquidity shock amplification models assume that banks are forced to sell assets (at fire sale prices, leading to a loss spiral) while if changes in fundamentals cause financial crises, financial institutions will pursue the cheapest alternative funding, which may not necessarily be asset sales. Shleifer and Vishny (1992) propose a setting where managers are forced to sell assets in a downturn at prices below fundamental values - by assumption, the firms are unable to either raise new equity or to renegotiate their debt. We investigate the applicability of these assumptions to financial institutions by examining alternative funding sources in a crisis. We note that commercial and investment banks can cut dividends, issue new equity, and/or suspend repurchase programs.[6] Commercial banks can rely more on insured deposits or debt with an implicit government guarantee, or just "muddle through" until better times return.[7]

The empirical literature suggests that these alternatives should not be ruled out so quickly. Some actions are indeed highly unattractive in normal times and it is reasonable to

[5] In the face of extreme withdrawals, hedge funds may suspend all redemptions. The data on such suspensions is not available. However, if hedge funds were able (or willing) to easily suspend redemptions, we would expect to see very few funds experiencing fund outflows during crises.

[6] Kahle and Stulz (2010) investigate debt funding problems at industrial firms after the Lehman bankruptcy in 2008 and find that they reduce share repurchases to make up for the shortfall.

[7] Deposit insurance allows insolvent banks to continue operating if incoming deposits are larger than operating losses, much like a Ponzi scheme. See Kane (1989). It is also possible for a bank with assets that are being repaid at a rapid pace on its amortizing loans to "muddle through" the downturn without doing much of anything, provided interest and returned principal from performing assets are sufficient to cover its immediate cash needs.

assume that firms will avoid them in most circumstances, but such actions may be less costly to firms than fire sales. For example, the 10% average drop in market value associated with a commercial bank dividend cut (Slovin, Sushka, and Polonchek (1999)) is clearly an event to avoid in most cases, but a 10% decline in market value is not so unappealing when it would prevent the bank from failing (a loss of 100%). Similarly, while equity issuance is usually considered highly costly, Cornett and Tehranian (1994) and Cornett, Mehran, and Tehranian (1998) show that regulatory pressure on banks to raise equity reduces information problems, lowering its relative cost in a crisis. Because these strategies are affected by regulations, we expect them to be more relevant for commercial banks than investment banks and hedge funds (Berger, DeYoung, Flannery, Lee, and Oxtekin (2008)).

Unlike the farmer in Shleifer and Vishny (1992) who is unable to renegotiate his debt, financial institutions can replace capital markets debt funding with less onerous forms of debt. For example, commercial banks may find it more cost effective to use the discount window in a crisis despite the associated stigma (Furfine (2001) and Armantier, Ghysels, Sarkar, and Shrader (2011)). And they typically have greater access to retail funds: Gatev and Strahan (2006), Gatev, Schuermann, and Strahan (2009), and Cornett, McNutt, Strahan, and Tehranian (2011) show that deposits naturally increase in turbulent times as investors seek a safe haven. In comparison, investment banks typically have fewer alternative forms of debt financing, and hedge funds likely have none.[8]

[8] If fire sales and loss spirals result from liquidity shocks, the amplification models provide a strong rationale for government intervention as the lender of last resort. That is, if regulators intervene early enough and with sufficiently strong programs, or if they are expected to do so, liquidity shocks will not lead to loss spirals, and a full-blown financial crisis can be averted. However, many of the new programs created took effect after Q4 2008 when our sample ends. Nevertheless, we investigate the effect government aid in detail during the last crisis.

Shleifer and Vishny (1992) highlight the fact that potential fire sales drive firms to reduce their leverage lest a shock force them into this dire situation. In contrast, liquidity shock theories typically ignore the fact that the endogenous choice to borrow with short-term debt reflects an expectation by the firm that it will survive shocks, due to large size, superior credit risk or the availability of alternative funding options in downturns. We investigate the potential for sample selection biases that are related to various firms' funding models.

Finally, we consider whether firms that experience funding problems engage in costly fire sales. Fire sales in the amplification models are defined as sales at prices so low that the firm does not receive enough cash to repay its debts, leading to even larger funding problems.[9] Therefore, under the amplification models, we should observe widespread fire sales that deplete firms' equity capital and drive them into insolvency. Shleifer and Vishny (1992) propose that fire sales occur when the entire industry is affected by a shock that causes the most likely buyers to be absent from the market for distressed assets. Their analysis predicts that banks will be forced to sell assets at discounted (fire sale) prices to industry outsiders who value them less than insiders. Again, it is an empirical question as to whether the assumptions in this model apply to financial institutions in a crisis. We examine two specific factors that would affect fire sales: the pool of potential buyers and cherry picking.

Unlike the farms in Shleifer and Vishny's example, financial assets are not likely to lose value because all the potential buyers are also in distress. Even in the worst of financial crises the pool of potential buyers of financial assets is likely to be fairly large, and some of them will have actually made money as a result of the crisis (in the recent crisis, this would include those that

[9] When a firm repays its debt, creditors receive face (book) value. Thus, a fire sale in these models occurs when the sale price of an asset is below the book value of the debt used to finance its purchase. Therefore, determining the fundamental value of an asset at the time of its sale is not a requirement of the amplification models; all that is necessary to avoid a loss spiral in the models is for the asset to be sold at or above par value so that creditors may be paid in full. We evaluate this empirically by examining reported gains and losses on the sales of assets.

shorted bank stocks or mortgage-backed securities). Moreover, these potential buyers are likely to also be in the financial services industry, and thus are not outsiders with less ability to generate the same returns as previous owners. In some cases, one can argue that buyers in a crisis, such as Warren Buffett, are more capable of putting the same assets to productive use.

The second factor that we examine, cherry picking of assets to sell, reflects the fact that financial firms own a diversified portfolio of assets. Some of these assets are less affected by the crisis, such as noncore assets whose fundamental values have not declined much. Other assets have deep markets with many buyers ready to provide liquidity. For example, commercial banks are especially likely to sell non-core assets instead of loans at distressed prices because they prefer to sell assets that have gained market value since their purchase. Sales of appreciated assets help boost capital ratios by shrinking the denominator without an adverse effect on the numerator. Furthermore, banks that must shrink would choose to sell securities over loans (Kashyap and Stein (2000)) and hedge funds would sell more liquid stocks (Anand, Irvine, Puckett, and Venkataraman (2010)). A large fraction of commercial bank financial assets, notably loan portfolios, are not marked to market, which allows banks some discretion in valuation. Avoiding sales of distressed assets allows for greater use of optimistic marks, while sales of appreciated assets do not discredit such valuations. Most important, bank accounting rules treat losses and gains on loans asymmetrically – losses are recognized via charge-offs and loan loss reserves, while gains are usually only recognized when assets are sold. Hence, cherry picking serves the additional purpose of raising reported capital (Beatty, Chamberlain, and

Magliolo (1995)).[10] In contrast, investment banks, which invest in less opaque assets, carry most, and hedge funds carry all, of their assets at market value and care less about book equity.[11] We investigate the extent to which cherry picking strategies are used over fire sales to differentiate the two explanations of crises. If liquidity shocks drive asset sales, the theory requires that such sales cause further distress for the seller and lead to additional sales; otherwise the liquidity shocks will not generate a loss spiral. In contrast, if fundamentals cause borrowing problems, then shrinking the asset portfolio through cherry picking is a good strategy for meeting regulatory capital rules.

In summary, we test liquidity shock amplification models by examining three predictions: First, a crisis involves widespread funding problems at financial firms, especially those that rely heavily on short-term debt markets. The alternative hypothesis is that funding dries up the most at firms that are closest to insolvency, i.e. firms with the worst assets. These are likely to be firms that started the crisis with the least amount of capital. Second, when funding problems arise, banks are forced to sell assets. A competing hypothesis is that they meet funding problems in debt markets by switching to deposits, discount window borrowing, equity issuance, dividend cuts, and ceasing share repurchases, and only sell assets when these other strategies are too costly. Third, if asset sales occur, liquidity shock models predict they will be at fire sale prices. In contrast, shocks to fundamentals predict that asset sales are most likely to be cases of cherry

[10] For example, in the recent crisis the following sales led to large gains that helped offset losses:

| Date | Bank | Divested Asset | Gain | Gain/Sh. Equity |
|---|---|---|---|---|
| 12/08 | JP Morgan | Chase Paymentech Solutions (credit card) | $1.0 b | 0.6% |
| 12/08 | Citigroup | German banking operations | $3.9 b | 2.8% |
| 12/08 | Merrill Lynch | Bloomberg, L.P. | $4.3 b | 11.2% |
| 12/07 | Bank of America | Marsico Capital Management | $1.5 b | 1.0% |
| 6/07 | PNC | Hilliard Lyons (asset management) | $0.1 b | 0.7% |

[11] Investment bank capital regulations motivate these firms to overstate reported equity as well, but SEC supervisory efforts in this arena have been modest compared to those for commercial banks, reducing such regulatory arbitrage.

picking, especially at firms with toxic assets that are in danger of failing to meet regulatory capital.

## II. Data

We identify booms and crises over 1980-2008 by examining NBER cycles, bank failures, the TED spread, Moody's Aaa-Baa bond spreads, flights to quality (Collin-Dufresne, Goldstein, and Helwege (2009)), the Long Term Capital Management (LTCM) episode, and credit crunches (Bordo and Haubrich (2010)). We correlate the top quartile of in-sample monthly distributions of bank failures, TED and credit spreads, and bottom quartile of stock market quarterly returns with monthly indicators of NBER recessions, flight to quality, and LTCM. Quartiles with positive outcomes are boom periods and those with negative outcomes are crises.

Table 1 presents our classification, with five crisis and three boom periods.[12] For example, the crisis period from March 2007 through December 2008 (the end of our sample period) is characterized by an NBER contraction, a high number of bank failures, high TED and credit spreads, high incidence of flight to quality, a credit crunch, and low stock market quarterly returns. The boom period from January 2003 through February 2004 is characterized by an NBER expansion, low credit spreads, and high stock market returns. In our tests involving quarterly data, for a particular observation to be classified as occurring during a crisis (boom) period, the crisis must last for the full fiscal quarter in order to observe quarterly changes.

We investigate the responses to liquidity shocks of three distinct groups of financial institutions: large commercial banks, investment banks, and hedge funds. For commercial banks, we use data from the Compustat Quarterly Bank and Thrift dataset for the period 1980-2008, which covers approximately 1,750 commercial banks. Among these banks we use data on the

[12] The remaining time periods are "neutral." In unreported results we shorten the crisis periods by one quarter both the beginning and the end and find that our conclusions are not sensitive to the change, providing further evidence that our results for 2007-2008 are not driven Federal Reserve liquidity programs.

largest 10%, as smaller banks that rely mostly on deposits are unlikely to be affected much by capital market liquidity shocks.[13] To mitigate survivorship bias we use all banks that fall into the top decile of total assets in at least one quarter during our sample period. If a bank fails, we include it up to the quarter immediately preceding its failure. Our final sample contains 168 unique banks, with the number ranging in any given quarter from 56 to 129.[14] CRSP delisting codes show that banks leave our sample due to mergers (95 instances) or being dropped by the exchange (12 cases). If a bank is involved in a merger we drop it from the sample for the quarter of the merger and then add it back in for subsequent quarters.[15] Based on the list of failed banks on the FDIC's website, five banks failed during the sample period.[16] Our sample of large banks is comparable to Kashyap and Stein's (1995) top 1% bank sample based on the Call Report data in Q2 1984, although their sample of 142 banks is larger than our 94 banks in 1984 because Compustat covers only banks with publicly traded equity.

Investment banks are identified from several sources: we include those with a Carter and Manaster rating of 8 or higher in each of the sub-periods studied by Loughran and Ritter (2004).[17] We also consult Institutional Investor rankings, Boyson, Stahel, and Stulz's (2010) list of "prime brokers," and SIC codes. Of these 17 investment banks, all but two have quarterly data in Compustat, although not necessarily for all years since 1980.[18]

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[13] Kashyap and Stein (1995) show large banks account for most of the lending in the economy. The top 10% have over 75% of all banking system assets and the top 1% account for half of such assets.

[14] Compustat includes data on some foreign banks. These account for about 10% of our firm-quarter observations.

[15] We exclude bank-quarter observations involving mergers because we cannot determine which actions are attributable to the original bank in a crisis.

[16] The failed banks are Bank of New England, Downey Financial Corp., MCorp, First Republic Bank Corp., and Washington Mutual. Only Downey and Washington Mutual – both well-known for their extensive subprime mortgage lending – failed in the subprime crisis.

[17] See Carter and Manaster (1990) and Carter, Dark and Singh (1998). Updated rankings through 2009 provided at http://bear.warrington.ufl.edu/Ritter/ipodata.htm.

[18] These firms are Bear Stearns, CIBC World Markets, Citigroup, Credit Suisse, First Boston, Goldman Sachs, HSBC Securities, JP Morgan, Lazard Freres, Lehman Brothers, Merrill Lynch, Morgan Stanley, Nomura, Salomon Brothers (through 1997), and Thomas Weisel Partners. Dillon Read & Co. and Sandler O'Neill Partners are not in

We supplement these data with commercial bank and investment bank asset sales data reported by Thomson Reuters' Securities Data Corporation (SDC). We also use footnote data from the SEC's EDGAR to investigate asset sales in the 2007-2008 period. Due to data availability, we estimate some cash flow statement variables by relying on their counterparts calculated from balance sheet data after ascertaining that the two are comparable. First, our analysis of periods for which both balance sheet and detailed cash flow data are available confirms that calculating flows with balance sheet information is a reliable method to estimate cash flow items. Second, we also use financial statement data from EDGAR and data on long-term debt issuance from SDC to confirm our results based on estimated cash flow items.

We obtain data on government programs in the most recent crisis from the Federal Reserve's website, individual company 10-K filings, and from the Federal Reserve's response to a Freedom of Information Act (FOIA) request on 3/31/2011. The FOIA release marks the first time in its history that the Federal Reserve has divulged the details of discount window borrowing, and the data only include borrowings after 2007. In addition to ordinary discount window loans, FOIA data include borrowings through the Primary Dealer Credit Facility (PDCF), Term Auction Facility (TAF), and Term Securities Lending Facility (TSLF).

Hedge fund data are obtained from two sources: mandatory 13(f) filings for stock holdings (reported by Thomson-Reuters) for institutions with over $100 million under management and the Lipper TASS individual hedge fund database. While data limitations necessitate that we focus only on long stock positions of hedge funds, common stock holdings comprise 22% of total hedge fund assets reported in Lipper TASS for those fund families with over $100 million in assets under management. Further, using TASS data, Cao, Chen, Liang, and

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the Compustat Quarterly database. Note that Citigroup is a commercial bank through 2Q 2005 and transitions to an investment bank during a neutral period that is not used in our analysis.

Lo (2010) show that hedge funds have significant exposure to the stock market. We use the dataset of Griffin and Xu (2009), which contains hedge funds that have filed 13(f) forms during the period 1980-2004 and extend it for 2005-2008 by matching fund and manager names in TASS and Thomson-Reuters.[19] We then check SEC-required ADV filings for these funds to ensure that they have at least 50% of their assets in hedge funds, or at least 50% of their assets owned by high net worth individuals, and that they charge incentive fees. This process yields 296 hedge fund families. We restrict the sample years to 1998-2008 due to limited data prior to 1998, yielding a sample of 272 hedge fund families.

We present summary statistics for the three types of financial firms in Table 2. Panel A shows that average (median) assets at commercial banks are $66 billion ($15 billion). Cash and securities account for approximately 27% of total assets, of which securities comprise about two-thirds. Loans represent 59% of assets on average (median of 61%). Most assets are funded by deposits (70% on average), despite the fact that we have eliminated community banks from the sample. In contrast, short-term debt averages only 10% of assets. The cross-sectional variation in short-term debt is substantial – the third quartile value is three times that of the first quartile. The average capital ratio of 7% is larger than the 4.8% in Kashyap and Stein (1995), in line with the recent capital build-up noted by Flannery and Rangan (2008).

Investment banks (Panel B) report median total assets of $192 billion. They hold 18% of their assets in cash and short-term investments and 29% in financial instruments. At 40%, trading-related assets constitute the largest category of assets.[20] Unlike commercial banks, short-

[19] We thank John Griffin for providing this list. Lipper TASS reports data for individual hedge funds while 13(f) filings are at the fund family (management company) level. Note that this data does not suffer from the survivorship bias that is frequently discussed when using self-reported data.

[20] For investment banks, the trading related assets frequently include derivatives and margins on futures contracts for which the investment banks acts in either trading capacity or as end user. See, for example, Lehman Brothers 10-Q for May 31, 2008, p. 13. These assets are marked to market daily.

term debt funds a large fraction of assets, although as with commercial banks, this variable exhibits significant cross-sectional variation. Compustat does not report investment bank deposits, if any exist. Compared to commercial banks, investment banks use more leverage (average and median equity ratios of 5% and 4%, respectively). Based on the CRSP delisting codes, four investment banks were acquired (First Boston, Bear Stearns, Merrill Lynch, and Salomon Brothers) and one filed bankruptcy (Lehman) during our sample period.

Panel C shows that hedge funds report mean (median) assets under management of $498 ($183) million. The typical fund reports quarterly average performance of 4.1%. The average lockup period is about 5 months, although most funds have a lockup of exactly one year. Similarly, the typical fund requires 90 days advance notice to redeem one's stake, and that constraint is usually binding. Panel C also reports summary statistics on the types of stocks held by hedge funds, with accounting data from Compustat as of the fiscal year immediately preceding the first appearance of the stock in the 13(f) filing, and stock price data from CRSP as of the prior quarter. The average (median) firm size based on assets is about $5.6 billion ($652 million) and mean (median) market capitalization is about $12 billion ($2 billion), indicating a preference for small to mid-cap stocks. The stocks preferred by hedge funds belong to companies with above average valuations as seen in the mean Tobin's Q of 3.15. These stocks are relatively liquid: the median Amihud (2002) illiquidity measure (lower values indicate higher liquidity) is 0.113, falling at the lower end of the range between 0.071 reported by Hasbrouck (2009) for a sample of NASDAQ and NYSE stocks over 1993-2006 and 0.336 reported by Amihud (2002) for all NYSE stocks over 1963-1996. The bid-ask spread of 0.012 is comparable to Kang, Hameed, and Viswanathan's (2010) value of 0.011 for a sample of NYSE stocks.

## III. Results

We examine commercial banks, investment banks, and hedge funds separately due to data limitations (differing sample periods and lack of comparability across balance sheets and income statements). For each type of institution, we investigate the change in funding during a crisis and look for evidence that asset sales involve fire sale prices. For commercial banks and investment banks, we also examine the availability of alternative funding sources, such as deposits, dividend cuts, and equity issuance. We pay special attention to the possibility that funding problems, when they arise, reflect concerns about solvency at particular institutions rather than market wide liquidity shocks. Likewise, we investigate the extent to which undercapitalized firms respond to asset quality problems by cherry picking.

### *A. Commercial banks*

We begin by examining the funding availability of commercial banks in Table 3. For the entire sample, reported in the first column, the average net debt issuance is positive during crises, indicating that banks are typically able to fund their pre-crisis level of lending activity.[21] Net debt issuance grows more slowly in crises than booms, and more banks experience a funding decline in crises (43% in crises and 36% in booms), suggesting that some banks suffer from funding shocks during crises. Counter to the view that crises are driven by shocks to short-term capital markets, the decline in long-term debt issuance is comparable.[22] Finally, deposits at commercial banks rise in crises, although not significantly more than in booms.

[21] We also analyze medians of all variables and reach similar conclusions (results omitted).

[22] Data in SDC also show positive long-term debt issuance during crises, albeit at lower levels than during booms. Due to Compustat data limitations, we cannot tell whether changes in short-term debt owe to muted effects on repos and CP, or whether shocks in those markets are offset in a crisis with Federal Home Loan Bank (FHLB) advances, federal funds and discount window borrowings. EDGAR filings indicate that some firms report short-term CP as long-term debt because they plan to roll it over, but this would change to short-term debt if such plans were foiled. Ashcraft, Beck and Frame (2010) provide evidence that FHLB advances increased during the crisis, primarily at large banks suffering from shocks to fundamentals. We control for discount window borrowing during the recent crisis in our analysis.

While funding at large commercial banks does not decline during crises overall, liquidity shock theory suggests that it may decline at banks that rely heavily on the capital markets. We split the sample based on the ratio of deposits to total assets in the preceding quarter, and classify banks in the top (bottom) quartile as high (low) deposit banks. High (low) deposit banks are less (more) reliant on capital market funding. Alternatively, if shocks to fundamentals drive crises, less creditworthy banks should have more trouble obtaining external funding during crises. We therefore split the sample based on equity ratios in the quarter immediately preceding a crisis (boom) period, and classify banks in the top (bottom) quartile as high (low) equity banks. While our intent is to separately examine the impact of liquidity risk and credit risk on commercial bank funding, these risks would be difficult to disentangle if low deposit banks are identical to weakly capitalized banks. These two groups in our sample overlap but are not exactly the same.

Table 3 shows that low deposit banks have positive net debt issuance in crises, albeit lower than in booms, and well below that of high deposit banks. This finding suggests that obtaining capital from the markets is not easy in a crisis. Nevertheless, net debt issuance is still positive and therefore not strictly a negative shock to funding sources as predicted by the amplification models. These banks are often also weakly capitalized, and if the overlap of low deposit/low equity banks were exact, we would see the same slowdown in debt issuance for the low equity banks. However, net debt issuance actually declines more sharply in crises among weakly capitalized (low equity) banks, suggesting that solvency concerns are an important factor that dampens debt issuance in crises.

Further supporting the idea that solvency concerns are important in financial crises, Table 3 shows that weakly capitalized banks experience significantly lower deposit growth during crises than well-capitalized banks, likely reflecting concerns about insolvency among large

depositors not covered by the FDIC's safety net. By comparison, banks with low deposits going into the crisis do not suffer from a decline in deposit growth during the crisis.[23] Further, the deposit growth for low deposit banks is not statistically different from the deposit growth of high deposit or high equity banks.

Table 4 shows univariate results on asset sales and some alternatives to selling assets. Overall, total asset growth is sharply lower in a crisis than a boom, but remains positive. There are pockets of weakness – both low deposit and poorly capitalized banks are more likely to shrink. As the largest asset category, loans also experience slower growth overall. Notably, this decline in growth does not vary based on deposit base or equity ratios, suggesting that the loan slowdown is related to future prospects for the aggregate economy. Unfortunately, we cannot determine from Compustat data whether a change in assets is due to asset sales or a change in the reported values of assets (write-downs), but the shrinkage in assets cannot be completely due to sales, as net charge-offs increase in crisis periods for all types of banks.

The positive asset growth in Table 4 is not an artifact of government assistance. In Figure 1 we examine quarterly asset growth and net debt issuance during the most recent crisis when government assistance would have had the largest impact on our results. The figure shows that the subprime crisis does not start with a liquidity shock, as net debt issuance remains positive through Q3 2008. Only in Q4 2008 is net debt issuance negative, but asset growth is positive in that quarter. Furthermore, the only quarter with negative asset growth is Q2 2008, a quarter characterized by positive net debt issuance. These patterns are inconsistent with the predictions of theories that rely on liquidity shocks to generate fire sales and loss spirals. And, they hold

[23] In approximately 80% of all bank-quarters during a crisis, low deposit banks remain low deposit banks while in 20% of these bank-quarters low deposit banks actually improve their deposit networks. Only two banks in three quarters during a crisis (or 0.4%) actually became classified as high deposit banks.

even if we net out the debt obtained from the Federal Reserve. We note that discount window[24] borrowing by our banks during 2008 is inconsistent with a liquidity shock explanation of the crisis, as discount window loans are negligible until September 2008. Moreover, the upward spike in September owes mainly to borrowing by Wachovia after it agreed to be taken over by Wells Fargo.[25] Our results are consistent with He, Khang, and Krishnamurthy (2010) who find that commercial banks during the subprime crisis had ample access to liquidity and did not fully tap all sources of debt financing available to them.[26]

Two government programs that started before the end of our sample period, the Capital Purchase Program (CPP) and the Treasury Loan Guarantee Program (TLGP), mainly added liquidity in late December 2008 and did not affect Q4 2008 balance sheets. Nevertheless, we investigate SEC filings of our banks in Q4 2008 and find that these firms received $176 billion through the CPP, including $31 billion received by Citigroup, PNC, and Fifth Third on New Year's Eve 2008 that was unlikely to have increased their Q4 lending. Indeed, lending among the banks receiving these funds fell by $68 billion in the last quarter of 2008. The banks received another $82 billion through the TLGP, nearly all of which came in December. Again, lending at commercial banks that received TLGP assistance fell in Q4 2008.

Banks can avoid fire sales in crises by issuing equity, cutting dividends, and selling off highly valued and/or more liquid assets. Table 4 provides evidence that the latter two strategies are alternatives to fire sales: equity issuance is significantly higher and dividends are lower in a

[24] We include primary and secondary credit, Primary Dealer Credit Facility (PDCF), Term Securities Lending Facility (TSLF), and Term Auction Facility (TAF) in discount window borrowing.

[25] We also note that the FOIA data show the majority of discount window borrowing during 2008 was by foreign banks. The foreign banks with largest balances are Dexia, Depfa, Fortis, and Bank of Scotland.

[26] We reach similar conclusions for other crises in our sample (not reported). Specifically, on average, banks continue to grow during every quarter throughout the crises in our sample. Only for two quarters during the 12/1989-12/1992 crisis is the median asset growth negative and these two quarters with asset declines occur in the second half of the 16-quarter long crisis.

crisis.[27] With respect to asset sales, first, SDC data show that banks divest assets less frequently in crises, which contradicts the prediction of the amplification models that numerous forced sales at depressed prices generate loss spirals. Second, commercial banks primarily sell assets that generate reported gains. Rather than revealing massive losses on forced sales of toxic assets, the investment securities gain or loss accounts show only a slight decline in crises.

Prior to 1993, the investment securities gain or loss account included only gains or losses from sales of securities but since then this account includes both gains and losses from sales and write-downs of "available for sale" securities that are considered "other than temporarily impaired" (OTTI).[28] If banks engage in fire sales, this variable should reflect actual sales much more than write-downs. Hence, to calculate the actual gains or losses on sales of securities, we manually examine footnotes in 10-K reports filed with the SEC for all banks in the sample during 2007 and 2008. The results provide evidence for cherry picking and against fire sales. For 2007, our commercial banks report investment securities gains totaling $369 million. Of this, about $1.9 billion reflects gains on actual sales while -$1.6 billion reflects OTTI write-downs. The results for 2008 are even more extreme. The net figure recorded across all banks is -$1.5 billion, which reflects $9.8 billion in gains on sales and -$11.3 billion in OTTI write-downs.[29] Essentially, the strategy of cherry picking drives the main components of the investment gains/losses variable. Finally, we note that the majority of the 2008 write-downs (about $7.3 billion) came in the fourth quarter, coinciding with cash injections from the government's new programs – implying that banks were "using" some of these funds to reduce examiner pressure

[27] Results reported in Table 3 and 4 are not qualitatively affected by relying on asset-based value-weighted averages.
[28] Since 1993 FASB 115 has required that banks adjust their earnings to reflect market value changes in their investment securities that are classified as "available-for-sale." If an unrealized loss in this asset category is considered permanent, it is recorded as if it were a realized loss. By contrast, very few loans are marked to market.
[29] Net realized gains from sales are positive for both annual periods, reflecting realized gains among bank-quarter observations that are nearly 3 times as much as losses during 2007 and 4 times as much as losses in 2008.

vis-à-vis loan valuations while "using" the rest to improve their capital ratios. Based on data for the recent crisis, we conclude that commercial banks cherry pick financial assets to sell, in order to offset write-downs on assets that have suffered from negative valuation shocks.

In addition to investment security sales, we also examine banks' SEC filings for 2007 and 2008 for sales of other assets. Examples of these other sales are bank branch sales and divestitures of subsidiaries. As noted earlier, SDC data suggest fewer sales in crises, but realized gains in SEC filings for these sales are quite large, which indicates that banks are selective about the assets they choose to sell in a downturn. In aggregate, realized gains total $3.0 billion in 2007 and $1.1 billion in 2008 for our sample of commercial banks, again providing strong evidence that in times of crises banks tend to cherry pick assets to boost reported equity. In contrast, loss spiral models predict unusually high sales and large losses on most transactions.

In Figures 2 through 4 we investigate the relative costs of alternative funding avenues in more depth by relying on the banks' revealed preferences. Commercial banks have four major alternatives to fire sales when debt funding dries up: increased deposits, equity issuance, decreased dividends, and sales of assets that are unaffected by the crisis. Figure 2 shows how often each alternative is used, while Figures 3 and 4 focus on the fraction of lost funding that is replaced by deposits and asset sales. Due to data limitations, the category of "asset sales" includes both write-downs and actual sales since 1993. Furthermore we are not able to separate sales into instances of fire sales and cherry picking. Therefore, the total asset sales likely overstate the extent of fire sales.

Figure 2 shows that banks most frequently issue equity and increase deposits to replace lost debt funding in a crisis, choosing dividend cuts less frequently. For the 1,108 observations (out of 2,874) that face such shortfalls, banks issue equity to offset the funding loss more than

70% of the time. Even undercapitalized banks manage to issue equity. Among banks that do not issue equity, the next most popular approach to dealing with debt shortfalls is to increase deposits. Even low deposit banks increase deposits more often than resorting to asset sales, suggesting that the costs of these alternatives are not onerous. By contrast, banks choose to sell assets as the only course of action to replace debt shortfall in a mere 10% of instances (107/1,108), and, as noted earlier, these "asset sales" include both write-downs and cherry picking. Figure 2 also shows how frequently these alternatives are used in the recent crisis. While equity issuance is not as popular as in past crises, deposits are used to replace debt even more often, and asset sales are not notably more frequent than they are in other crises.

While Figure 2 shows that equity issuance is the most common tool for dealing with debt shortfalls in crises, the dollars raised via equity are relatively small. However, deposits (the second most frequently used replacement) increase substantially at these banks, as shown in Figure 3. In 44% of the cases with debt funding shortages (492 of 1,108), banks solve the problem entirely with new deposits. In another 243 instances (22% of the time), banks increase their deposits in response to the shortfall, replacing almost half the lost funds with deposits (untabulated), and using asset sales for most of the remainder. Thus, about two-thirds of banks experiencing debt shortfalls replace at least half their shortfalls with new deposits. This reliance on deposits also holds in the most recent crisis.

Only about a third of banks that face a debt shortfall (373 observations) also experience a decline in deposits. While high deposit and high equity banks replace more of their debt shortfall with deposits than low deposit and low equity banks, the proportion of banks experiencing funding shortfalls *and* deposit declines is comparable across all four types of banks. Given their

heavy reliance on cherry picking, it seems unlikely that liquidity shocks in these 373 cases could cause enough fire sales to lead to loss spirals and financial crises.

In Figure 4 we analyze how much of the dollar decline in debt is replaced by deposits and asset sales for two subsets of banks: (1) observations with a debt shortfall in a crisis (left panel) and (2) the subset of observations with both a debt shortfall and a decline in deposits in a crisis (right panel). Note that the typical decline in debt in a crisis, when it occurs, is small (the median drop is $137 million, and the average is less than 3% of assets). The left panel shows a revealed preference for deposits as the cheapest alternative to debt funding, since deposits comprise 72% of lost funds. The recent crisis is characterized by even higher reliance on deposits to replace the lost debt funding (84%). High deposit and high equity banks almost entirely offset the debt funding decline with increased deposits ($0.99 and $0.98 for each $1 of lost debt, respectively), while the comparable figures for low deposit and low equity banks are $0.50 to $0.59. For the 373 instances in which banks see outflows in deposits as well as debt declines, the panel on the right shows that asset sales make up about $1.99 of each $1 drop in debt. However, the largest asset sales are at healthier banks (high deposits as well as high equity), suggesting that the decline in assets is part of a retrenchment strategy rather than the result of desperate efforts to raise cash by firms that rely heavily on short-term capital markets.

Thus far our examination of banks' responses to negative shocks has involved only univariate analyses. In Table 5 we combine the various choices facing banks in regressions to determine the dominant factors affecting net debt issuance, changes in equity ratios, and changes in total assets. In Panel A we use all boom and crisis periods and in Panel B we use crisis periods only. Our regression results do not imply causality; rather, we consider the alternative ways banks deal with a liquidity shock in a multivariate setting. The regression models (1), (3), and (5)

in Panel A include only exogenous variables while models (2), (4), and (6) include variables from both sides of the balance sheet as well as the exogenous variables, allowing for a base effect for each variable and a shift in the coefficient during crisis periods.[30]

Holding constant the pre-crisis capital level of the bank, model (1) in Panel A reveals that net debt issuance does not decline on average in a crisis. Nor does debt issuance fall for firms that rely heavily on the capital markets rather than deposits. The regression coefficient on low equity banks does indicate, however, that funding problems are greater among firms that are perceived by the market to be in danger of failure. Model (2) in Panel A indicates that debt issuance does not fall in a crisis, holding constant other factors. Nor do the regressions indicate that the subset of banks that rely heavily on the capital markets for funding suffers from asset loss spirals because of funding shortfalls. Instead, the regressions indicate that commercial banks can substitute deposits for debt issuance. The positive and significant coefficient on the change in loans in model (2) is consistent with the idea that liquidity shocks lead to loan sales and potentially to fire sales, but the fact that the coefficient is less positive in crises contradicts this explanation.[31] In Table 5 Panel B, models (1) and (2) show that net debt issuance is no worse during crises for firms with few deposits, except in the subprime crisis. Therefore, even if liquidity shocks were more important in the most recent crisis, they are not typically a trigger for a crisis. The recent crisis is also different in that the coefficient on loans is not positive. In all crises, loans decline with funding, reflecting either a decision to lend less or a pattern of fire

[30] Not only do the coefficients in models (2), (4), and (6) not necessarily imply causality but sometimes they are affected by sorting. For example, model (4) suggests that higher charge-offs are associated with more equity, except in a crisis when the net coefficient is negative. While it may seem counterintuitive that charge-offs could ever lead to higher reported capital, they could if firms with more capital that can afford to report more losses to regulators do so in normal times. In crises, regulators would not find it credible that there are no losses. In fact, they are so large that all banks end up writing off some loans. The more they write off, the lower the capital, as one would expect in the absence of sorting.

[31] In unreported results, we examine the effect of high holdings of Treasuries to determine if their superior value in the repo market helped to avoid funding shortfalls (Gorton and Metrick (2009)), but we see no evidence of this.

sales. However, in the recent crisis the coefficient is negative, suggesting that fire sales of loans were not a major factor in the last crisis, *ceteris paribus*, thus confirming our manual review of SEC filings for 2007 and 2008 where we find very few sales of loans – at either gains or losses – during this period.

Many amplification models link a lack of liquidity and asset sales to a decline in capital, if not outright insolvency. We examine this prediction in models (3) and (4) of Table 5 Panel A. Consistent with the univariate results, we see little evidence that equity ratios are adversely affected by crises as the crisis coefficient is insignificant in model (3) and is actually positive and significant in model (4). Likewise, the low deposit indicator is insignificant, implying that reliance on capital market funding is not a path to insolvency. The negative net coefficient on charge-offs for crises in model (4) (0.22 + -0.72 = -0.50) suggests that changes in credit risk are a major contributor to banks' financial distress in crises. The net coefficients confirm that banks use dividend cuts and reported gains on securities (cherry picking) in crises to meet minimum regulatory capital requirements. We note that debt issuance has a net negative coefficient in crises, suggesting that firms with funding shortfalls end up being *less* leveraged. This result is contrary to the liquidity shock theories' proposition that in crises, decline in debt funding and the subsequent asset loss spirals lead to higher leverage (i.e. lower capital). Furthermore, if fire sales lead to insolvency, a drop in loans in crises would reduce capital, however, the coefficient of -0.07 in model (4) suggests otherwise. In Panel B, model (4) for the most recent crisis shows that the low deposit indicator is not significant, net debt issuance is not significantly negatively related to the equity ratio, and the drop in loans does not reduce capital, indicating that the most recent crisis is not characterized by fire sales. Finally, the use of deposits as a substitute for debt

is clear, supporting the conclusion of Gatev, Schuermann, and Strahan (2009) that banks are naturally able to hedge their loan commitment funding in a crisis.

Models (5) and (6) in Table 5 Panel A report regressions for changes in assets and show no unusual declines in assets during crises, even for firms that rely heavily on the capital markets for funding. In model (6) we allow a separate coefficient on debt issuance for firms with decreases in debt. If funding constraints lead to fire sales, this coefficient should be positive, significant, and greater than one (reflecting asset loss spirals). The coefficient is significantly positive but the magnitude implies less than a dollar for dollar decline in assets. This small coefficient suggests that these firms offset these funding shocks with proceeds from other sources, as in Figure 2. In Panel B of Table 5, banks with declines in debt financing have a positive coefficient of less than one in crises (0.54 in model (5)), and this coefficient is even smaller in the recent crisis (0.31 in model (6)). Finally, while a change in loans leads to a change in assets in the recent crisis, offering potential evidence that loan fire sales lead to feedback effects on other assets, our manual review of financial statements indicates little evidence of loan sales. More likely, this positive relationship reflects a strategy of shrinking when loan write-downs push a bank closer to the regulatory minimum as a way to boost a capital ratio.[32]

Overall, most banks do not experience debt declines in crisis and those that do replace such shortfalls with deposits. Dividend cuts and equity issuance also help banks manage capital ratios in troubled times. Likewise, banks appear to cherry pick assets rather than engage in fire sales. Our results are consistent with bank creditworthiness being an important explanation of financial crises.

[32] A detailed review of SEC filings for the ten largest commercial banks in Q4 2008 supports our conclusions. Specifically, for eight of the ten banks that report loans held for sale ("originate to distribute" loans) separately from "loans held for investment," loan write-downs on loans held for investment on average exceed loan sales of loans held for investment by a factor of 4. Loan sales at the other two banks that aggregate loans held for sale with loans held for investment are comparable to the levels in Q4 2007, and neither bank reported significant losses on sales.

*B. Investment banks*

Next we consider investment banks, which liquidity shock models predict will have greater problems than commercial banks because they rely more on short-term capital market funding. We split the sample based on the banks' median levels of short-term borrowing.[33] Table 6 indicates that investment banks do not experience a drop in overall funding during a crisis. However, similar to commercial banks, growth in debt issuance drops off in a crisis (albeit not significantly for these firms), and the number of banks with a decrease in debt funding is higher in crises as well. Surprisingly, the largest funding shocks occur at investment banks that rely *less* heavily on the short-term capital markets. However, instead of revealing disruptions in the repo market, this result reflects endogeneity of funding choice. That is, the CP market is typically closed to lesser quality borrowers, crisis or not (see Crabbe and Post (1994)), leading to *fewer* funding problems among the investment banks with greater reliance on short-term debt if they are healthier firms. Consistent with this explanation, data in Compustat on Standard & Poor's short-term credit ratings indicate that those with a higher fraction of short-term capital debt, on average, have higher ratings in crisis periods. Our results are also consistent with those reported by Gao and Yun (2009) who document a decrease in reliance on CP borrowing by less creditworthy borrowers in the wake of Lehman Brothers' bankruptcy.[34]

Asset growth is lower in crises than in booms, but not significantly for firms reliant on short-term capital markets. Indeed, very little differs across crises and booms for these higher-rated firms. The few significant changes in crises exhibited by the firms with high short-term

[33] A detailed review of SEC filings from 2006 to 2008 for these banks indicates that "Debt in Current Liabilities" includes unsecured short-term borrowing, payables to customers, brokers, and dealers, other secured financing, and repos, whereas the cash flow item "Change in Current Debt" does not typically include repos. We therefore estimate the change in current liabilities from the balance sheet instead of the cash flow statement. Unreported calculations comparing data in SEC filings to this estimate of the change in current liabilities show they are closely related.

[34] Note that one of the largest CP issuers going into the crisis, GE Capital, suffered enormous losses on residential real estate and its funding pressures may have reflected credit quality concerns more than liquidity risk (see Kacperczyk and Schnabl (2010)).

debt are in net equity issuance (repurchases decline), capital ratios (which increase as a result of higher earnings retention), and trading assets (which decrease). Given that funding does not decline, one must interpret the change in trading assets as a strategic move to reduce enterprise risk, rather than a forced sale of assets arising from liquidity shocks. Most of the significant differences in Table 6 owe to changes in the situation facing less creditworthy investment banks – those that rely *less* on short-term capital markets. While we cannot say with certainty whether the declines in assets reflect actual sales or write-downs, the asset declines are likely not driven by declines in funding since net debt issuance for even these investment banks is not actually negative. Similar to commercial banks, investment banks are more likely to engage in divestitures in boom periods, but the difference is not statistically significant.

We investigate funding and asset growth during the subprime crisis in detail and find that, as with commercial banks, the patterns are inconsistent with predictions of the liquidity shock theories. In untabulated results, we find that the typical investment bank does not experience negative net debt issuance until Q2 2008, a full year after the beginning of the crisis and likely because of credit concerns raised by Bear Stearns rather than because of a liquidity shock. Borrowing via the PDCF, TAF, and TSLF programs increased in Q2 2008 and again after the failure of Lehman Brothers, but some of the increases owe to borrowing by JP Morgan Chase for its Bear Stearns takeover in April 2008 and new rules in Q3 2008 that allowed financial institutions to borrow from the Fed using lower quality collateral. We also manually review their SEC filings to analyze cherry picking at investment banks: in 2007, gains on sales of other assets totaled $687 million among our investment banks, while total gains in 2008 were an impressive $9.6 billion.

Table 7, Panels A and B, presents regressions for investment banks similar to those in Table 5 for commercial banks. As with commercial banks, the regressions provide little evidence that funding declines significantly in a crisis. Indeed, the crisis indicator is significantly *positive* in the net debt regression. The only two significant interaction variables in model (2) are charge-offs and financial instruments owned, suggesting that declines in funding reflect creditworthiness rather than liquidity shocks. The individual crisis regressions in Panel B are consistent with this conclusion as the short-term debt indicator is insignificant and the intercept is generally positive. Moreover, Panel B suggests that investment banks also rely more heavily on equity issuance (or at least engage less in share repurchases) when debt funding declines.

The change in the equity ratio at investment banks (models (3) and (4)) is also no different in a crisis, as the crisis indicator coefficient is insignificant and the firms that rely more on short-term funding do not show a greater risk of insolvency in a crisis. Extraordinary items is one of the few variables that is significantly different in a crisis and it suggests that credit risk, not liquidity risk, is the dominant factor in reducing capital ratios in a crisis. Turning to Panel B, the evidence again does not provide support for the liquidity shock channel, since the indicator variables for high short-term debt type are insignificant in crises. A decline in debt issuance does not lead to insolvency as predicted by amplification models and, in fact, has the wrong sign, except in the recent crisis when it is not significant. Extraordinary items are detrimental to equity capital in crises, indicating that one-time charges likely outweigh efforts at cherry picking assets.

Investment banks' assets are not strongly linked to funding shocks in crises. While model (5) in Table 7 Panel A shows a significant negative 3.5% effect of a crisis on asset changes, this result disappears when controlling for other firm characteristics in model (6). Model (6) provides support for the amplification models in that assets decrease when debt issuance declines, and

sharply so for the firms with negative debt issuance. However, the outsized coefficient on extraordinary items raises the question of whether write-downs contribute the most to difficulties in borrowing. The asset changes, as noted before, may reflect revaluations rather than sales of portfolio securities. Interestingly, the point estimate for the coefficient on net debt issuance for firms with lower borrowing is actually lower in the recent crisis (Panel B, Table 7, model (6)) despite the fact that it was the only one described by the Federal Reserve as "the worst financial crisis since the Great Depression" during which "credit markets froze."[35] Finally, none of the coefficients on negative net debt issuance exceed one, indicating that even if assets shrink at investment banks because of their inability to borrow in frozen debt markets, the decline in borrowing does not lead to an asset price spiral via fire sales.

While liquidity shock amplification models predict that investment banks will be more sensitive to capital market disruptions than commercial banks, the data do not show strong evidence that liquidity shocks affect them strongly in recent or earlier crises. As with commercial banks, the typical investment bank does not shrink in a crisis. While some pockets of weakness exist, the overall connection between funding and asset growth in a crisis is tenuous. Nor is it obvious that fire sales are a common problem at investment banks in a crisis, and asset shrinkage, to the extent it exists, may instead reflect mark to market adjustments of assets that are impaired because of firm fundamentals.

*C. Hedge funds*

Relative to commercial and investment banks, hedge funds should have the most exposure to liquidity shocks due to reliance on investor cash flows. Funds with short lock-up periods are likely to suffer even more from liquidity shocks. Thus, we analyze funds that have

[35] Federal Reserve Chairman Ben Bernanke speech on April 7, 2010 to Dallas Regional Chamber, and Governor Elizabeth A. Duke speech at the annual Consumer Bankers Association in Hollywood, Florida on June 8, 2010.

negative quarterly net flows and a lockup period under 12 months ("constrained" hedge funds) and compare them to the funds that are most insulated from liquidity shocks, those with a lockup period greater than 12 months and positive quarterly net flows ("unconstrained" funds).[36] Hence, by construction, constrained hedge funds are affected by a liquidity shock. Thefore, our analysis focuses on whether asset sales by hedge funds involve fire sales that cause loss spirals and amplify the liquidity shocks.

Table 8 reports that a significantly larger fraction of hedge funds experience outflows during crises than booms. Overall, quarterly hedge fund flows and returns are lower during crises than booms. This mainly reflects problems at funding constrained hedge funds, as unconstrained funds do not have negative returns, and their average inflows are not significantly lower in crises. The dramatically worse performance of constrained funds in both crises and booms is consistent with Aragon (2007) who finds that funds with lockup provisions generally outperform those without. During a financial crisis, the constrained firms earn an average of 16% less than unconstrained funds (annualizing the quarterly returns).

While outflows and losses at constrained funds are consistent with liquidity shocks, Table 8 shows that these funds' problems are also consistent with changes in fundamentals of the firms whose stock they own. Funding-constrained funds hold smaller stocks than unconstrained funds, based on total assets and market capitalization, regardless of the period studied. Compared to unconstrained funds, constrained funds hold stocks of firms that are less profitable (based on Tobin's Q and stock returns).. In unreported results we compare both types of funds' stocks with those of the full sample of hedge funds and find that both types of funds hold more profitable

[36] Many funds have lockup periods of exactly 12 months (it is both the median and the mode), so it is a natural cutoff for short versus long lockup periods. Of the 4,685 fund-quarter observations during the sample period, 1,346 are outflow/short lockup period funds while 197 are inflow/long lockup funds, with 3,142 observations falling in neither category. Our results are similar when we use leading flows to capture the impact of redemption notification periods (which have a median of 90 days in our sample), as in Boyson, Stahel, and Stulz (2010).

stocks (relative to funds that are neither constrained nor unconstrained) during both booms and crises, implying that even constrained funds hold stocks with relatively good past performance and growth opportunities. Turning to measures of stock liquidity, there are no economically significant differences in the Amihud (2002) illiquidity measure or bid-ask spreads between the two types of funds in crises or booms. Both types of funds hold more liquid assets during crises than booms. These results suggest that poor stock returns in the constrained funds' portfolios are due more to fundamentals than to price pressure from distressed sales. Finally, we find no significant differences between sales during crises and booms in the proportion of market capitalization that each sale represents. If selling pressure drives down prices in crises, hedge funds might be expected to hide their trades by splitting them into several smaller transactions; however, all funds increase their average transaction size during a crisis. The increase is even greater for constrained funds that sell more of their portfolios.

In Table 9, we further investigate the impact of hedge fund quarterly stock sales by classifying each stock in the portfolio as either increased (the hedge fund bought more of an existing position), unchanged, or sold (the hedge fund sold all or a portion of an existing position) relative to the market value of that stock's position in the prior quarter (as in Coval and Stafford (2007)). By construction, our analysis ignores the initial purchase of stocks each quarter, causing a bias that overstates selling and understates buying. Table 9 shows that constrained hedge funds sell 51% of prior period holdings on average in crises. This is consistent with Ben-David, Franzoni, and Moussawi's (2011) finding that all hedge funds (not just constrained funds) sold 29% of their assets in the recent financial crisis. Such extreme declines, coupled with the fact that constrained funds sell 22% more of their assets than unconstrained funds, suggest that fire sales by funds facing redemption requests may be a major problem in crises. However,

one fact in Table 9 contradicts the fire sale scenario: both types of hedge funds increase positions in existing stocks during crises. The buying reported in this table understates the total purchases by constrained hedge funds, as it ignores initial purchases of stock. Remarkably, the average increase for stocks bought by constrained funds is actually larger during crises than booms. Rather than selling assets solely to raise cash for redemption requests, the most constrained hedge funds use some sales proceeds to buy more shares. This suggests that for some of their stockholdings, constrained funds' motives for selling during crises may be more closely tied to information (i.e., views on the likelihood of a high return) than to redemption pressures.

Table 10 reports a multivariate analysis of trading by all hedge funds during the sample period. Since the univariate results of Table 9 indicate that constrained funds are also *buying* stock during financial crises, we focus on hedge funds' net sales. The dependent variable is the proportion of shares sold less the proportion of shares purchased (as noted earlier, shares purchased includes only additions to existing positions). As is typical in the literature, we control for a number of fund characteristics. We have five regression specifications: three that combine observations for crises and booms, one using only crisis data, and one for the most recent crisis. In models (1) and (3), the crisis indicator has the wrong sign and is insignificant, indicating that hedge funds' net selling is not different between crises and booms. Model (2) results indicate that constrained funds' net selling is significantly higher during both crisis and boom periods. However, model (3) shows that the net selling in crises is *not* statistically distinguishable from net selling in booms, providing evidence against fire sales caused by liquidity shocks. In model (5) we note that the results for the most recent crisis are similar to the results using all crises.

In Table 11, we investigate the types of stocks that hedge funds sell in booms and crises. To appropriately benchmark these results, we compare stocks that are sold to stocks that are "not

sold" ("unchanged" and "increased") by the same hedge funds during the same periods, with particular emphasis on the choices made by constrained hedge funds. If constrained hedge funds are driven to sell off assets at bargain basement prices, they should sell their most liquid stocks with the best performance in order to minimize losses. Contrariwise, during crises, we find that constrained funds sell *smaller* stocks with slightly *worse* prior year annual returns, and *lower* Tobin's Q than stocks they do not sell. Importantly, similar patterns hold during boom periods. Further, there are no significant differences in either the Amihud (2002) illiquidity measure or bid-ask spreads between stocks sold and not sold. For unconstrained funds, these patterns are similar, although statistical significance for the unconstrained fund results is generally weaker. Hence, it appears that some of the selling by constrained funds is motivated by a desire to sell losers and invest more in winners.

As a final test of whether hedge funds' trading is affected by liquidity shocks or by change in fundamentals of their holdings, we examine cumulative abnormal returns of stocks sold and not sold during financial crises. Returns of stocks sold due to liquidity should display price reversals after the sale date, indicating that the price decline was temporary, while the performance of stocks sold strategically due to change in fundamentals would not experience the same rebound. We calculate cumulative monthly abnormal returns for the 12 months prior and 18 months following the event date, where the event date is the crisis quarter, and the performance is calculated in excess of the CRSP value-weighted index. Figure 5 plots the returns for all crises while Figure 6 plots results for the most recent crisis. Since our holdings data is quarterly but our returns data is monthly, we are not certain exactly when a stock was sold during the quarter, so the event date for this analysis is denoted T1, T2, or T3, representing the first, second, and third months during the quarter, respectively.

The results in both figures indicate no evidence of fire sales. While the stocks sold by constrained funds underperform those sold by unconstrained funds prior to sale, the graphs do not reveal price declines due to fire sales that subsequently reverse for either type of fund. Further, the stocks not sold by constrained funds behave similarly to the stocks they do sell. For both periods, stocks sold and not sold by constrained hedge funds underperformed the market during crises and then outperformed the market after crises. If this result were due to liquidity-induced sales by constrained funds, it should only hold for stocks sold, not for stocks that were not sold.

Overall, the results show that constrained hedge funds continue to buy stocks during crisis periods, despite the pressures to meet redemption requests. The stocks that constrained funds sell during crises and boom periods tend to be similar: they are smaller with worse profitability and worse prior year performance than the stocks they do not sell, and these patterns are similar to those exhibited by unconstrained funds. Given that the unconstrained hedge funds are under much less pressure to sell, the similarities of the securities that either type of hedge fund sells likely reflect common strategies for dealing with unprofitable bets rather than liquidity shocks.

## IV. Conclusion

A major research issue in financial economics is how financial crises snowball into major problems for the real economy. Recent theoretical research emphasizes liquidity shocks to financial intermediaries that force them to sell assets at fire sale prices. In many of these amplification models, the asset sales create a loss spiral that can lead to insolvency. The lack of funding and reduced capital at the aggregate level can translate into a shortage of financing for nonfinancial firms and lower business activity overall. An alternative view points to the

importance of shocks to fundamentals and highlights the idea that difficulties in rolling over short-term debt reflect concerns about solvency.

We test these two explanations by considering the financing choices, portfolio composition, and equity ratios of commercial banks, investment banks and hedge funds using data that begins in 1980 for commercial and investment banks, and 1998 for hedge funds. Our tests focus on three elements of the liquidity shock theories: (1) capital market disruptions cause a decline in debt funding at most institutions, especially those that rely heavily on short term debt; (2) when these funding shortfalls occur financial firms have no alternative but to shrink via asset sales; and (3) asset sales are at fire sale prices that lead to loss spirals in financial markets. We examine the balance sheets of commercial banks and investment banks during crises and find that liquidity shocks, if they exist, are not strong enough to cause a decline in debt issuance at either type of bank. Nor do we see assets fall on average in crises. While the evidence is consistent with pockets of weakness, as banks are more likely to suffer a drop in debt issuance and negative asset growth in a crisis, we find no evidence that their problems owe to market wide liquidity shocks. For commercial banks, these pockets more often contain banks that are closer to insolvency. But even among these firms, the evidence is not compelling: a dollar decline in funding does not translate into more than a dollar decline in assets, as loss spirals would imply. Most commercial banks find alternative sources of funding, mainly in deposits, and this result holds for the most recent crisis. Likewise, we do not see strong evidence of funding concerns or fire sales among investment banks. Indeed, investment banks that rely more heavily on short-term debt financing are less affected by funding problems as these firms enter the crisis period with more capital and higher bond ratings. Finally, while hedge funds suffer from outflows during crises, particularly those funds with short lockup periods, their stock sales seem as much

motivated by a desire to dump losers as by the need for cash to satisfy redemption requests. Even funds suffering the most still manage to make significant stock purchases during crises. Moreover, sales at hedge funds often involve stocks that do not differ significantly from the stocks they do not sell in terms of liquidity, indicating that they are not trying to minimize price pressures by selling their most liquid stocks during crises.

We do not find that liquidity shocks play a larger role in the most recent crisis than in other crises. Although government provision of liquidity to commercial banks and investment banks is dramatically higher during the last crisis, most large banks in our sample do not avail themselves of these facilities in response to a liquidity shock. Borrowing at the discount window by most large U.S. commercial banks is negligible and the exception (Wachovia) cannot be attributed to liquidity problems. Likewise, the timing of Federal Reserve's loans to investment banks is inconsistent with a crisis triggered by liquidity shock. Moreover, to the extent that government programs are accessed, the funds provided by them are not used to expand the balance sheet as the amplification models predict.

Rather than liquidity shocks driving financial crises, we see greater evidence that problems emanate from the asset side of the balance sheet in the form of shocks to fundamental value: commercial banks' equity and assets are strongly affected by the level of net charge-offs while investment banks' asset changes seem to reflect market valuation changes more than asset sales. Meanwhile, hedge funds seem to be dumping their worst investments and allocating some of these proceeds to increase positions in stocks they believe will outperform in the future.

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**Figure 1: Quarterly Change in Total Assets and Net Debt Issuance: Q2 2007 - Q4 2008**

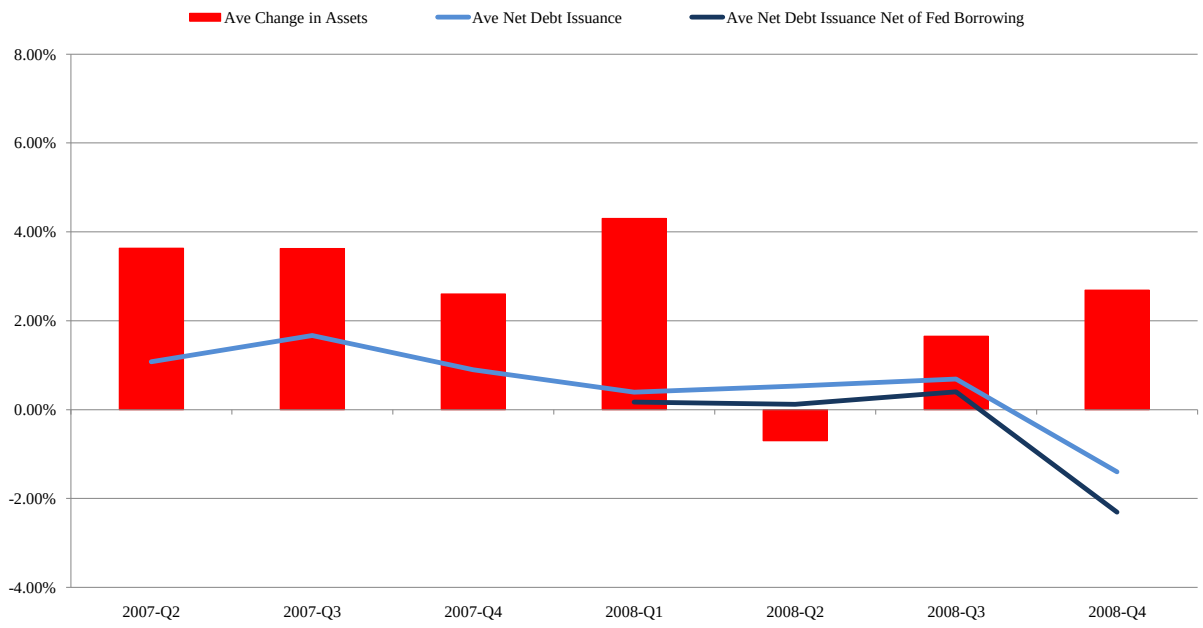



**Figure 2: Frequency of Actions Taken by Commercial Banks During Crises**

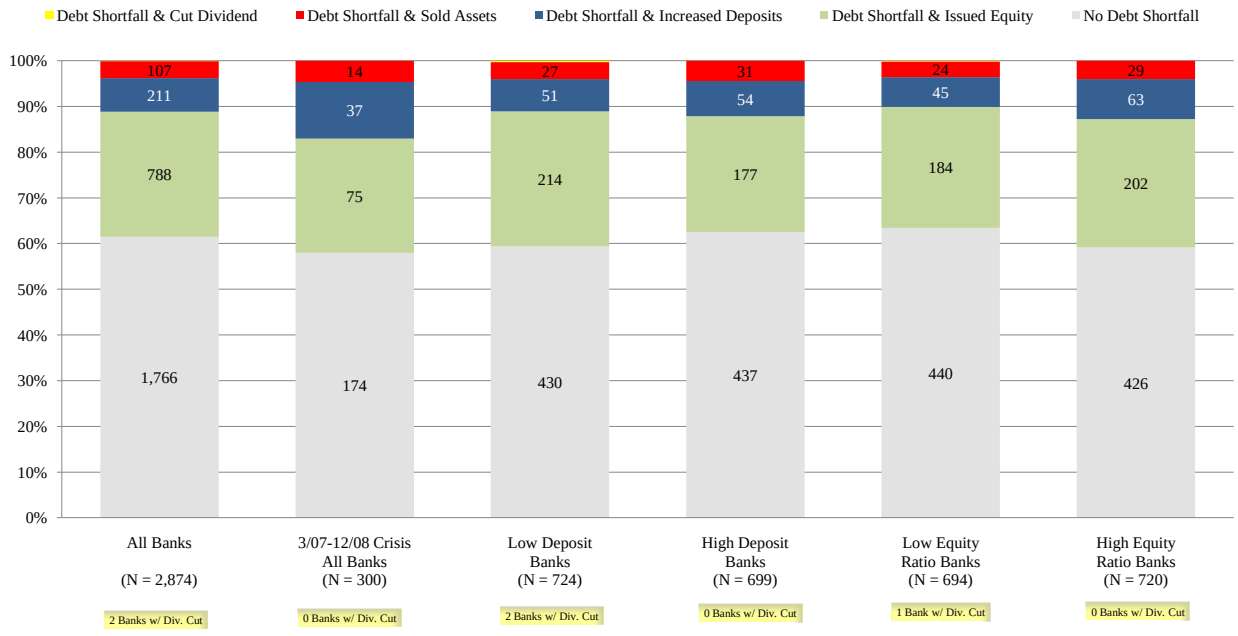


**Figure 3: Fraction of Commercial Banks During Crises Partitioned by Debt Shortfall and Change in Deposits**

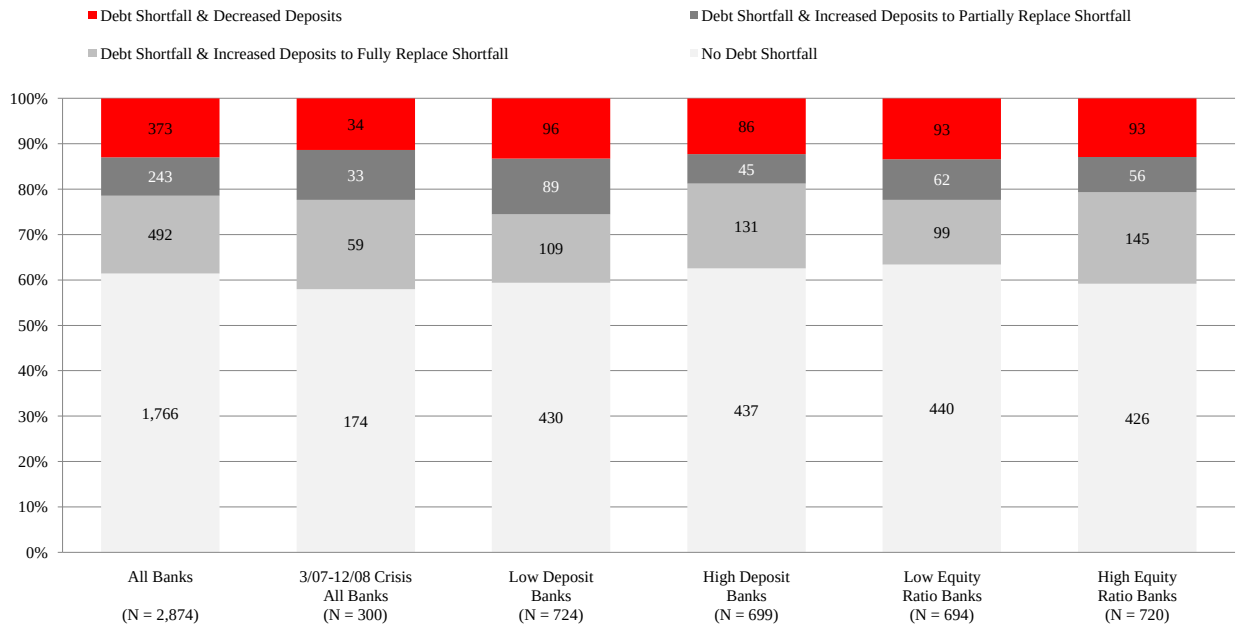
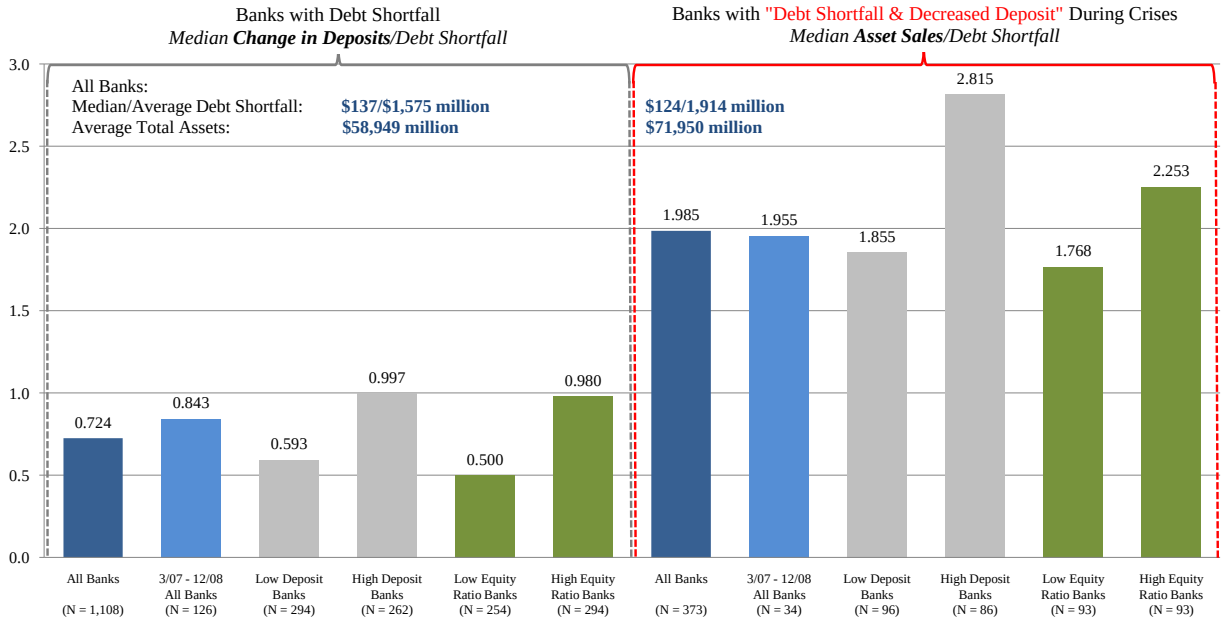
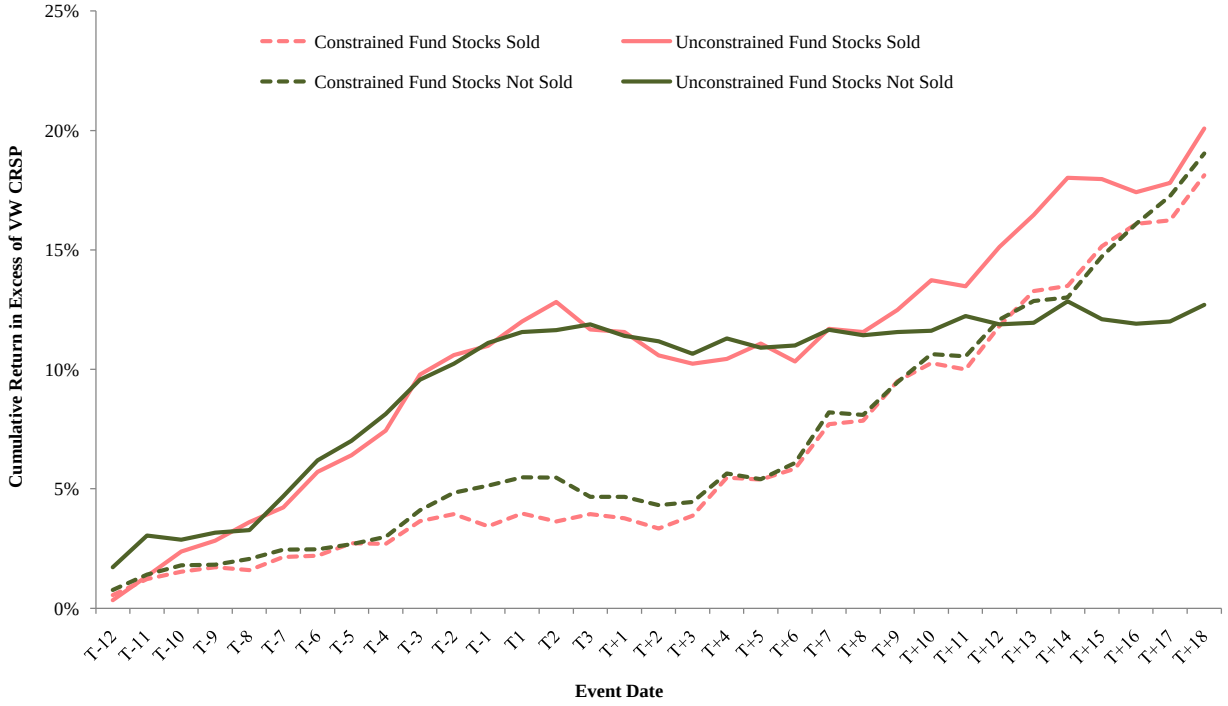



**Figure 4: Replacement of Debt Shortfall for Subsamples of Commercial Banks During Crises**



## Figure 5: Cumulative Abnormal Return of Stocks Sold and Not Sold by Unconstrained and Constrained Funds During all Crises




## Figure 6: Cumulative Abnormal Return of Stocks Sold and Not Sold by Unconstrained and Constrained Funds During the 2007-2008 Crisis

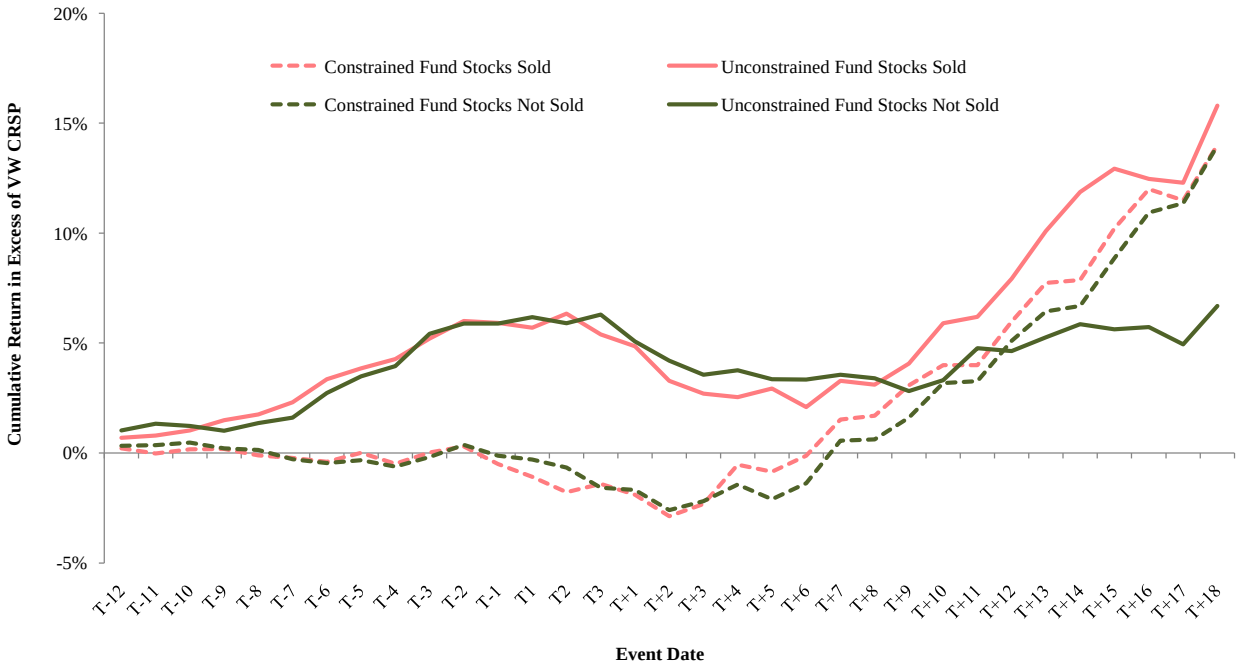


**Table 1**

This table reports the periods of Booms and Crisis as determined by in-sample distribution of the following indicators: NBER recessions and expansions; bank failures (normalized by the contemporaneous number of banks); TED spread; Moody's AAA-Baa credit spreads; flight to quality indicator (Collin-Dufresne, Goldstein, and Helwege (2003)); the Long Term Capital Management ("LTCM") episode; stock market declines and increases; and credit crunch periods (Bordo and Haubrich (2009)).

| Periods | Dates | Notes |
|---|---|---|
| Crisis | 1/1980 - 11/1982 | - NBER contraction (1/1980 - 6/1981)<br>- High TED and credit spreads<br>- Flight to quality in late 1982<br>- Credit crunch early 1980<br>- Low stock market returns in 1980 and 1981 |
| | 12/1988 - 12/1992 | - NBER contraction (7/1990 - 3/1991)<br>- High bank failures (S&L crisis)<br>- Periods of high TED spread<br>- Flight to quality<br>- Credit crunch<br>- Low stock market returns |
| | 8/1998 - 1/1999 | - High TED spread<br>- Flight to quality<br>- LTCM episode<br>- Low stock market returns |
| | 3/2001 - 11/2001 | - NBER contraction (3/2001 - 11/2001)<br>- Flight to quality<br>- Low stock market returns |
| | 3/2007 - 12/2008 | - NBER contraction (12/2007 - Present)<br>- High bank failures<br>- High TED and credit spreads<br>- Flight to quality<br>- Credit crunch<br>- Low stock market returns |
| Boom | 11/1993 - 10/1997 | - NBER expansion<br>- Low bank failures<br>- Low TED and credit spreads<br>- High stock market returns |
| | 6/1999 - 5/2000 | - NBER expansion<br>- High stock market returns |
| | 1/2003 - 2/2004 | - NBER expansion<br>- Low credit spreads<br>- High stock market returns |

**Table 2 - Sample Characteristics: Commercial Banks, Investment Banks, and Hedge Funds**

For large commercial banks and investment banks quarterly accounting data are obtained from Compustat and are scaled by contemporaneous total assets. Loans are loans net of allowance for total loan losses. Failed banks are excluded from the sample after the date of their failure per FDIC website. Quarterly Fund Flow is the average quarterly hedge fund flow, scaled by beginning of quarter assets under management. Quarterly Return of hedge funds is reported in excess of the risk-free rate. Flow, Return, Asset Under Management, Fund Age, Lockup Period, and Redemption Frequency data are from Lipper TASS. Stock characteristic data is from CRSP and Compustat. Prior Year Annual Excess Return is the return for the prior year, net of the risk-free rate. In Panel C, Total Assets and Tobin's Q are calculated using data from the most recent annual report in Compustat. Market Capitalization, Bid/Ask Spread, and Daily Trading Dollar Volume (in millions) are calculated as of the previous quarter, using daily (end-of-day) data. The Amihud Illiquidity Measure is the ratio of the absolute daily return to the dollar trading volume on that day. There are 10,828; 833; 4,948; and 199,273 commercial bank-quarter, investment bank-quarter, hedge fund family-quarter, and stock-quarter observations, respectively.

| ***Panel A: Commercial Banks*** | Ave | Q1 | Median | Q3 |
|---|---|---|---|---|
| Total Assets | 66,250 | 6,524 | 15,181 | 41,056 |
| Cash and Securities | 0.27 | 0.20 | 0.26 | 0.33 |
| Loans | 0.59 | 0.53 | 0.61 | 0.67 |
| Deposits | 0.70 | 0.64 | 0.71 | 0.79 |
| Short-Term Debt | 0.10 | 0.05 | 0.09 | 0.15 |
| Equity | 0.07 | 0.06 | 0.07 | 0.08 |
| ***Panel B: Investment Banks*** | Ave | Q1 | Median | Q3 |
| Total Assets | 369,395 | 59,084 | 191,894 | 455,587 |
| Cash and S-T Investments | 0.18 | 0.05 | 0.18 | 0.27 |
| Finc'l Instruments Owned | 0.28 | 0.19 | 0.29 | 0.38 |
| Trading Related Assets | 0.40 | 0.30 | 0.40 | 0.49 |
| Short-Term Debt | 0.42 | 0.19 | 0.44 | 0.65 |
| Equity | 0.05 | 0.03 | 0.04 | 0.06 |
| ***Panel C: Hedge Funds*** | Ave | Q1 | Median | Q3 |
| ***Fund Family Characteristics - Family Level*** | | | | |
| Assets Under Management (AUM) | 498 | 55 | 183 | 453 |
| Fund Age in Years | 6.46 | 3.89 | 6.15 | 8.75 |
| Lockup Period in Months | 5 | 0 | 0 | 6 |
| Redemption Frequency in Days | 114 | 60 | 90 | 109 |
| Quarterly Fund Flow as % of AUM | -0.07 | -0.11 | -0.04 | -0.01 |
| Quarterly Return | 0.04 | 0.00 | 0.02 | 0.06 |
| Number of Stocks per Filing | 116 | 32 | 68 | 127 |
| ***Stocks Owned Characteristics - Stock Level*** | | | | |
| Prior Year Annual Excess Return | 0.16 | -0.21 | 0.05 | 0.33 |
| Total Assets | 5,569 | 139 | 652 | 2,754 |
| Tobin's Q | 3.15 | 1.16 | 1.84 | 3.49 |
| Market Capitalization, Prior Quarter | 11,792 | 540 | 1,764 | 6,993 |
| Amihud Illiquidity Measure x $10^6$ | 0.113 | 0.070 | 0.107 | 0.136 |
| Bid/Ask Spread: (Bid-Ask)/Bid | 0.012 | 0.003 | 0.006 | 0.018 |

**Table 3 - Funding of Large Commercial Banks**

Means of commercial bank characteristics are reported. Low/High Deposit Banks are determined for each quarter as the bottom/top quartile of large commercial banks based on lag(Deposits scaled by Total Assets). Banks with Low/High Equity Ratio are determined in the quarter immediately preceeding a crisis at the bottom/top quartile of large commercial banks based on Equity scaled by Total Assets. All variables are scaled by total assets as reported at the end of prior quarter. Net Debt Issuance(t), if not available on Compustat, equals change in debt (short-term and long-term) in current quarter. Net Long-Term Debt Issuance(t), if not available on Compustat, equals the change in long-term debt as reported in the current quarter. Change in Deposits(t), if not avalable on Compustat, equals the change in net deposits from end of prior quarter. Any observation for which the estimated net issuance or change is below/above 1st/99th percentile is excluded from the sample. Failed banks are excluded from the sample after the date of their failure per FDIC website. Any observation that involves a bank acquiring another bank during the relevant fiscal quarter is eliminated from the analysis. Statistical significance at the 1%, 5%, and 10% level for two-tailed t-test is indicated with ***, **, and *, respectively.

| | | All | Low Deposits Banks | High Deposits Banks | Low Equity Ratio Banks | High Equity Ratio Banks |
|---|---|---|---|---|---|---|
| Net Debt Issuance | Crisis | 0.45% | 0.18% | 0.58% | 0.22% | 0.47% |
| | Boom | 0.96% | 1.02% | 0.88% | 1.34% | 0.88% |
| | *Diff.* | *-0.50%*** | *-0.84%*** | *-0.30%** | *-1.12%*** | *-0.41%** |
| Net Debt Issuance < 0 | Crisis | 43.11% | 49.03% | 39.91% | 48.41% | 42.36% |
| | Boom | 36.32% | 36.20% | 33.71% | 35.75% | 31.91% |
| | *Diff.* | *6.79%*** | *12.83%*** | *6.20%** | *12.66%*** | *10.45%*** |
| Net L-T Debt Issuance | Crisis | 0.19% | 0.21% | 0.22% | 0.12% | 0.20% |
| | Boom | 0.56% | 0.73% | 0.43% | 0.86% | 0.47% |
| | Diff. | -0.38%*** | -0.52%** | -0.21%* | -0.74%*** | -0.27%* |
| Change in Deposits | Crisis | 1.69% | 1.79% | 1.71% | 1.02% | 2.00% |
| | Boom | 1.97% | 2.18% | 1.17% | 1.98% | 1.75% |
| | *Diff.* | *-0.28%* | *-0.39%* | *0.54%* | *-0.96%** | *0.24%* |

**Table 4 - Asset Changes, Net Equity Issuance, Cash Dividends Paid, and Divestitures by Large Commercial Banks**

Means of commercial bank characteristics are reported. Low/High Deposit Banks are determined for each quarter as the bottom/top quartile of large commercial banks based on lag(Deposits scaled by Total Assets). Banks with Low/High Equity Ratio are determined in the quarter immediately preceeding a crisis at the bottom/top quartile of large commercial banks based on Equity scaled by Total Assets. Change in Assets (Loans) is the percentage change in total assets (loans) from prior quarter scaled by lagged total assets. Net Charge-Offs, Loan Loss Reserves, and Cash Dividend are as reported for the current quarter in Compustat and are scaled by total assets as of the end of the prior quarter. Investment Securities Gain/Loss is as reported for the current quarter in Compustat and is scaled by common equity as of the end of prior quarter. Net Equity Issuance is calculated as sale minus purchase of common and preferred stock. If data on sale and purchase of stock is not available, the Net Equity Issuance is estimated as the change in shareholder equity less the change in retained earnings. Any observation for which the estimated net equity issuance is in excess of the 1st/99th percentile is excluded from the sample. Divestiture is an indicator variable equal to one if the bank divested a subsidiary during a current quarter and zero otherwise (data from SDC). Failed banks are excluded from the sample after the date of their failure per FDIC website. For analysis of accounting-based information, any observation that involves a bank acquiring another bank during the relevant fiscal quarter is eliminated from the analysis. Statistical significance at the 1%, 5%, and 10% level for two-tailed t-test is indicated with ***, **, and *, respectively.

| | | All Banks | Low Deposits Banks | High Deposits Banks | Low Equity Ratio Banks | High Equity Ratio Banks |
|---|---|---|---|---|---|---|
| Change in Assets | Crisis | 2.63% | 2.70% | 2.66% | 1.78% | 3.04% |
| | Boom | 3.51% | 3.83% | 2.35% | 3.75% | 3.14% |
| | *Diff.* | *-0.87%*** | *-1.13%** | *0.31%* | *-1.98%*** | *-0.10%* |
| Change in Loans | Crisis | 1.27% | 1.20% | 1.25% | 0.82% | 1.31% |
| | Boom | 2.25% | 2.12% | 1.98% | 2.22% | 2.05% |
| | *Diff.* | *-0.99%*** | *-0.92%*** | *-0.72%** | *-1.41%*** | *-0.74%** |
| Net Charge-Offs | Crisis | 0.13% | 0.15% | 0.13% | 0.15% | 0.13% |
| | Boom | 0.09% | 0.11% | 0.07% | 0.10% | 0.11% |
| | *Diff.* | *0.05%*** | *0.04%** | *0.06%*** | *0.05%*** | *0.02%* |
| Inv. Securities Gain, Loss | Crisis | 0.04% | 0.02% | 0.08% | -0.04% | 0.02% |
| | Boom | 0.09% | 0.15% | 0.06% | 0.19% | 0.05% |
| | *Diff.* | *-0.06%** | *-0.13%* | *0.02%* | *-0.23%** | *-0.02%* |
| Net Equity Issuance | Crisis | 0.13% | 0.12% | 0.18% | 0.12% | 0.15% |
| | Boom | 0.06% | 0.07% | 0.09% | 0.12% | 0.04% |
| | *Diff.* | *0.07%*** | *0.05%* | *0.09%* | *0.00%* | *0.10%** |
| Cash Dividend | Crisis | 0.08% | 0.06% | 0.09% | 0.05% | 0.11% |
| | Boom | 0.10% | 0.08% | 0.11% | 0.05% | 0.12% |
| | *Diff.* | *-0.02%*** | *-0.01%*** | *-0.02%*** | *0.00%* | *-0.01%** |
| Divestiture | Crisis | 3.31% | 3.75% | 3.04% | 3.49% | 2.44% |
| | Boom | 8.11% | 8.40% | 5.09% | 7.96% | 4.67% |
| | *Diff.* | *-4.81%*** | *-4.65%*** | *-2.06%** | *-4.47%*** | *-2.22%** |

**Table 5 - OLS Regression Analysis of Quarterly Net Debt Issuance, Change in Equity Ratio, and Change in Total Assets by Large Commercial Banks**

The sample includes all investment banks with available data in crisis and boom periods only (Panel A) and crisis periods only (Panel B) as defined in Table 1. Banks with Low/High Deposits(t-1) is an indicator variable equal to one if the bank fell in the lowest/highest quartile of in-sample distribution of total deposits to total assets ratio during the prior quarter and to 0 otherwise. High Inv. Securities(t-1) is an indicator variable equal to 1 if the bank fell in the highest quartile of in-sample distribution of investment securities to total assets ratio during the prior quarter and to 0 otherwise. Divestiture Occuring w/in 90 Days of Acquisition is an indicator variable equal to one if a divestiture occured within 90 calendar days of the day of the most recent acquisition. Net Debt Issuance < 0 equals to Net Debt Issuance if Net Debt Issuance is negative and to zero otherwise. Net Debt Issuance > 0 equals to Net Debt Issuance if Net Debt Issuance is not negative and to zero otherwise. All other variables are defined in prior tables. Any observation for which the estimated net equity issuance is in excess of the 1st/99th percentile is excluded from the sample. Accounting variables are scaled by total assets as of the end of prior quarter and percentages are used for all continuous variables (i.e., 10%=10). Failed banks are excluded from the sample after the date of their failure. Heteroskedasticity-consistent standard errors are used. ***, **, and * denotes statistical significance at 1%, 5%, and 10%.

| **Panel A: Crises and Booms** | Net Debt Issuance | | Change in Equity Ratio | | % Change in Total Assets | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Intercept | 0.85 *** | 0.13 | -0.01 | 0.03 * | 3.74 *** | -1.38 *** |
| Crisis (t) | -0.18 | 0.18 | 0.01 | 0.07 *** | -0.36 | -0.12 |
| Banks with Low Equity Ratio (pre-crisis) | -0.37 * | -0.13 | | | -1.56 *** | -0.27 * |
| Banks with High Equity Ratio (pre-crisis) | -0.12 | -0.25 ** | | | 0.43 | 0.25 * |
| Net Charge-Offs | | 0.75 | | 0.22 ** | | -0.50 |
| Number of Acquisitions in Current Quarter | | | | | | 0.05 |
| Divestiture | | | | | | -0.01 |
| Divestiture Occuring w/in 90 Days of Acq. | | | | | | -0.27 |
| log(prior quarter Total Assets) | | | | | | 0.16 *** |
| ***Liabilities & Equity:*** | | | | | | |
| Banks with Low Deposits(t-1) Indicator | 0.02 | 0.29 | 0.03 | 0.02 | -0.81 | -0.04 |
| Banks with High Deposits(t-1) Indicator | 0.04 | -0.08 | 0.04 | 0.00 | -0.87 * | -0.02 |
| Change in Deposits | | -0.42 *** | | -0.06 *** | | 0.93 *** |
| Net Debt Issuance | | | | -0.06 *** | | |
| Net Debt Issuance $\geq$ 0 | | | | | | 0.87 *** |
| Net Debt Issuance < 0 | | | | | | 0.81 *** |
| Net Equity Issuance | | -0.24 | | 0.45 *** | | 0.96 *** |
| Change in Dividend | | | | 0.24 ** | | |
| ***Assets:*** | | | | | | |
| Change in Loans | | 0.55 *** | | 0.05 *** | | 0.17 *** |
| Change in Inv. Securities | | 0.55 *** | | -0.01 | | 0.12 ** |
| High Inv. Securities (t-1) Indicator | | -0.01 | | | | |
| Inv. Securities Gain, Loss | | 1.62 | | 0.03 | | 4.25 *** |
| Extraord and Discont. Items | | 15.27 | | 1.32 * | | 1.77 |
| ***Crisis (t) x :*** | | | | | | |
| Net Charge-Offs | | -1.45 | | -0.72 *** | | 0.58 |
| Banks with Low Deposits(t-1) Indicator | -0.28 | -0.40 | -0.04 | -0.04 | 0.60 | 0.12 |
| Banks with High Deposits(t-1) Indicator | -0.04 | 0.03 | -0.01 | 0.00 | 0.66 | -0.02 |
| Change in Deposits | | 0.31 *** | | 0.04 ** | | -0.39 *** |
| Net Debt Issuance | | | | 0.03 ** | | |
| Net Debt Issuance $\geq$ 0 | | | | | | -0.19 |
| Net Debt Issuance < 0 | | | | | | -0.27 |
| Net Equity Issuance | | -0.05 | | 0.08 | | -0.29 |
| Change in Dividend | | | | -0.56 ** | | |
| Change in Loans | | -0.36 *** | | -0.07 *** | | 0.53 *** |
| Change in Inv. Securities | | -0.01 | | 0.00 | | 0.33 *** |
| High Inv. Securities (t-1) Indicator | | 0.04 | | | | |
| Inv. Securities Gain, Loss | | -1.69 | | 0.93 ** | | -4.08 ** |
| Extraord and Discont. Items | | -14.44 | | -0.41 | | -2.10 |
| Adjusted R-squared | 0.004 | 0.361 | -0.001 | 0.503 | 0.002 | 0.943 |
| Observations | 4,288 | 4,288 | 4,264 | 4,264 | 4,288 | 4,288 |

**Table 5 - Continued**

| **Panel B: Crises Only** | Net Debt Issuance | | Change in Equity Ratio | | % Change in Total Assets | |
|---|---|---|---|---|---|---|
| | All | 3/07 - 12/08 | All | 3/07 - 12/08 | All | 3/07 - 12/08 |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Intercept | 0.31 *** | 0.93 *** | 0.10 *** | 0.03 | -1.60 ** | -6.35 ** |
| Banks with Low Equity Ratio (pre-crisis) | -0.13 | -0.31 | | | -0.27 * | 1.20 * |
| Banks with High Equity Ratio (pre-crisis) | -0.25 ** | -0.03 | | | 0.25 * | 1.02 ** |
| Net Charge-Offs | -0.70 ** | -1.66 | -0.49 *** | -1.23 ** | 0.05 | -0.98 |
| Number of Acquisitions in Current Quarter | | | | | 0.21 | 0.30 |
| Divestiture Indicator | | | | | 0.14 | -0.59 |
| Divestiture Occuring w/in 90 Days of Acq. | | | | | -0.21 | -0.26 |
| log(prior quarter Total Assets) | | | | | 0.17 ** | 0.48 ** |
| ***Liabilities & Equity:*** | | | | | | |
| Banks with Low Deposits(t-1) Indicator | -0.10 | -0.76 * | -0.03 | -0.11 | 0.08 | -0.53 |
| Banks with High Deposits(t-1) Indicator | -0.05 | 0.12 | 0.00 | 0.06 | -0.03 | -0.04 |
| Change in Deposits | -0.11 ** | -0.07 | -0.03 * | -0.10 *** | 0.54 *** | 0.70 *** |
| Net Debt Issuance | | | -0.03 ** | -0.03 | | |
| Net Debt Issuance $\geq$ 0 | | | | | 0.68 *** | 0.47 *** |
| Net Debt Issuance < 0 | | | | | 0.54 *** | 0.31 ** |
| Net Equity Issuance | -0.29 * | -0.36 | 0.53 *** | 0.58 *** | 0.67 *** | 1.01 *** |
| Change in Dividend | | | -0.32 | -0.30 | | |
| ***Assets:*** | | | | | | |
| Change in Loans | 0.18 ** | -0.11 ** | -0.02 | -0.06 ** | 0.70 *** | 1.32 *** |
| Change in Inv. Securities | 0.54 *** | 0.76 *** | -0.01 | 0.01 | 0.44 *** | 0.82 *** |
| High Inv. Securities (t-1) Indicator | 0.03 | 0.05 | | | | |
| Inv. Securities Gain, Loss | -0.07 | 0.30 | 0.96 *** | 1.18 ** | 0.14 | -1.08 |
| Extraord and Discont. Items | 0.82 | 2.52 | 0.91 *** | 1.16 *** | -0.34 | -4.02 * |
| Adjusted R-squared | 0.306 | 0.465 | 0.441 | 0.555 | 0.924 | 0.928 |
| Observations | 2,546 | 348 | 2,532 | 347 | 2,546 | 348 |

**Table 6 - Funding, Asset Changes, Net Equity Issuance, and Dividends Paid by Investment Banks**

Low/High S-T Debt is determined based relative to the in-sample median of short-term debt to total assets. Net Debt Issuance is calculated as change in short-term debt (based on balance sheet information) plus change in long-term debt (based on financing cash flows items and if not available, change in long-term debt based on balance sheet information. All variables are defined in prior tables. With the exception of Extraordinary Items which is scaled by prior quarter equity, all accounting variables are scaled by total assets as of the end of prior quarter. Divestiture is an indicator variable equal to one if the bank divested some of its subsidiaries and zero otherwise (data from SDC). For analysis of accounting-based information, any observation involving an acquisition during the relevant fiscal quarter is dropped from the calculation of average. ***, **, and * denotes statistical significance for two-tailed t-test at 1%, 5%, and 10%, respectively.

| | | All | Low S-T Debt | High S-T Debt |
|---|---|---|---|---|
| Net Debt Issuance | Crisis | 1.13% | 0.48% | 1.95% |
| | Boom | 2.31% | 1.85% | 2.76% |
| | *Diff.* | *-1.18%* | *-1.36%* | *-0.81%* |
| Net Debt Issuance < 0 | Crisis | 44.68% | 50.00% | 37.14% |
| | Boom | 29.76% | 28.57% | 29.13% |
| | *Diff.* | *14.92%*** | *21.43%*** | *8.02%* |
| Net L-T Debt Issuance | Crisis | 0.55% | 0.34% | 0.82% |
| | Boom | 0.75% | 0.94% | 0.74% |
| | *Diff.* | *-0.20%* | *-0.60%* | *0.08%* |
| Change in Assets | Crisis | 4.24% | 4.81% | 3.45% |
| | Boom | 4.59% | 4.63% | 4.77% |
| | *Diff.* | *-0.35%* | *0.18%* | *-1.32%* |
| Equity / Total Assets | Crisis | 6.85% | 9.43% | 3.70% |
| | Boom | 4.13% | 5.99% | 3.01% |
| | *Diff.* | *2.72%*** | *3.44%*** | *0.68%*** |
| Change in Finc'l Instr. Owned | Crisis | 0.17% | -0.69% | 1.44% |
| (N differs) | Boom | 1.33% | 0.57% | 1.72% |
| | *Diff.* | *-1.15%** | *-1.25%** | *-0.28%* |
| Change in Cash and S-T Inv. | Crisis | 0.77% | 0.07% | 1.42% |
| (N differs) | Boom | 0.91% | 0.25% | 1.13% |
| | *Diff.* | *-0.14%* | *-0.18%* | *0.28%* |
| Change in Trading Related Assets | Crisis | 1.31% | 2.31% | 0.21% |
| (N differs) | Boom | 1.88% | 2.46% | 1.84% |
| | *Diff.* | *-0.57%* | *-0.15%* | *-1.63%** |
| Net Equity Issued | Crisis | 0.04% | 0.09% | -0.01% |
| | Boom | -0.02% | 0.00% | -0.04% |
| | *Diff.* | *0.06%* | *0.08%* | *0.03%** |
| Dividends | Crisis | 0.05% | 0.06% | 0.028% |
| | Boom | 0.03% | 0.04% | 0.024% |
| | *Diff.* | *0.02%* | *0.02%* | *0.004%* |
| Extraordinary Items | Crisis | 0.00% | 0.01% | 0.00% |
| | Boom | -0.02% | 0.06% | -0.07% |
| | *Diff.* | *0.02%* | *-0.06%** | *0.07%* |
| Divestiture | Crisis | 7.38% | 9.70% | 4.72% |
| | Boom | 9.36% | 18.18% | 3.88% |
| | *Diff.* | *-1.98%* | *-8.48%* | *0.83%* |

**Table 7 - OLS Regression Analysis of Investment Banks**

The sample includes all investment banks with available data in crisis and boom periods only (Panel A) and crisis periods only (Panel B) as defined in Table 1. All variables are defined in prior tables; accounting variables are scaled by total assets as of end of the prior quarter. Percentages are used for all continuous variables (i.e., 10%=10). Heteroskedasticity-consistent standard errors are used. ***, **, and * denotes statistical significance at 1%, 5%, and 10%.

| **Panel A: Crises and Booms** | Net Debt Issuance | | Change in Equity Ratio | | % Change in Total Assets | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Intercept | 0.01 | -0.03 | 0.00 | 0.00 | 0.03 *** | 0.01 |
| Crisis (t) | -1.09 | 5.17 ** | 0.32 | 0.08 | -3.51 *** | 0.31 |
| Net Charge-Offs | | 16.41 | | -0.63 | | 2.80 |
| log(prior quarter Total Assets) | | | | | | 0.00 |
| Number of Acquisitions in Current Quarter | | | | | | -0.02 |
| Divestiture | | | | | | -0.01 |
| ***Liabilities & Equity Changes, Dividends:*** | | | | | | |
| Banks with High S-T Debt(t-1) Indicator | 1.78 | -0.45 | 0.01 | 0.03 | 1.59 | 0.50 |
| Net Debt Issuance | | | | 0.01 | | |
| Net Debt Issuance $\geq 0$ | | | | | | 0.30 ** |
| Net Debt Issuance $< 0$ | | | | | | -0.01 |
| Net Equity Issuance | | -2.18 | | 0.16 | | -0.96 |
| Change in Dividend | | | | 0.00 | | |
| ***Asset Changes:*** | | | | | | |
| Finc'l Instr. Owned(t-1) | | 0.08 | | 0.00 | | -0.03 |
| Change in Finc'l Instr. Owned | | 1.03 *** | | -0.03 *** | | 0.86 *** |
| Change in Trading Related Assets | | 0.52 *** | | -0.01 | | 0.79 *** |
| Extraord and Discont. Items | | -3.91 | | -0.38 | | 22.44 *** |
| ***Crisis (t) x :*** | | | | | | |
| Net Charge-Offs | | -23.90 * | | 0.34 | | -1.35 |
| Banks with High S-T Debt(t-1) Indicator | 0.71 | 1.04 | -0.32 | -0.14 | 1.84 | 0.72 |
| Net Debt Issuance | | | | -0.04 *** | | |
| Net Debt Issuance $\geq 0$ | | | | | | 0.40 * |
| Net Debt Issuance $< 0$ | | | | | | 0.96 *** |
| Net Equity Issuance | | 1.04 | | 0.31 | | 2.25 |
| Change in Dividend | | | | 0.67 | | |
| Finc'l Instr. Owned(t-1) | | -0.14 ** | | 0.01 | | -0.01 |
| Change in Finc'l Instr. Owned | | -0.02 | | -0.03 | | -0.32 * |
| Change in Trading Related Assets | | -0.32 | | 0.01 | | -0.54 *** |
| Extraord and Discont. Items | | 1.86 | | -10.12 *** | | -38.15 *** |
| Adjusted R-squared | 0.016 | 0.396 | 0.003 | 0.173 | 0.044 | 0.782 |
| Observations | 326 | 326 | 326 | 326 | 326 | 326 |

**Table 7 - Continued**

| **Panel B: Crises Only** | Net Debt Issuance | | Change in Equity Ratio | | % Change in Total Assets | |
|---|---|---|---|---|---|---|
| | All | 3/07 - 12/08 | All | 3/07 - 12/08 | All | 3/07 - 12/08 |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Intercept | 0.03 ** | 0.01 | 0.00 | 0.00 | 0.01 | 0.03 |
| Net Charge-Offs | -7.49 ** | -11.25 | -0.29 | -1.43 | 1.42 | 41.22 *** |
| log(prior quarter Total Assets) | | | | | 0.00 | 0.00 |
| Number of Acquisitions in Current Quarter | | | | | -0.02 | 0.02 |
| Divestiture | | | | | 0.00 | 0.01 |
| ***Liabilities & Equity Changes, Dividends:*** | | | | | | |
| Banks with High S-T Debt(t-1) Indicator | 0.60 | -0.58 | -0.12 | -0.17 | 1.23 | 2.63 ** |
| Net Debt Issuance | | | -0.04 ** | -0.08 | | |
| Net Debt Issuance $\geq$ 0 | | | | | 0.70 *** | -0.12 |
| Net Debt Issuance < 0 | | | | | 0.95 *** | 0.86 *** |
| Net Equity Issuance | -1.14 *** | -1.21 *** | 0.47 ** | 0.38 * | 1.28 *** | 1.02 *** |
| Change in Dividend | | | 0.68 | 0.86 | | |
| ***Asset Changes:*** | | | | | | |
| Finc'l Instr. Owned(t-1) | -0.06 * | -0.02 | 0.00 | 0.00 | -0.04 | 0.08 |
| Change in Finc'l Instr. Owned | 1.01 *** | 0.58 *** | -0.06 | -0.14 | 0.54 *** | 0.83 *** |
| Change in Trading Related Assets | 0.20 | 0.41 *** | 0.00 | 0.04 | 0.25 ** | 0.84 *** |
| Extraord and Discont. Items | -2.05 | 5.18 | -10.51 *** | -10.56 * | -17.78 | -47.44 *** |
| Adjusted R-squared | 0.451 | 0.434 | 0.182 | 0.162 | 0.779 | 0.745 |
| Observations | 198 | 74 | 198 | 74 | 198 | 74 |

**Table 8 - Hedge Fund Family and Stock Characteristics During Crises and Booms**

Means of variables of fund family characteristics and stock characteristics for the sample of hedge funds, by fund type (constrained or unconstrained) and period (crisis or boom) are reported. Constrained and unconstrained funds are defined in Section 3 and crisis and boom periods in Table 1. Fund Quarterly Flow is scaled by beginning of quarter assets, and fund quarterly return is net the risk-free rate. Prior Year Annual Excess Return is net of the risk free rate. Total Assets and Tobin's Q use most recent Compustat data. Market Capitalization and Bid/Ask Spread are as of the previous quarter, using daily data. Amihud Illiquidity Measure is the ratio of the absolute daily return to the dollar trading volume on that day. Decreases in existing positions are reported as a percent of a stock's total market capitalization sold and as an average transaction size. Statistical significance at the 1%, 5%, and 10% level for two-tailed t-test is indicated with ***, **, and *, respectively.

| | | All | Constrained Hedge Funds | Unconstrained Hedge Funds | Difference: Constrained - Unconstrained |
|---|---|---|---|---|---|
| ***Family Characteristics*** | | | | | |
| Fund Quarterly Flow < 0 | Crisis | 0.49 | | | |
| | Boom | 0.45 | | | |
| | *Diff* | *0.05**** | | | |
| Fund Quarterly Flow | Crisis | 0.00 | -0.14 | 0.10 | -0.24*** |
| | Boom | 0.04 | -0.10 | 0.13 | -0.23*** |
| | *Diff* | *-0.04**** | *-0.04**** | *-0.03* | |
| Fund Quarterly Return | Crisis | 0.00 | -0.02 | 0.02 | -0.04*** |
| | Boom | 0.05 | 0.04 | 0.06 | -0.02*** |
| | *Diff* | *-0.05**** | *-0.06**** | *-0.04*** | |
| ***Stock Characteristics (All Holds)*** | | | | | |
| Prior Year Annual Excess Return | Crisis | 0.00 | -0.01 | 0.03 | -0.04*** |
| | Boom | 0.11 | 0.11 | 0.32 | -0.21*** |
| | *Diff* | *-0.11**** | *-0.12**** | *-0.29**** | |
| Total Assets ($ million) | Crisis | 5,481 | 7,563 | 13,106 | -5,543*** |
| | Boom | 5,380 | 8,358 | 11,005 | -2,647*** |
| | *Diff* | *101* | *-795**** | *2,101**** | |
| Tobin's Q | Crisis | 2.94 | 2.83 | 3.17 | -0.34*** |
| | Boom | 3.69 | 3.92 | 4.39 | -0.47*** |
| | *Diff* | *-0.75**** | *-1.09**** | *-1.22**** | |
| Market Capitalization, Prior Qtr. ($ mil.) | Crisis | 12,617 | 10,912 | 16,206 | -5,294*** |
| | Boom | 10,050 | 9,848 | 13,774 | -3,926*** |
| | *Diff* | *2,567**** | *1,064**** | *2,432*** | |
| Amihud Illiquidity Measure * $10^6$ | Crisis | 0.146 | 0.074 | 0.051 | 0.023* |
| | Boom | 0.088 | 0.061 | 0.050 | 0.011*** |
| | *Diff* | *0.058**** | *0.013*** | *0.001** | |
| Bid/Ask Spread: (Bid-Ask)/Bid | Crisis | 0.013 | 0.010 | 0.006 | 0.004 |
| | Boom | 0.012 | 0.011 | 0.009 | 0.002 |
| | *Diff* | *0.001* | *-0.001* | *-0.003**** | |
| ***Characteristics of Stocks Sold*** | | | | | |
| Percent of Market Cap. Sold | Crisis | 0.30% | 0.41% | 0.29% | 0.12% |
| | Boom | 0.28% | 0.31% | 0.28% | 0.02% |
| | *Diff* | *0.01%* | *0.11%* | *0.01%* | |
| Transaction Size ($ million) | Crisis | 4.89 | 6.01 | 4.82 | 1.19*** |
| | Boom | 3.57 | 3.37 | 3.52 | -0.15 |
| | *Diff* | *1.32**** | *2.64**** | *1.30**** | |

**Table 9: Hedge Fund Sales and Purchases**

This table reports detail on the disposition of stocks by hedge funds each quarter, relative to their positions in the prior quarter. Each quarter, an individual stock's position maybe be unchanged, increased, or sold. The "sold" category includes both full and partial sales. Each quarter, the change in market value of each stock is measured relative to its prior position in the fund, and stocks are aggregated by firm by quarter. The Increase in Existing Holdings is the proportion of prior period market value of stocks in which hedge funds increased their holdings. Statistical significance at the 1%, 5%, and 10% level for two-tailed t-test is indicated with ***, **, and *, respectively.

| | | All Families | Constrained Hedge Funds | Unconstrained Hedge Funds | Difference: Constrained - Unconstrained |
|---|---|---|---|---|---|
| Proportion Unchanged | Crisis | 0.09 | 0.07 | 0.20 | -0.13*** |
| | Boom | 0.09 | 0.08 | 0.16 | -0.08** |
| | *Diff* | *-0.01* | *-0.01* | *0.04* | |
| Proportion Sold | Crisis | 0.45 | 0.51 | 0.29 | 0.22*** |
| | Boom | 0.44 | 0.46 | 0.35 | 0.11** |
| | *Diff* | *0.01* | *0.05*** | *-0.06* | |
| Proportion with Increases | Crisis | 0.25 | 0.20 | 0.29 | -0.09*** |
| | Boom | 0.24 | 0.23 | 0.27 | -0.04 |
| | *Diff* | *0.01* | *-0.03** | *0.02* | |
| Increase in Existing Holdings | Crisis | 0.15 | 0.16 | 0.14 | 0.02 |
| | Boom | 0.14 | 0.12 | 0.15 | -0.03 |
| | *Diff* | *0.01* | *0.04*** | *-0.01* | |

**Table 10: Regression Analysis of Hedge Fund Net Sales**

This table reports results of OLS regressions where the dependent variable is the net stock sales (Sold - Increases of Existing Positions). All indicator variables are multiplied by 100. Specifications 1 to 3 include both crisis and boom periods, and specifications 4 to 5 include only crisis periods. All standard errors are clustered at the fund and time levels. Statistical significance at the 1%, 5%, and 10% level is indicated with ***, **, and * respectively.

| | Crisis and Boom Periods | | | Crisis Periods: | |
|---|---|---|---|---|---|
| | | | | All | 3/2007 - 12/2008 |
| | **1** | **2** | **3** | **4** | **5** |
| Intercept | 0.66 *** | 0.65 *** | 0.66 *** | 0.69 *** | 0.75 *** |
| Constrained Fund Indicator | | 8.89 *** | 7.22 ** | 9.42 *** | 10.30 *** |
| Unconstrained Fund Indicator | | -8.33 *** | -4.31 | -9.99 *** | -8.80 *** |
| Crisis Indicator | -1.16 | -0.76 | -1.13 | | |
| Crisis Indicator x Constrained Fund Indicator | | | 2.41 | | |
| Crisis Indicator x Unconstrained Fund Indicator | | | -6.11 | | |
| Quarterly Fund Flow | -0.10 *** | 0.00 | 0.00 | -0.01 | -0.02 |
| Log of Fund Size | -0.02 *** | -0.03 *** | -0.02 *** | -0.03 *** | -0.03 *** |
| Quarterly Return | -0.19 *** | -0.14 ** | -0.14 * | -0.14 | -0.16 |
| Log Fund Age | 0.02 ** | 0.02 ** | 0.02 ** | 0.03 *** | 0.03 |
| Fund Incentive Fee | 0.05 | 0.10 | 0.11 | 0.07 | 0.05 |
| Fund Management Fee | 0.99 | 0.67 | 0.67 | -0.39 | -0.04 |
| Adjusted R-squared | 0.03 | 0.05 | 0.05 | 0.06 | 0.06 |
| Observations | 1,799 | 1,799 | 1,799 | 1,243 | 977 |

**Table 11 - Characteristics of Stocks Sold and Not Sold**

This table reports averages of stock characteristics that hedge funds sell as compared to stocks they do not sell ("Unchanged" + "Increased" from Table 10). Characteristics are measured in the period prior to sale. Statistical significance at the 1%, 5%, and 10% level for two-tailed t-test is indicated with ***, **, and *, respectively.

| | | Sold | | | Not Sold | | | Difference: | |
|---|---|---|---|---|---|---|---|---|---|
| | | Constrained | Unconstrained | Difference: Constrained - Unconstrained | Constrained | Unconstrained | Difference: Constrained - Unconstrained | Sold - Not Sold (Constrained) | Sold - Not Sold (Unconstrained) |
| Prior Year Annual Excess Return | Crisis | -0.01 | 0.05 | -0.06*** | 0.01 | 0.02 | -0.01 | -0.03*** | 0.02 |
| | Boom | 0.11 | 0.39 | -0.28*** | 0.07 | 0.25 | -0.18*** | 0.03 | 0.14** |
| | *Diff* | *-0.12**** | *-0.34**** | | *-0.06**** | *-0.23**** | | | |
| Total Assets | Crisis | 8,541 | 11,847 | -3,305*** | 21,950 | 29,065 | -7,103** | -13,408*** | -17,219*** |
| | Boom | 8,230 | 10,740 | -2,510*** | 21,388 | 23,715 | -2,328 | -13,157*** | -12,975*** |
| | *Diff* | *311* | *1,107* | | *562* | *5,350* | | | |
| Tobin's Q | Crisis | 2.86 | 2.99 | -0.13 | 5.11 | 4.19 | 0.92 | -2.25*** | -1.20* |
| | Boom | 3.90 | 4.61 | -0.71*** | 4.00 | 5.04 | 1.04** | -0.10 | -0.43 |
| | *Diff* | *-1.04**** | *-1.62**** | | *1.11* | *-0.85* | | | |
| Market Capitalization, Prior Qtr. | Crisis | 10,614 | 16,206 | -5,592*** | 11,435 | 18,621 | -7,186*** | -822*** | -2,415 |
| | Boom | 8,172 | 13,774 | -5,602*** | 13,223 | 14,413 | -1,190 | -5,051*** | -639 |
| | *Diff* | *2,442**** | *2,432*** | | *-1,788**** | *4,208*** | | | |
| Amihud Illiquidity Measure * $10^6$ | Crisis | 0.077 | 0.051 | 0.026* | 0.065 | 0.038 | 0.027 | 0.012 | 0.013 |
| | Boom | 0.053 | 0.048 | 0.005 | 0.072 | 0.068 | 0.004** | -0.019 | -0.020 |
| | *Diff* | *0.024*** | *0.003**** | | *-0.007* | *-0.030* | | | |
| Bid/Ask Spread: (Bid-Ask)/Bid | Crisis | 0.011 | 0.006 | 0.005 | 0.014 | 0.006 | 0.008 | -0.003 | 0.000 |
| | Boom | 0.010 | 0.009 | 0.001 | 0.013 | 0.010 | 0.003 | -0.002 | -0.001 |
| | *Diff* | *0.000* | *-0.003* | | *0.001* | *-0.004* | | | |