

Deciphering the Liquidity and Credit Crunch 2007-2008

Markus K. Brunnermeier

Presentation by Aaroosh Kohli and Nithya Sheshadri

Purpose

- “This paper attempts to explain the economic mechanisms that caused losses in the mortgage market to amplify into such large dislocations and turmoil in the financial markets, and describes common economic threads that explain the plethora of market declines, liquidity dry-ups, defaults and bailouts that occurred after the crisis broke in summer 2007.”

Key Factors Leading up to the Housing Bubble

- Low Interest Rate
- Asian countries bought U.S. Securities
 - Peg the exchange rates at an export-friendly level
 - Hedge against a depreciation of their own currencies against the dollar
- Fed Reserve Bank did not counteract the buildup of the housing bubble because they feared a deflationary period after the bursting of the Internet bubble
- The traditional banking model was replaced with the “originate and distribute” banking model

Banking Industry trends leading up to the Liquidity Squeeze

- Securitization: Credit Protection, Pooling, and Tranching Risk
- Shortening the Maturity Structure to Tap into Demand from Money Market Funds
- Rise in Popularity of Securitized and Structured Products

Securitization: Credit Protection, Pooling, and Tranching Risk

- Collateralized debt obligations (CDOs)- structured products banks create to offload risk
- The first step is to form diversified portfolios of mortgages and other types of loans, corporate bonds, and other assets like credit card receivables.
- The next step is to slice these portfolios into different tranches.
- These tranches are then sold to investor groups with different appetites for risk.

Securitization: Credit Protection, Pooling, and Tranching Risk

- The safest tranche— known as the “super senior tranche”— offers investors a (relatively) low interest rate, but it is the first to be paid out of the cash flows of the portfolio.
- In contrast, the most junior tranche—referred to as the “equity tranche” or “toxic waste”—will be paid only after all other tranches have been paid. The mezzanine tranches are between these extremes.
- Investors can purchase Credit default swaps (CDS) to insure against the default of a particular bond or tranche. The buyer of these contracts pays a periodic fixed fee in exchange for a contingent payment in the event of credit default.

Shortening the Maturity Structure to Tap into Demand from Money Market Funds

- Leading up to the crisis, commercial and investment banks were heavily exposed to maturity mismatch both through granting liquidity backstops to their off-balance sheet vehicles and through their increased reliance on repo financing. Any reduction in funding liquidity could thus lead to significant stress for the financial system.
- Off-balance sheet investment vehicles: structured investment vehicles that raise funds by selling short-term asset-backed commercial paper with an average maturity of 90 days and medium-term notes with an average maturity of just over one year, primarily to money market funds

Liquidity Backstops

- The strategy of off-balance-sheet vehicles exposes the banks to funding liquidity risk: investors might suddenly stop buying asset-backed commercial paper, preventing these vehicles from rolling over their short-term debt.
- To ensure funding liquidity for the vehicle, the sponsoring bank grants a credit line to the vehicle, called a “liquidity backstop.”
- As a result, the banking system still bears the liquidity risk from holding long-term assets and making short-term loans even though it does not appear on the banks’ balance sheets.

Repos

- Investment banks also started financing their balance sheets with short-term repurchase agreements, or “repos”
- 2000-2007: The fraction of total investment bank assets financed by overnight repos roughly doubled. This greater reliance on overnight financing required investment banks to roll over a large part of their funding on a daily basis.
- Any reduction in funding liquidity could thus lead to significant stress for the financial system, as we witnessed starting in the summer of 2007.

Rise in Popularity of Securitized and Structured Products

- Through securitized and structured financial products, risk can be widely spread among many market participants.
 - Lower mortgage rates
 - Lower interest rates
 - allows certain institutional investors to hold assets (indirectly) that they were previously prevented from holding by regulatory requirements
- However, a large part of the credit risk never left the banking system

Regulatory and Ratings arbitrage

- The Basel I accord required that banks hold capital of at least 8% of the loans on their balance sheets
- Moving a pool of loans into off-balance-sheet vehicles, and then granting a credit line to that pool to ensure a AAA-rating, allowed banks to reduce the amount of capital they needed to hold to conform with Basel I regulations while the risk for the bank remained essentially unchanged.
- Basel II attempted to fix this but it didn't work.

Statistical Models of structured finance products

- The statistical models of many professional investors and credit rating agencies provided overly optimistic forecasts about structured finance products
 - models were based on historically low mortgage default and delinquency rates
 - past downturns in housing prices were primarily regional phenomena.
- structured products may have received more favorable ratings compared to corporate bonds because rating agencies collected higher fees for structured products

Consequences: Cheap Credit and the Housing Boom

- The rise in popularity of securitized products ultimately led to a flood of cheap credit, and lending standards fell.
- This combination of cheap credit and low lending standards resulted in the housing frenzy that laid the foundations for the crisis.
- By early 2007, many observers were concerned about the risk of a liquidity bubble.
- “When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to get up and dance. We’re still dancing.”

- Chuck Prince, 2007

The Unfolding of the Crisis: Event Logbook

- Feb 2007: The Subprime Mortgage Crisis
- July 2007: Asset-Back Commercial Paper
- Summer 2007: The LIBOR, Repo, and Federal Funds Markets
- Aug 2007: Central Banks Step Forward
- Oct 2007: Continuing Write-downs of Mortgage-related Securities

Subprime Mortgage Crisis

- First noted in Feb 2007, the increase in subprime mortgage defaults

Figure 1: Decline in Mortgage Credit Default Swap ABX Indices



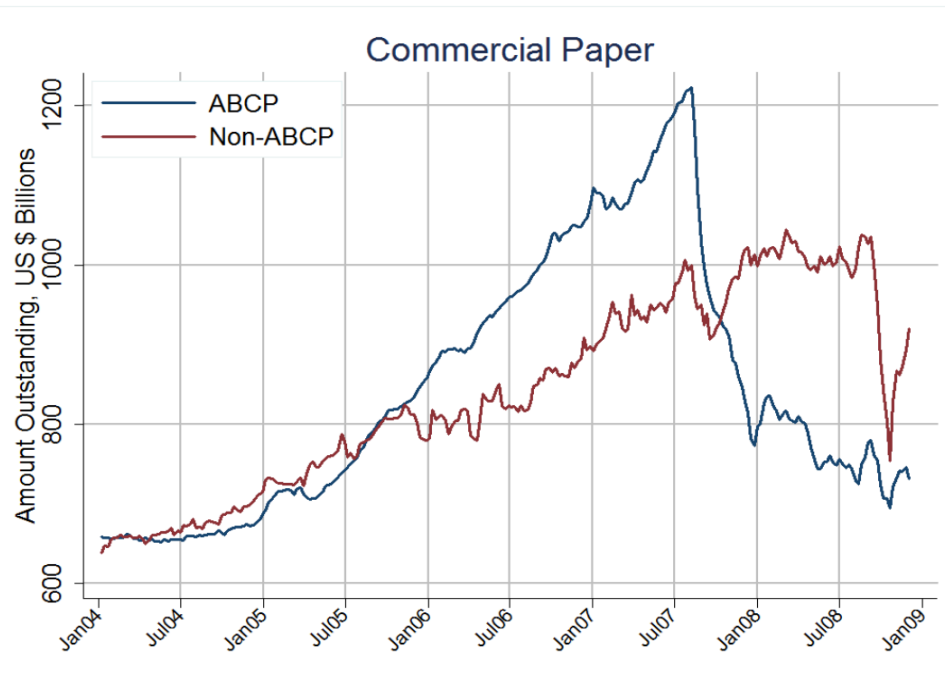
Subprime Mortgage Crisis

- As the price index decreases, the cost of insuring a basket of mortgages of a certain rating against default increases
- On May 4, 2007, UBS shut down its internal hedge fund, Dillon Read, after suffering about \$125 million of subprime-related losses. Later that month, Moody's put 62 tranches across 21 U.S. subprime deals on "downgrade review," indicating that it was likely these tranches would be downgraded in the near future. This review led to a deterioration of the prices of mortgage-related products.
- On July 26, 2007, an index from the National Association of Home Builders revealed that new home sales had declined 6.6 percent year-on-year, and the largest U.S. homebuilder reported a loss in that quarter. From then through late in 2008, house prices and sales continued to drop

Asset-backed commercial paper

July 2007: the market for short-term asset-backed commercial paper began to dry up

Figure 2: Outstanding asset-backed commercial paper and unsecured commercial paper.



Asset-backed commercial paper

- International: IKB, a small German bank, was the first European victim of the subprime crisis. In July 2007, its conduit was unable to roll over asset-backed commercial paper and IKB proved unable to provide the promised credit line. After hectic negotiations, a €3.5 billion rescue package involving public and private banks was announced. On July 31, American Home Mortgage Investment Corp. announced its inability to fund lending obligations, and it subsequently declared bankruptcy on August 6. On August 9, 2007, the French bank BNP Paribas froze redemptions for three investment funds, citing its inability to value structured products.
- Following this event, a variety of market signals showed that money market participants had become reluctant to lend to each other.

The LIBOR, Repo, and Federal Funds Markets

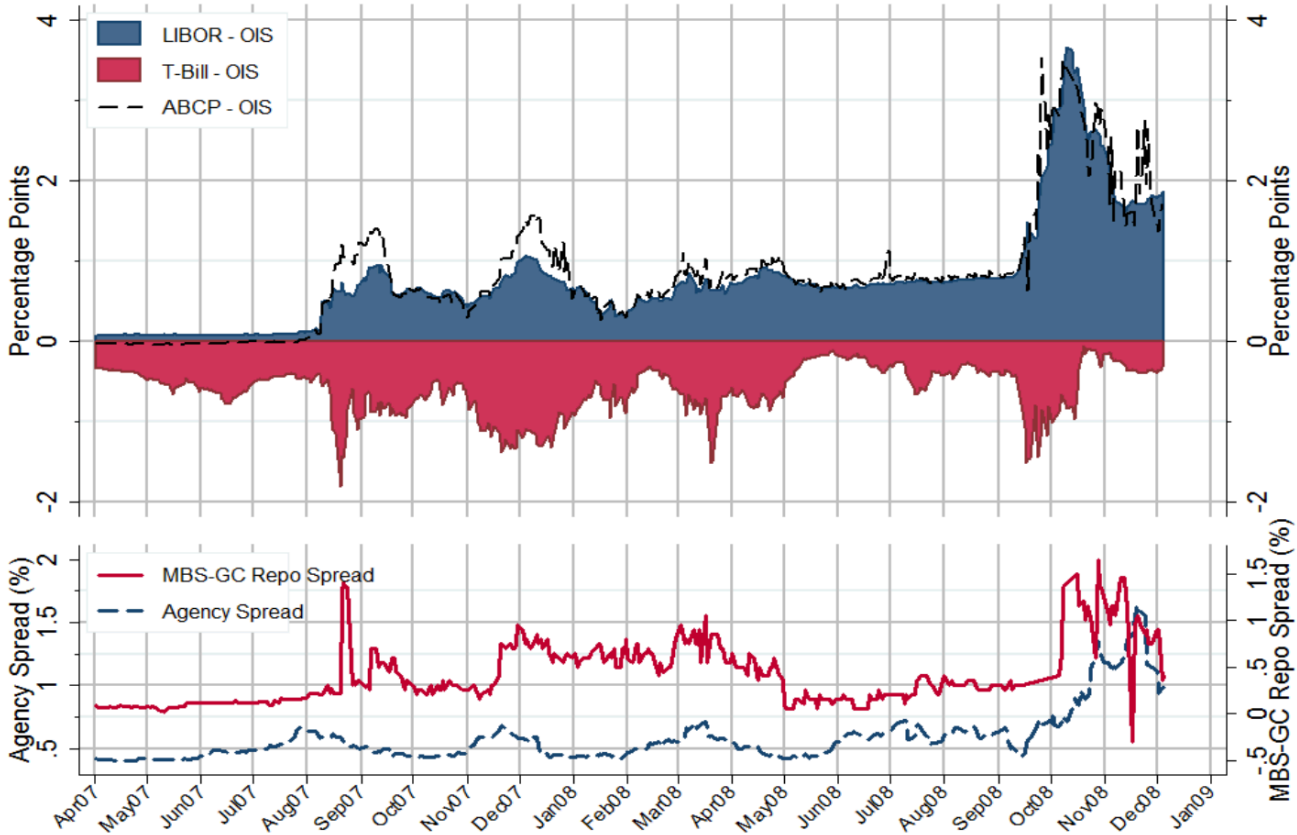
- Banks use the repo market, the federal funds market, and the interbank market to finance themselves
 - Repos allow market participants to obtain collateralized funding by selling their own or their clients' securities and agreement to repurchase them when the loan matures.
 - Federal funds rate: overnight interest rate at which banks lend reserves to each other to meet the central bank's reserve requirement.
 - LIBOR (London Interbank Offered Rate) market or interbank market: banks make unsecured, short-term (typically overnight to three-month) loans to each other. LIBOR is the average interest rate for those loans.

The LIBOR, Repo, and Federal Funds Markets

- TED spread shrank to historically low levels during the “liquidity bubble” and then surged upward in the summer of 2007.
- When there is uncertainty in the market, banks charge higher interest for unsecured loans, which increases the LIBOR rate. To get first-rate collateral, they hold more Treasury bonds, which pushes down the Treasury bond rate.
- TED spread widens in times of crisis (look at Figure 3)

Interest Rate Spreads

Figure 3: Interest Rate Spreads



Central Banks Step Forward

- Aug 9, 2007: First “illiquidity wave” on the interbank market, drove up LIBOR.
 - ECB injected €95 billion in overnight credit into the interbank market, US Fed injected \$24 billion.
 - Aug 17: Fed reduced the discount rate by half a percentage point to 5.75%, broadened the type of collateral that banks could post, and lengthened the lending horizon to 30 days.
 - Banks were reluctant to borrow at the Fed’s discount window because it could signal a lack of creditworthiness on the interbank market
 - September 18: Fed lowered the federal funds rate by half a percentage point to 4.75% and the discount rate to 5.25%

Continuing Write-downs of Mortgage-related Securities

- Nov 2007: It became clear that the total loss in the mortgage markets was greater than the estimated \$200 billion and banks were forced to take larger write-downs.
 - Dec 2007: Fed cuts the federal funds rate by .25%
- In Dec 2007, the Fed created the Term Auction Facility (TAF), which let commercial banks bid anonymously for 28-day loans against a broad set of collateral (including mortgage-backed securities)

The Monoline Insurers

- Monoline insurers focused completely on one product, insuring municipal bonds against default (in order to guarantee a AAA- rating)
- When losses in the mortgage market increased, the monoline insurers were on the verge of being downgraded by the rating agencies.
- This would have led to a rating downgrade across financial instruments with a face value of \$2.4 trillion and a huge sell-off of these assets by money market funds.
- Jan 2008: Fitch (rating agency) downgraded the monoline insurer, Ambac. Subsequently, share prices dropped worldwide
 - 15% drop in Asia, 5% drop in Europe, Dow Jones and Nasdaq futures were down 5-6%
 - As a result, Fed cut the federal funds rate by 0.75%, leading to a 3.5% interest rate

Bear Sterns

- Early March 2008:
 - Credit spreads between agency bonds and treasury bonds started to widen again
 - Fed announced \$200 billion Term Securities Lending Facility
 - As government was aiming to help an investment bank, everyone pointed to the smallest most leveraged one with large mortgage exposure, Bear Sterns
 - Also, a late email reply by Goldman Sachs executives may have also contributed to the run of Bear Sterns by its hedge-fund clients
 - Liquidity situation worsened because it was suddenly unable to secure funding on the repo market

JP Morgan-Bear Sterns Deal

- Bear Sterns was considered “too interconnected” to fail so a big party had to step up to minimize counterparty risk.
- Original deal was brokered at \$2 a share (\$236 million) but was eventually agreed for \$10 per share
- Fed cut the discount rate from 3.5 to 3.25% and for the first time opened the window to investment banks

Fannie Mae and Freddie Mac

- Publicly traded, but government chartered institutions that securitized a large fraction of U.S. mortgages and held about \$1.5 trillion in bonds outstanding
- Mortgage delinquency rates continued to increase
- By mid-July things began flaring up and the Fed decided to make their implicit guarantee explicit and was put under federal conservatorship on September 7th
- Created a “credit event” as large payments had to be paid to those who purchased credit default swaps

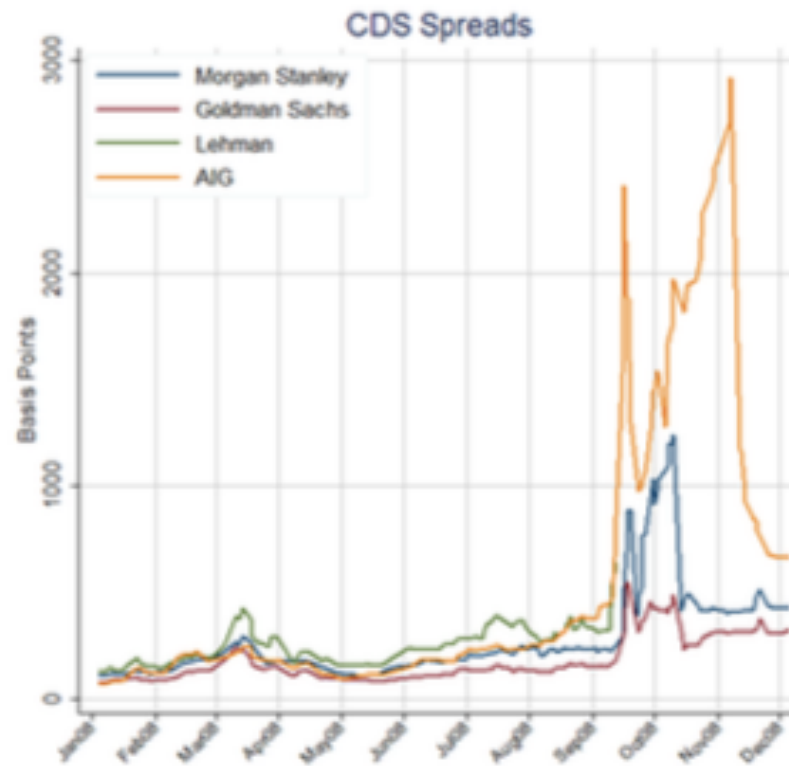
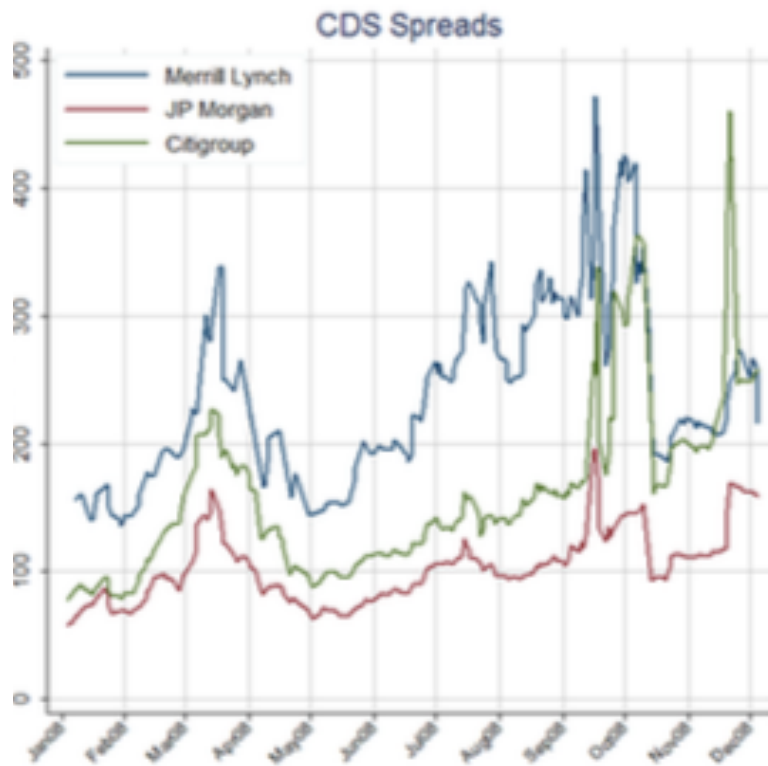
Lehman Brothers

- Lehman Brothers had survived fallout of March 2008
- Banks were unwilling to buy Lehman without a government guarantee and the government was unwilling to guarantee
- Forced to file bankruptcy in order to net various offsetting Lehman positions
- “The effects of Lehman’s bankruptcy would ripple throughout the global financial markets”

Effects of Lehman Brothers Bankruptcy

- Effects were difficult to predict because Lehman had counterparties across the globe
- Many money market funds suffered losses
- To avoid the broad repercussions of a run on money market funds, the U.S. Treasury set aside \$80 billion to guarantee brokers' money market funds
- The prices paid for credit default swaps that offer protection against defaults of the remaining banks soared, as each bank tried to protect itself against counterparty credit risk—that is, the risk that other banks would default

Credit Default Swap Spreads



Merrill Lynch and AIG

- Merrill Lynch had agreed to be bought by Bank of America for \$50 Billion
- AIG, who had been largely involved in credit derivatives including credit default swaps, were also extremely hard hit
- Bailed out for a cumulative \$162 Billion over 3 months in exchange for an 80% equity stake due to interconnectedness in the credit derivatives business

Stock Market Decline, Washington Mutual, Wachovia, and Citibank

- Washington Mutual experienced a “silent” bank run where rather than physically queuing, they withdrew their money electronically
- Washington Mutual sold to JP Morgan, Wachovia sold its banking operations to Wells Fargo after a bidding war with Citibank
- Stock market lost \$8 trillion dollars in a year after its peak in October 2007
- Wall Street Problems began to spill over to Main Street

Coordinated Bailout

- Fed had taken a piecemeal approach, but had to change to proactive, coordinated action across all solvent banks
- September 19 the Treasury Secretary proposed a \$700 Billion bailout plan called the Emergency Economic Stabilization Act of 2008
- Despite this Citibank needed additional support in November of 2008
- Several facilities were established that enabled the Fed to buy commercial paper and almost any type of asset-backed security and agency paper

Funding Liquidity

- Liquidity split in to funding liquidity and market liquidity
- Funding liquidity describes the ease with which expert investors and arbitrageurs can obtain funding from financiers
- Typically a leveraged trader, such as a dealer, hedge fund, or investment bank purchases an asset, he uses the purchased asset as collateral and borrows (short-term) against it

Funding Liquidity

- Financial institutions that rely substantially on short-term (commercial) paper or repo contracts have to roll over their debt
- An inability to roll over this debt (due to illiquid assets) is equivalent to margins increasing to 100 percent, because the firm becomes unable to use the asset as a basis for raising funds
- Withdrawals of demand deposits or capital redemptions from an investment fund have the same effect as an increase in margins

Market Liquidity

- Market liquidity is equivalent to the relative ease of finding somebody who takes on the other side of the trade (market liquidity is low when selling the asset depresses the sale price)
 - Bid-ask spread
 - Market Depth
 - Market Resiliency
- The mechanisms that explain why liquidity can suddenly evaporate operate through the interaction of market liquidity and funding liquidity

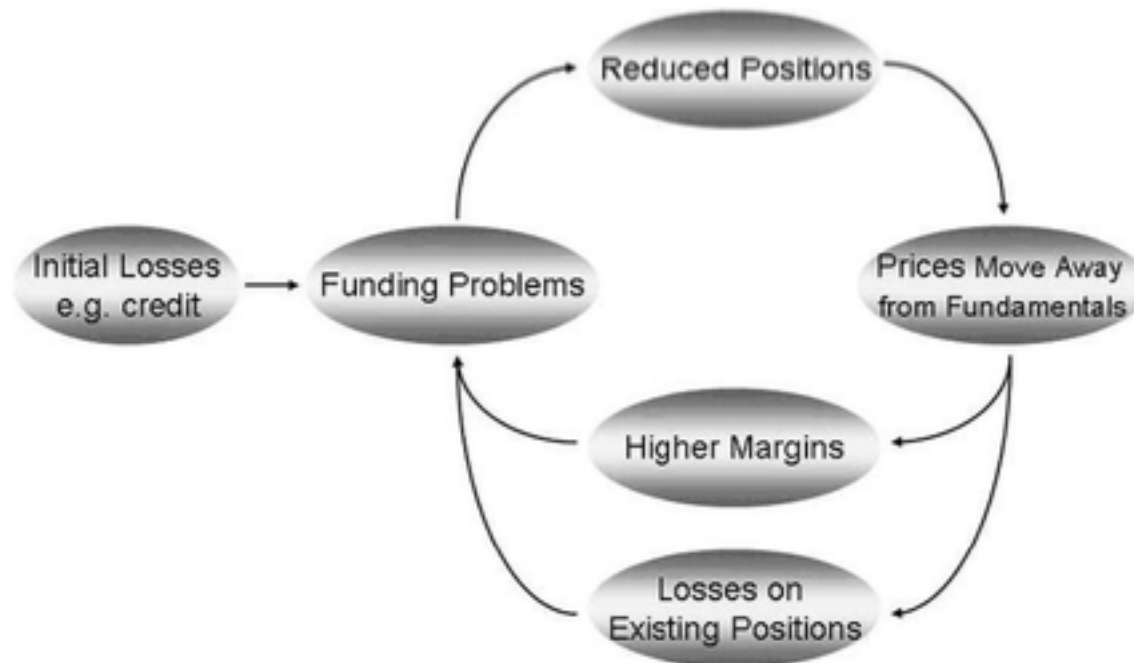
Borrower's Balance Sheet Effects: Loss Spiral and Margin Spiral

- A loss spiral is when in attempts to maintain leverage ratios, investors must sell assets. These assets must be valued lower and this will go in to the balance sheet and the cycle will continue as assets continue to be sold as reductions in investors net worth further reduces asset prices

Margin Spiral

- As margins rise, the investor has to sell even more because the investor needs to reduce its leverage ratio (which was held constant in the loss spiral)
- Margins spike in times of large price drops leading to a general tightening of lending

Loss and Margin Spirals



Lending Channel

- Two main mechanisms: moral hazard in monitoring and precautionary hoarding
 - Most lending is intermediated by banks, and for them to monitor most effectively they must high stakes of their own. This leads to moral hazard as the intermediaries' stake falls as a result of its own monitoring
 - Precautionary hoarding arises if lenders are afraid that they might suffer from interim shocks and that they will need funds for their own projects and trading strategies. Precautionary hoarding therefore increases when 1) the likelihood of interim shocks increases, and 2) outside funds are expected to be difficult to obtain

Runs on Financial Institutions

- Bank runs are almost obsolete due to deposit insurance, but runs still occur on other financial institutions
- Bear Sterns and AIG (“margin run”)
- First movers are advantaged in other institutions like hedge funds as they sell liquid assets first

Network Effects: Counterparty Credit Risk and Gridlock Risk

- Counterparty risk best categorized by Bear Sterns/ Goldman Sachs in March 2008
- Because parties only know of their contracts and cannot have a multilateral netting arrangement so there is a fear of counterparties defaulting
- Happened right after the Lehman Brothers bankruptcy also as all banks feared that other banks would default
- Can be combatted by a clearinghouses or another central authority or regulator who knows who owes what to whom



Conclusion

- An increase in mortgage delinquencies due to a nationwide decline in housing prices was the trigger for a full-blown liquidity crisis that emerged in 2007
- What is new about this crisis is the extent of securitization, which led to an opaque web of interconnected obligations