

The 2008 Financial Crisis: Institutional Facts, Data and Economic Research

Saki Bigio¹

Columbia GSB

October 17, 2014

The 2008-2009 Financial Crisis

- The 2008-2009 Financial Crisis was the biggest postwar era downturn

The 2008-2009 Financial Crisis

- The 2008-2009 Financial Crisis was the biggest postwar era downturn
- These are the main macroeconomic implications...

The 2008-2009 Financial Crisis

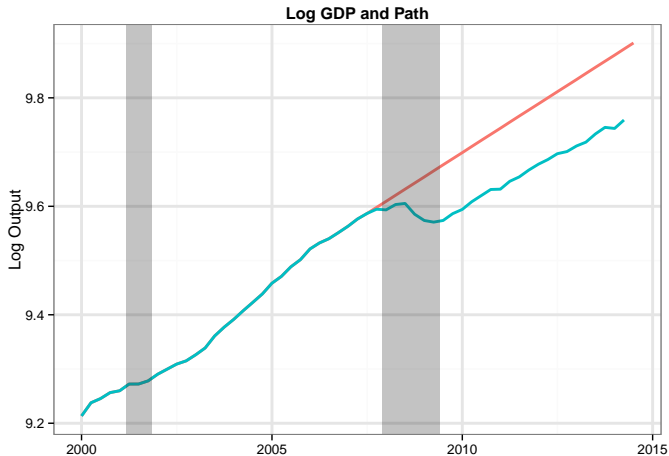


Figure: Log-GDP around crisis period.

The 2008-2009 Financial Crisis

Deviation from Historical Growth Rates

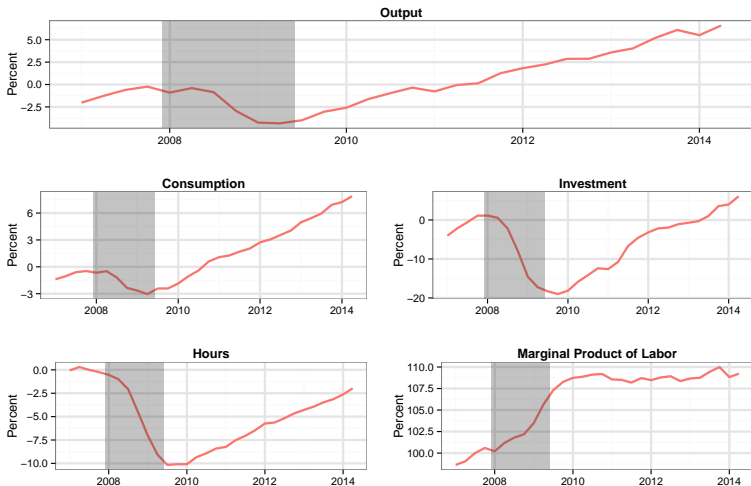


Figure: % Deviations from Pre-crisis level correcting for trend.

The 2008-2009 Financial Crisis

	Data 2007Q4-2009Q2
Output	-4.99%
Consumption	-3.86%
Investment	-42.2%
Hours	-9.52%
Wages	6.94%
MPL	↑

Table: Financial Crisis Data. Source: Data is obtained from the Federal Reserve Bank of St. Louis FRED system. Figures correspond to the percent change between the levels in the last quarter of 2007 and the levels the second quarter of 2009. Pre-crisis growth rates are subtracted.

The 2008-2009 Financial Crisis

- These presentation presents some facts, policy implications, institutional features and data
- Throughout the presentation we discuss some personal thoughts and relate them to the recent macro-finance literature

Leading up to the Crisis

The Rise in House Prices

- House prices rose steadily from the 1990s to 2006
- The appreciation in house prices exceeded 10% per year from early 2004 to early 2006
- The home-ownership rate rose to a record level of 68.6% of households by 2007
- It was not clear whether prices would be sustained

House Prices, 1994-2009

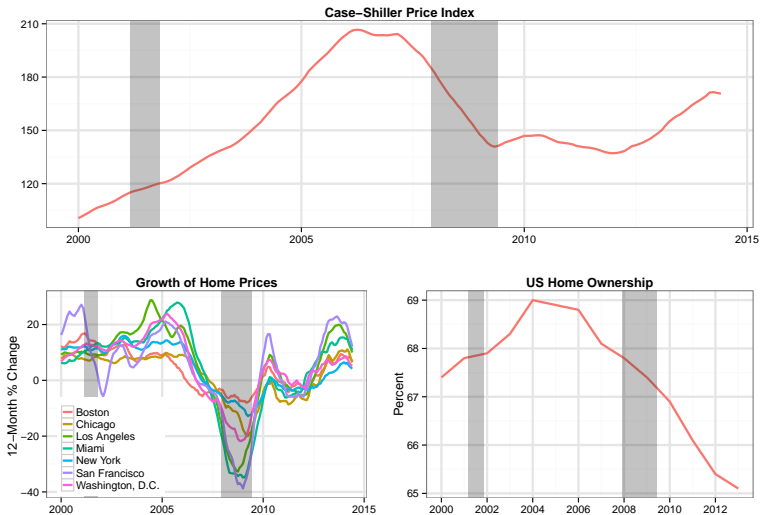


Figure: Home prices and ownership in the United States.

The Creation of Subprime Mortgages

- Traditional mortgages required substantial down payments; typically 20% of the house price needed to be put down to receive a mortgage for 80% of the price
 - the total value of the house was collateral for the mortgage and would exceed the loan, reducing the default risk
- But as house prices rose, leading mortgage lenders began to create subprime loans for people who wouldn't normally qualify to buy homes

The Creation of Subprime Mortgages

- Lenders reduced down payments and even offered mortgages with zero money down
- Subprime lenders also loosened rules about borrowers' incomes— often there was no documentation of income
- Most subprime loans had adjustable interest rates, with a low initial interest rate (often called "teaser rates") that would later rise in a process known as mortgage reset

The Creation of Subprime Mortgages

- As long as housing prices kept rising, both lenders and borrowers thought the subprime loans would work out
 - if a borrower was short on cash, he could take out a second mortgage because the higher value of his home gave him more collateral
 - a borrower could also always sell his house at a higher price to pay off the loans
- Indeed subprime lending was profitable in the late 1990s and early 2000s because default rates were moderate

The Rise of Securitization

- Traditionally when a bank made loans, these became part of the banks assets
- Over the last decades this changed
- Today, banks now “securitize” many of their loans

The Rise of Securitization

- Rather than holding loans as part of their assets, banks sell many of their loans to a large financial institution, called the securitizer
- The securitizer gathers a pool of loans and transforms the pool into securities that traded in financial markets
 - for example, a pool might be \$100 million worth of mortgage loans to people with certain credit scores
- The security entitles the owner to a share of the payments in the loan pool
- These securities are bought by financial institutions, including other commercial banks, investment banks, pension funds, insurance companies or mutual funds

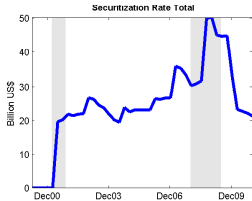
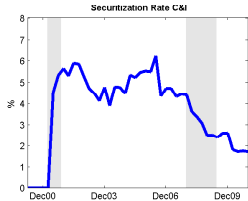
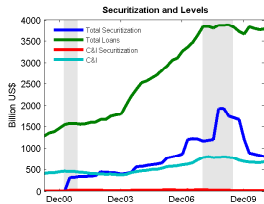
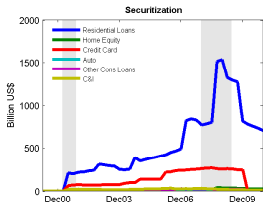
Securitization - Tranching

- Securitization is more than selling loans
- Pools of loans face agency problems in the effort to monitor or select loans
 - To resolve the agency problem the industry designed “tranching” mechanisms
- By tranching loan pools, the issuer of securities keeps residual risk
 - Pools of mortgages are divided into securities of different seniority
 - \Rightarrow a junior tranche pays-off only if the senior tranches are payed first
- Tranching allowed MBS issuers to raise capital from more risk averse agents (pension funds, money markets)

Securitization - Tranching and Tail Events

- Tranching makes valuations of assets particularly sensible to assumptions about correlations
- Simple thought experiment. Coin toss game
 - Pay 1 for heads, -0.5 for tails
- Think of a sequence N of trials
 - Player sells senior security offering $N*0.1$ in return if return is $> N*0.1$
 - Player is residual claimant
 - Structure changes risk structure of the security
- Ex-ante valuation for the issuer depends on correlation assumption and tranching
- For i.i.d, N large, there's low risk. Small changes in correlations can increase risk exposure
- Sensitivity also depends on the security design

Securitization



Fannie and Freddie

- Home mortgages were really the first market of loans to be securitized
- The two largest issuers of mortgage-backed securities (MBSs) were Fannie Mae and Freddie Mac
- Fannie Mae was created in 1938 as part of the New Deal, Freddie Mac was created in 1970
- Fannie and Freddie are government sponsored enterprises—private corporations with stocks that are traded on the NYSE but are linked to the government and were established by the government
- The purpose was to increase the supply of mortgage loans in a large scale and thereby help more people achieve homeownership

Fannie and Freddie

- Initially Fannie and Freddie held onto all the mortgages they bought with the funds they raised
- In the 1970s however they started issuing mortgage-backed securities which they sold to other financial institutions
 - the buyers of the securities became entitled to the interest and the principal that borrowers made on the underlying mortgage
- Over half of U.S. mortgage debt is securitized by Fannie and Freddie
- Initially they purchased only prime mortgages—borrowers with low default risk and high credit scores

Securitization and the Investment Banks

- Before the 1990s there was little securitization beyond the prime MBSs created by Fannie and Freddie
- In the early 2000s, the five largest investment banks, Goldman Sachs, Morgan Stanley, Merrill Lynch, Lehman Brothers, and Bear Stearns, also started issuing mortgage-backed securities (MBS)
- However, securities issued by the investment banks were subprime: they were loans to people with weak credit histories

Securitization and the Investment Banks

- To create these securities, the investment banks purchased home mortgage loans from the original lenders (originators) and bundles them together
- Sub-prime borrowers would eventually pay higher interest rates than traditional mortgage borrowers
- As a result, securities backed by subprime promised high returns to their owners as long as the borrowers made their mortgage payments
- Investment banks sold safe tranches of mortgages holding on to riskier tranches for themselves (tranching)

Fannie and Freddie

- As mentioned before, Fannie and Freddie initially purchased only prime mortgages—low default risk and high credit scores
- However, in the early 2000s they began to purchase subprime mortgages
- The securities they sold to other institutions were still backed entirely by prime mortgages
- Fannie and Freddie held onto the subprime mortgages they purchased

All together: Subprime, Securitization, and House Prices

- As investment banks saw profits in subprime, they began securitizing more subprime mortgages and held onto a larger share of these securities
- At the same time, they bore risk from junior tranches
- Securitization provided the means to diversify risk
- Securitization furthermore provided more funds for subprime loans
- Less risk and more volume led banks to require less collateral for subprime loans
- In turn, more subprime lending increased the demand for housing, leading to higher house prices

Foreseeing the crisis

- Few people saw the risks since few anticipated the sharp decline in housing prices at a nationwide level
- Alan Greenspan in 2005: “Overall, while local economies may experience significant speculative price imbalances, a national severe price distortion (i.e. a housing bubble) seems most unlikely in the United States, given its size and diversity”
- In fact, Greenspan was right from a historical perspective: there had been very low correlations in housing price movements in the past
- Lowest price growth correlation in a U.S. cities jumped from -60% to 17% and highest from 94% to 96%
- Based on these low correlations, risks were low, and the whole industry architecture made sense

Taking stock I

- A popular view (press and academia) is that the system of securitization was plagued by greedy bankers and real estate agents
- Indeed, a lot of dirt was found under the carpet. (What crisis doesn't raise carpets?)
- In my view, the heart of the problem was systematic mispricing
- The system of securitization grew based on low historical correlation assumptions. The problem is, the system itself, build correlation!
- Securitization, and subprime lending led to a correlation that would make the system vulnerable to small shocks

Taking stock II

- As argued before, securitization led ABS-issuers to bare residual risk
- These changes in the risk structure lead small shocks to become large losses for them
- Based on historical nationwide correlations, the probability of such losses was low
- Related to models with financial intermediaries, small shocks (Katrina for example) would affect the ABS issuers net-worth. These would lead them to cut-back from lending
- Constrained lending could move prices in many regions
- Reductions in home prices would trigger national defaults causing a spiral effect
- With higher correlations, no-one would want to bare risks
- Boz and Mendoza (2010), have a paper with a similar flavor
- Should we expect systematic mistakes of this magnitude in the near future?

The Housing Crash and the Financial Crisis

The Crash in House Prices

- House prices began to fall dramatically in 2006
- Homeowners now had mortgage payments they couldn't afford
 - With falling house prices, they couldn't borrow more and they couldn't sell their houses for enough to pay-off their mortgages
- As a result, delinquency rates on subprime mortgages rose together with foreclosures
- The effects of falling housing prices also spread to prime mortgages

Subprime Mortgages

Subprime graph goes here.

The Subprime Crisis

- Falling house prices led many subprime borrowers to default
- As defaults rose, the financial markets realized that securites backed by subprime mortgages would produce less income than previously expected
- This led many investors to simultaneously try to sell off MBSs, leading to a huge decline in their prices
- The crash in the prices of these securities caused large losses to the investment banks and other owners of the securities

The Subprime Crisis

- Institutions that had made subprime loans began to suffer large losses
 - New Century Financial and Ameriquest declared bankruptcy in 2007
- Other financial institutions that held securities backed by subprime mortgages suffered billions in losses
- However, no one thought this would lead to a major financial crisis:
 - by mid-2007, financial institutions were estimated to lose a total of \$150 billion, but this is not very much compared to total US GDP of \$14 trillion

The Liquidity Crisis and Interbank Markets

- As losses on subprime mortgages rose, banks became suspicious about the solvency of one another
- Due to these worries, banks began to reduce credit availability to each other, lenders became scarce
- On August 9-10, 2007, these fears showed up in the federal funds market, as the federal funds rate increased far above the Fed's target
- The Fed responded with open market operations—it purchased large amounts of government bonds, pushing cash into the system and reducing interest rates

The Run on Northern Rock

- In September 2007, Northern Rock Bank in the U.K. ran short of liquid assets
- It asked Bank of England for an emergency loan
- The Bank of England approved the loan, but the news caused depositors to lose confidence
- This produced the UK's first bank run in over a century: depositors rushed to withdraw funds (since only 90% of deposits were insured)
- The run lasted three days until the British govt intervened and announced it would guarantee all of Northern Rock's deposits

The Fed's Response

- The Fed responded to the freeze in interbank lending market by playing its role of lender of last resort
- It encouraged banks to request loans at the discount window if they needed cash (rather than buying bonds)
- It reduced the discount rate by half a percentage point
- But very few banks borrowed discount loans, due to fear that this action would signal weakness

The Term Auction Facility

- In response to the low level of discount window lending, the Fed made credit available through special lending facilities
- In December 2007, the Fed created the Term-Auction Facility (TAF)
- Under this program, the Fed lent to banks through closed-bid auctions
 - every two weeks it provided a predetermined level of loans (\$25-75 billion) to banks that submitted the highest interest rate bids
- Banks were more eager to bid in these auctions than to take out traditional discount loans
 - participation was not publicized as widely, so these loans had less of a stigma effect

Taking Stock - Signalling Weaknesses

- Repo-Rollover, CP
- Speculation and predatory pricing
- Runs by firms to demand committed loans

The Economy begins to fall in 2007

- As housing prices fell, wealth fell
- The reduction in wealth led to less consumption, in particular of durable goods
- Consumption and investment were also dampened by uncertainty about the economy
- One also sees inventories picking-up

Monetary Policy

- Fed cut its interest rate target sharply, reducing its target for the federal funds rate from 5.25 to 3.0
- Despite the expansionary policies pursued by the Fed, the economy contracted sharply in the second half of 2008 and early 2009

Bear

- Bear Stearns held large quantities of subprime mortgage-backed securities
- It suffered huge losses as the prices of these securities fell
- In March 2008 rumors spread that Bear might become insolvent
- Bear relied heavily on short-term borrowing to fund its asset holdings
- However, financial institutions stopped lending to Bear or buying its bonds once they feared that Bear would default on its obligations
- As funding disappeared, Bear ran out of money to pay off its existing loans and commercial paper

The Fed bails out Bear

- In March 2008 Bear's lawyers prepared to file for bankruptcy
- The first financial rescue during the crisis occurred on March 16 2008:
 - The Fed made a \$30 billion loan to JP Morgan Chase to purchase Bear
 - The loan was not collateralized by JP Morgan assets but by Bear Stearns assets
 - This led to many criticisms of the Fed (increased risk and moral hazard by saving Bear's creditors)

The Fed

- In March 2008, the Fed again reduced its target for the federal funds rate to 2.0
- It established the Primary Dealer Credit Facility (PDCF) which offered loans to primary dealers in the govt securities market—the institutions that trade with the Fed when it performs open-market operations
- primary dealers include the largest investment banks as well as commercial banks (thus investment banks also became eligible for emergency loans)
- In June 2008, Ben Bernanke: “The risk that the economy has entered a substantial downturn appears to have diminished over the last month or so”

Fannie and Freddie

- Because Fannie Mae and Freddie Mac had held onto the subprime mortgages, they suffered huge losses in 2007
- Mounting losses on these mortgage-backed securities threatened the solvency of Fannie and Freddie
- Default would have caused catastrophic losses to banks that held trillions of dollars of Fannie and Freddie bonds
- Bankruptcy would have also disrupted mortgage lending

Fannie and Freddie

- On Sept 7 2008, the government took Fannie and Freddie into conservatorship
 - Treasury promised to cover Fannie and Freddie's losses with public funds so they wouldn't default on bonds they had issued
 - Technically the companies remained private, but government regulators took control of their operations
- The government received stock that gave it 80 percent ownership in Fannie and Freddie
- Nonetheless, it was mostly a pure giveaway since it was clear that Fannie and Freddie were insolvent
- As of 2010, the Fannie and Freddie rescues had cost the government more than \$200 billion

Lehman Brothers

- Like Bear Stearns, Lehman Brothers had large losses on mortgage-backed securities
- Doubts about its survival led other institutions to cut off lending to Lehman
- The Federal Reserve sought to arrange a takeover by Barclay's, but the deal fell through at the last minute
- Lehman Brothers declared bankruptcy on Sept 15 2008

Lehman Brothers

- Lehman's failure completely shocked financial markets
- It was the largest U.S. firm in any industry ever to file for bankruptcy, and had been a pillar of financial system since 1850
- As Lehman defaulted on its borrowings from other financial institutions, these financial institutions suffered
- Furthermore, since few people knew exactly how much Lehman owed and to which institutions, fears arose that many institutions would suffer losses that threatened their solvency
- This led to widespread financial panic

Criticism over not bailing out Lehman

- Critics contend that policy makers could have done something and that they misjudged the harm of letting Lehman fail
- It's unclear whether the Fed or Treasury could still have saved Lehman
- Bernanke and Paulson said that they did not have the legal authority to provide funds to Lehman
- They may have also hesitated after the earlier negative reaction after bailing Bear

Credit Default Swaps and the AIG Fiasco

- A Credit default swap (CDS) is a derivative tied to debt securities, such as bonds, that promise certain future payments
- A CDS buyer pays premiums to the seller
- Payments on the CDS are triggered by defaults on the original security
- It is basically an insurance policy

Credit Default Swaps and the AIG Fiasco

- Many CDSs issued in the 2000s were tied to subprime MBSs
- The sellers of CDSs on MBSs promised to pay CDS buyers if the market prices of the underlying securities fell under a certain level
- When prices of MBSs fell in 2006-2008, this triggered payments on CDSs
- Firms had used them to hedge the risk of holding MBSs
- For example, in 2006 Goldman analysts started worrying that housing prices might fall, so it started buying CDSs to hedge against possible losses
- Other firms used it to speculate: John Paulson's hedge fund bet against MBSs by purchasing CDSs on securities they didn't own, and earned \$15 billion

Credit Default Swaps and the AIG Fiasco

- Who was selling CDSs? AIG
- American International Group (AIG) was a giant insurance conglomerate
 - it had issued large amounts of credit default swaps (CDS) on mortgage-backed securities
- AIGs swaps promised payments of hundreds of billions if prices of MBSs fell far enough
- They didn't anticipate the fall in housing prices and its effects on MBS prices..
- In 2006, an AIG report to government regulators said the likelihood of losses on CDSs was "remote, even in severe recessionary market scenarios"

Credit Default Swaps and the AIG Fiasco

- They turned out to be very wrong
- As MBS prices fell, AIG had to make larger and larger payments to holders of its CDSs, and hence suffered large losses
- If AIG went bankrupt, it would have defaulted on all of the promised payments on the credit default swaps it had sold on mortgage-backed securities
- Institutions would not have been compensated for losses on these securities
- Also, individuals and businesses that had purchased insurance policies from AIG would have lost their insurance
- Furthermore, AIG would have defaulted on the \$20 billion of commercial paper it had issued

The AIG Bailout

- The Fed made an emergency loan of \$85 billion to AIG on September 16 2008
- The Treasury also helped by purchasing AIG stock
- Bernanke said that a failure of AIG “could have resulted in a 1930s-style global financial and economic meltdown, with catastrophic implications for production, income, and jobs”
- AIG survived, but the Fed and Treasury were widely criticized for their use of taxpayers money

The Money Market Crisis

- A final part of the September 2008 crisis involved Money Market Mutual Funds (MMMFs)
- Money Market Mutual Funds hold Treasury bills (short-term govt bonds) and commercial paper (short-term corporate bonds), and sell shares to savers
- They yield low returns but are considered safe because assets have short maturities and low default
- Since they were invented in the 1970s, almost no one who put a dollar in an MMMF ended up with less than a dollar
- People came to view MMMFs as similar to bank accounts—very safe

The Money Market Crisis

- On the same day as the AIG rescue, one large MMMF, the Reserve Primary Fund, “broke the buck”: the value of a share in the fund, which originally cost \$1, fell to 97 cents
- Why? The fund owned large quantities of Lehman Brothers commercial paper
- Unlike bank deposits, government insurance does not cover shares in MMMFs
- The result: there was a run on money market mutual funds on September 17 and 18
 - panicked holders withdrew \$210 billion from the funds, reducing the funds assets by 22%.
- On Sept 19 the Treasury Dept announced it would temporarily offer insurance to MMMFs, but confidence remained shaky and funds assets slipped further over the next few months

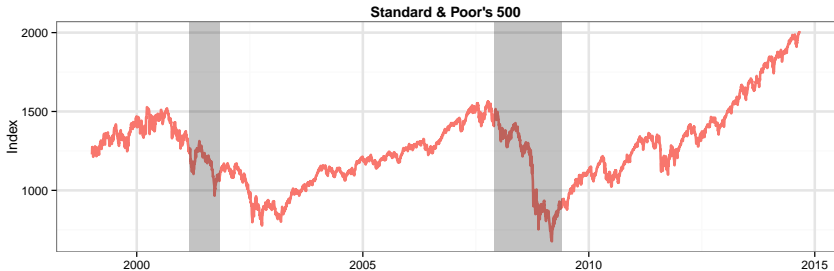
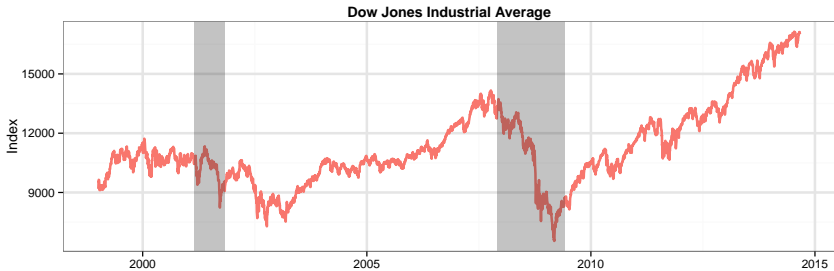
Panic and flight to safety

- Quick succession of crises at major institutions created widespread financial panic
- These was a new type of financial panic. It was internal to financial institutions. In the past, depositors would hoard to banks under fear of losing savings. This was distrust within the system.
- Others suggest firms drew from credit lines fearing they wouldn't be promised or renewed in the future. This caused further reduction in bank liquidity
- Financial institutions became fearful of any assets that appeared risky (stocks, bonds of corporations without top credit ratings, and securities backed by bank loans)
- Formerly used credit ratings were mistrusted as they were mostly based models that didn't conceive a systemic crisis

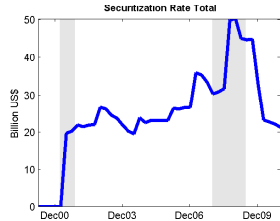
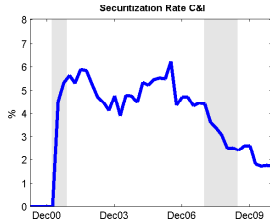
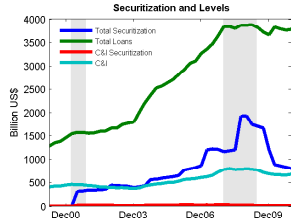
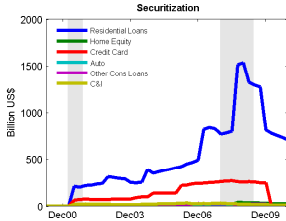
Flight to safety

- They dumped these assets and bought the safest assets: 3 and 6 month Treasury bills (it was unlikely the U.S. govt would default on its debt over the next six months)
- Stock Prices plummeted
- Securitization fell dramatically as demand for securitized loans disappeared
- The prices of BAA-rated corporate bonds fell (bonds with moderate default risk), which implied a sharp rise in their interest rates
- The flight to Treasury bills pushed their prices up and interest rates fell almost to zero

Dow Jones Index of Stock Prices

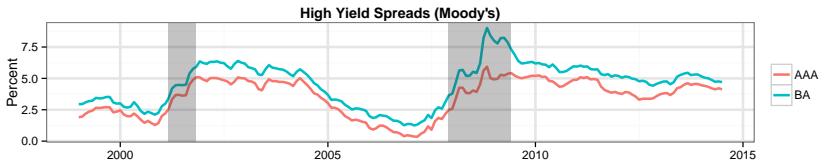
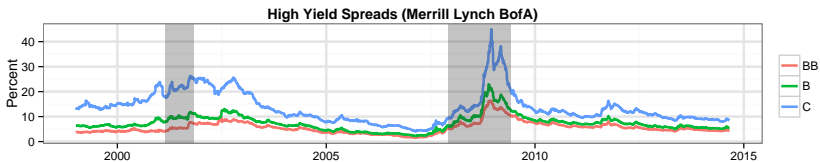
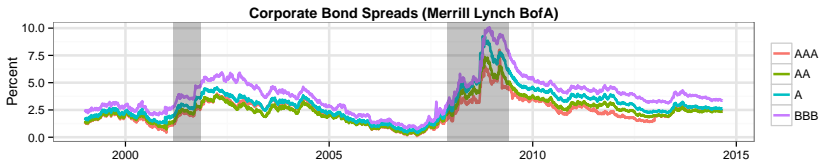


Securitization of Bank Loans



Corporate Bond Rates

Corporate Bond Spreads



Treasury Bill Rates

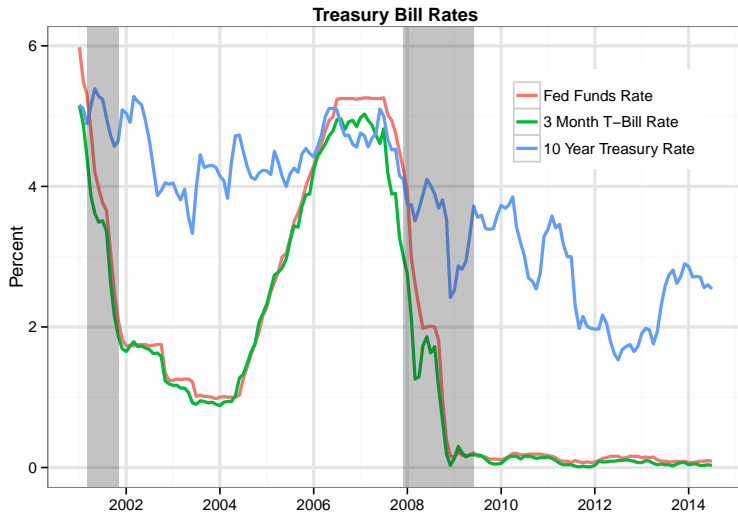


Figure: Key Rates

What about the other Investment Banks?

- On the same day as Lehman's bankruptcy, Bank of America purchased Merrill Lynch
- Goldman Sachs and Morgan Stanley had held fewer mortgage-backed securities than the other investment banks.
 - They lost less and were able to remain independent but needed to reassure other financial institutions that they would survive
- Both firms became bank holding companies on September 21, 2008
 - This reorganization gave them the right to open commercial banks and to receive emergency loans from the Fed, but in return they accepted greater Fed regulation

The Economy in 2008-2009

- Falling stock and house prices reduced consumers' wealth, reducing their credit and willingness to spend
- Financial panic also caused a credit crunch
- Banks could not resell loans to securitizers, and hence had fewer funds to lend
- Banks also worried about insolvency from further losses

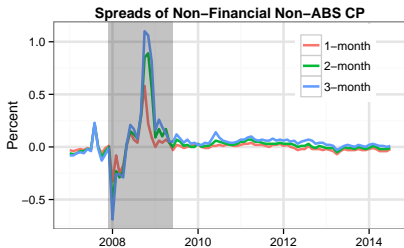
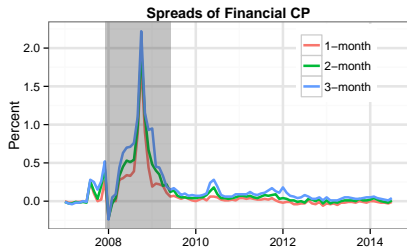
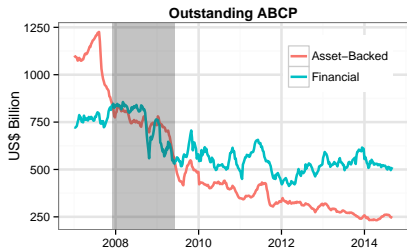
The Economy in 2008-2009

- The run on the MMMFs was perhaps one of the most damaging events to the economy
- MMMFs had to make large payments to shareholders, and this depleted the cash they would normally have used to purchase new commercial paper from firms
- Firms across the country suddenly had difficulty selling commercial paper

The Economy in 2008-2009

- Commercial paper helps cover corporations' short-term needs for cash (to cover production costs, wages, materials, intermediate goods, etc.)
- The breakdown of commercial paper in Sept 2008 caused firms to slash costs
- This led to sharp reductions in output and layoffs of workers

Commercial Paper



Corporate Bond by Risk Type	2006Q4	Crisis Peak
BoAML AAA	0.22%	5.92%
BoAML AA	0.27%	6.84%
BoAML A	0.48%	8.5%
BoAML BBB	0.86%	9.82%
BoAML BB	1.78%	16%
BoAML B	2.82%	20.7%
BoAML C	5.39%	38.5%
Moody's AAA	0.47%	5.43%
Moody's BAA	1.37%	8.4%
Commercial Paper by Maturity	2006Q4	Crisis Peak
Financial 1M	0.4%	1.56%
Financial 2M	0.39%	1.66%
Financial 3M	0.39%	1.78%
Non-Financial 1M	0.38%	1.25%
Non-Financial 2M	0.35%	1.24%
Non-Financial 3M	0.34%	1.23%

The Economy in 2008-2009

- Commercial paper also shows that the decline in ABS-CP issuances precedes the Financial CP and Non-Financial CP)
- There is some indirect evidence of the mechanism that was at play
 - $ABS \Rightarrow Bank\ Losses \Rightarrow \Downarrow Intermediation$

The Economy in 2008-2009

- As unemployment rose, this further pushed down aggregate demand: consumption fell among laid-off workers
- Furthermore, the unemployed could not pay their mortgages, pushing house prices and MBS prices down even further
- As stock and housing prices continued to fall it caused even more borrowers to default on bank loans, increasing the banks' risk of insolvency

In search for the Key mechanism

- Unfortunately, in economic theory we haven't found yet a conclusion on the strengths of different possible mechanisms that explain how the financial crisis spread
- Taking the reduction of home prices as the starting point...
- It is clear that the crisis would have affected construction sectors and the balance sheet of banks, investment banks and mutual funds.
- But how did it spread to the rest of the economy (manufacturing)
- The profession is in search of multipliers that explain the magnitude of the crisis

Mechanism: Investment Demand Mechanisms

- Uncertainty: although rarely modeled explicit, firms are linked in complex production networks
- Contractions in construction spread directly to furniture, paint, steel, cement wood producers. These sectors, in turn, affect machine and equipment production, transport, mining sectors
- As workers get laid-off and household wealth collapses (homes and stocks), demand for durables goods collapsed immediately
- The complexity of these relations, leads firms to face greater uncertainty about their demand prospects

Taking Stock - Investment Demand Mechanisms

- There is a growing literature on the effects of uncertainty shocks in presence of adjustment costs
 - GARCH productivity
 - See Bloom (2007), Kahn and Thomas (2009), Arellano, Kehoe and Bai (2009), Schall (2010)
 - This literature has some identification problems. In the data, it has lag problem. Output falls before increases in firm sales dispersion
 - Do firms face more sudden heterogeneity in TFP (which explains dispersion in sales), or are they different ex-ante more sensible to financial or consumer demand conditions?
 - The right measure of uncertainty should control for firm observables, such as leverage, location and industry type

Taking Stock - Supply of Credit → Credit Rationing

- Worsening of Asymmetric Information: complexity could aggravate asymmetric information
- The idea is that upon a great shock hitting several sectors, firms had better information on how the crisis would affect them, which production lines, which account receivables and other assets would be more affected
- Asymmetric information could lead to credit rationing
 - Kurlat(2010) and Bigio (2010) incorporate asymmetric information in production economies

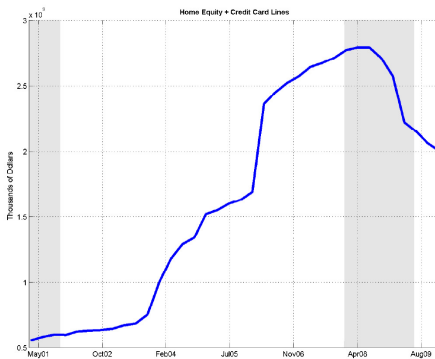
Taking Stock - Disruptions on Investment

- There is a problem faced by models that disrupt investment (with representative firms)
- Investment is a small fraction of the capital stock
 - Lucas: “How is it that production is disrupted if we have the same number of machines and workers?”
- Many models with financial frictions focus on constraints on investment following a tradition in Corp. Finance.
- Macro models must incorporate additional multiplier-mechanism, typically a “New-Keynsian” layer
 - But the same multiplier-mechanism makes the economy sensible to other shocks
 - This is why many shocks in Smets and Wouters turn out to be important

Taking Stock - Supply of Credit → Household Demand

- Other papers have focused on how consumers faced tighter borrowing constraints as their homes were worth less
 - See Midrigan-Phillipon (2011) and Lorenzoni-Guerrieri(2011)
 - Tighter constraints could follow from corrections in expected TFP, for example
- With a new-keynesian layer and durable goods the mechanism could explain strong movements in output

Deterioration of Consumer Lines of Credit



Taking Stock - Supply of Credit → Bank Balance Sheet

- Other's argued that the heart of the transmission has been through banks.
- Any shock that hits banks net-worth particularly severely will dampen their intermediation capacity.
 - See Gertler-Karadi(2010), Gertler-Kiyotaki(2010), Brunnermeier-Sannikov(2010), He-Krishnamurthy(2010),
- Motivated by Moral-hazard, and magnified by fire-sale effects.
- Why can't bank raise more capital immediately?
 - Bigio(2011) combines these feature with asymmetric information

Taking Stock - The Quest for the underlying mechanism

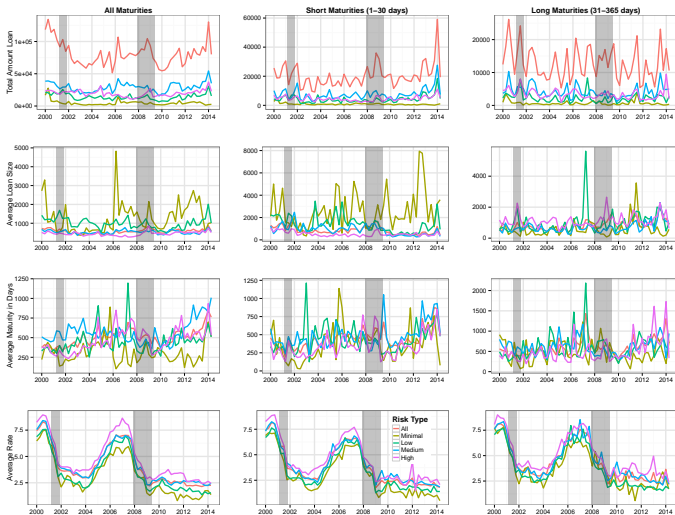
- Discovering which mechanisms played the biggest role in the crisis are for me one of the most important in contemporary macro.
 - La'O and Bigio (2011) use heterogeneity in time to build to distinguish consumption demand from supply of credit
- The answer to these questions will tell us something about the relative strength and where to place Federal resources (if at all)
 - Government spending?
 - Recapitalize banks?
 - Asset purchases?
 - Financial regulation?
- Unfortunately, there is still a lot of debate among many issues, and for good reason

A debate - Were firms really constraints?

- Christiano, Chari and Kehoe (2008) questioned the idea that the origins of the crisis stemmed from lack of access to funding.
- Indeed, a first look at the data suggests their view.
- In related work, Chari and Kehoe (2008) make a strong point suggesting that firms had the funds (via retained earnings, dividends and cash holdings) to finance all their investment at the aggregate level.
 - Focusing only on constrained firms from Compustat (biased-sample) they argue credit constraints could explain only 16% of the fall in investment.

Survey to Loan Officials

Survey of Loans Officials



Data from Survey of Loan Officials

Maturity	Short	Long	All
Loan Volume¹			
All Risks	0.293%	0.162%	0.263%
Minimal Risk	0.632%	0.525%	0.694%
Low Risk	0.418%	0.0499%	0.327%
Medium Risk	0.355%	0.255%	0.31%
High Risk	0%	0%	0.221%
Average Loan Size²			
All Risks	0.0699%	0.511%	0.0418%
Minimal Risk	0.447%	0.307%	0.671%
Low Risk	0.372%	0.62%	0.377%
Medium Risk	0.212%	0.682%	0.229%
High Risk	0%	0%	0%
Interest Rate³			
All Risks	5.45%	5.64%	5.66%
Minimal Risk	5.81%	5.44%	6.64%
Low Risk	5.39%	5.46%	5.73%
Medium Risk	5.52%	5.88%	5.86%
High Risk	5.13%	5.5%	5.74%
Average Maturity⁴			
All Risks	0.259%	0.348%	0.438%
Minimal Risk	0.0866%	0.49%	0.545%
Low Risk	0.345%	0.398%	0.57%
Medium Risk	0.125%	0.17%	0.274%
High Risk	0.462%	0.553%	0.494%

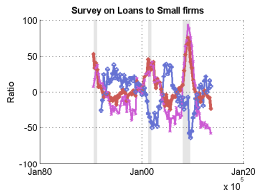
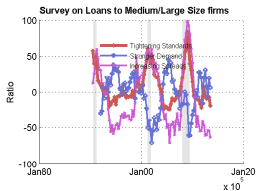
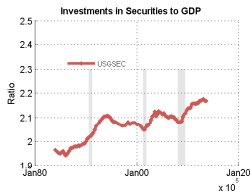
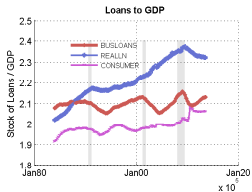
Table: Items 1,2 and 4 are the largest % drop since the beginning of the recession until two years after its end. Item 3 is the largest interest rate spread over the FEDFUNDS rate since the beginning of the crisis.

A debate - Were firms really constrained?

- C&I lending actually grows at the beginning of the crisis.
- It only falls, well in the midst of the crisis and collapses after.
- Spreads jump rapidly though, which is odd.
 - By the end of the crisis, the collapse in C&I lending is very clear.
- Where firms constrained? What did bankers say?

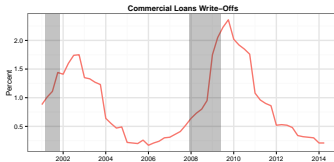
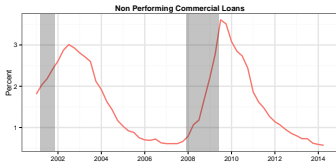
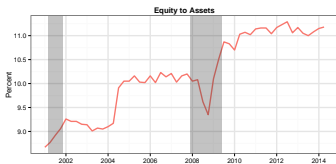
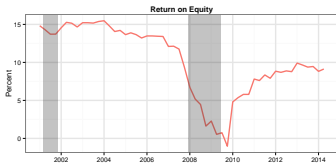
Survey to Loan Officials

Key Banking Indicators



Key Bank Indicators

Key Banking Indicators



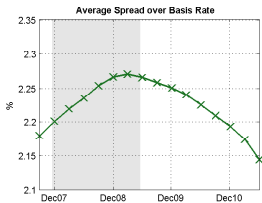
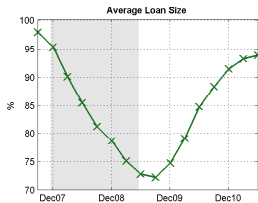
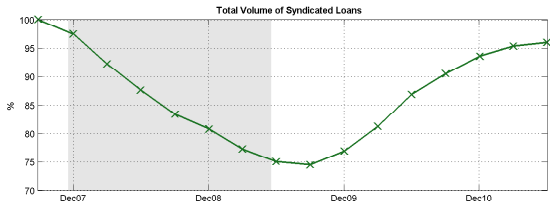
Key Bank Indicators

	Data 2007Q4	Crisis Trough
Return on Equity	9.33%	-1.00%
Return on Assets	0.94%	-0.09%
Equity to Asset Ratio	10.2%	9.34%
Net Interest Margin	3.36%	3.84%
Non-Performing C&I Loans	0.66%	3.61%
C&I Loan Right-Offs	0.52%	2.36%

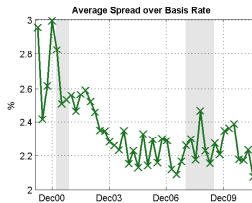
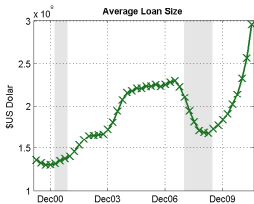
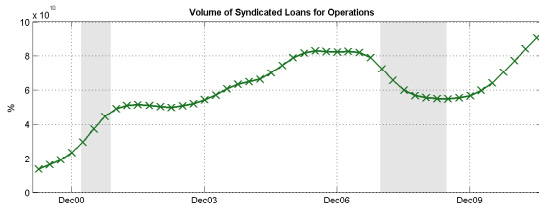
Table: Financial Crisis Data. Source: Data is obtained from the Federal Reserve Bank of St. Louis FRED system. Figures correspond to the levels in the quarter of the beginning of the crisis and the lowest levels since the beginning of the crisis.

- Ivashina and Scharfstein (AER,2010) claim that CCK(2008's) may be misleading
 - Some firms could have drawn fund from existing lines of credit
 - They propose looking at syndicated lending
 - Loan syndicates are typically huge loans made by clubs of financial institutions
 - They are typically originated by a lead institution which typically will hold a larger share of the loan
 - The lead share of the majority of loans went up during the crisis

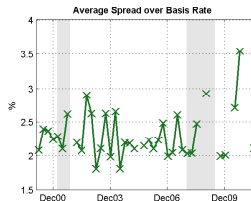
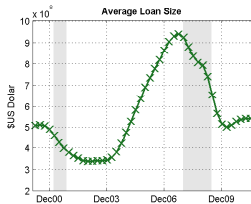
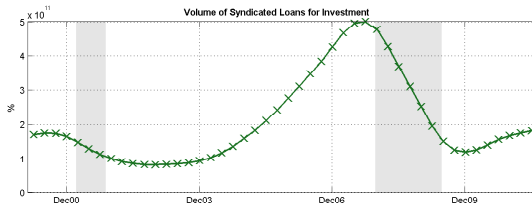
Syndicated Loans - Total



Syndicated Loans - Current Operations



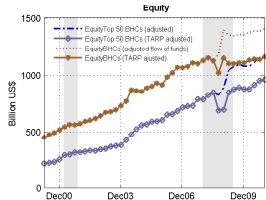
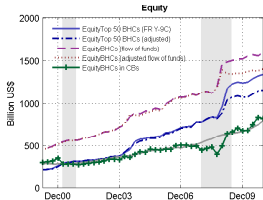
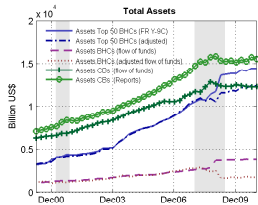
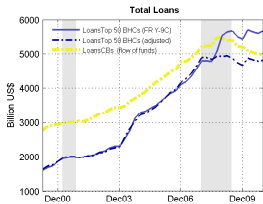
Syndicated Loans - Investment Purposes



The need to go deeper in the data...

- Flow of Funds data on banks may be misleading
 - Many institutions became banks or were purchased by banks during the crisis. (e.g., Washington Mutual)
 - Loans may have increased due to compounding of interests before write-offs.
 - Loans to off-balance sheet subsidiary, recourse on non-performing loans
- C&I is only 25% of corporations ext. funding, commercial paper and corp bonds account for the rest
- It is clear that bank (holding) level balance sheet data is key to get a good idea
 - Correct for commitments, purchases and accounting problems
 - Keep institutions fixed
- Aggregate bank balance sheet data does reveal immediate deterioration of bank conditions

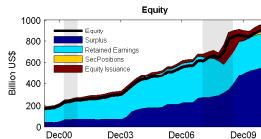
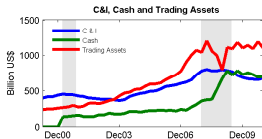
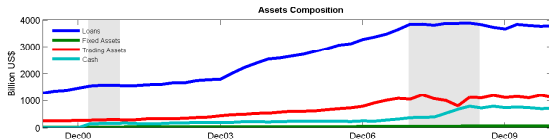
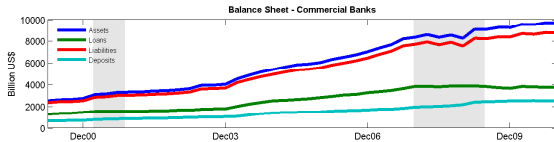
Flow of Funds and Bank Balance Sheet Data



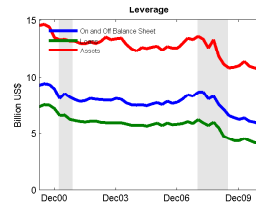
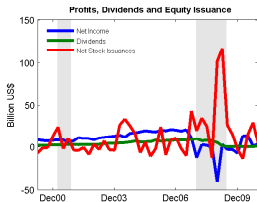
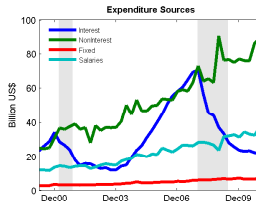
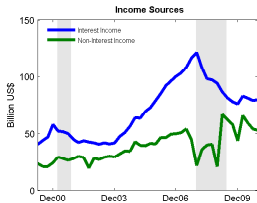
Bank Balance Sheet Data

- It is clear that bank (holding) level balance sheet data is key to get a good idea
 - Correct for commitments, purchases and accounting problems
- Aggregate bank balance sheet data does reveal immediate deterioration of bank conditions

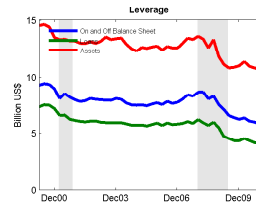
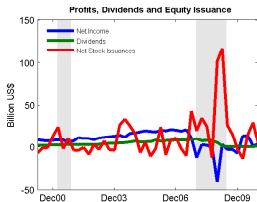
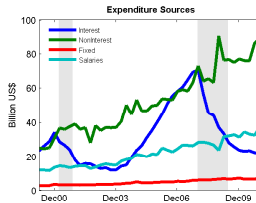
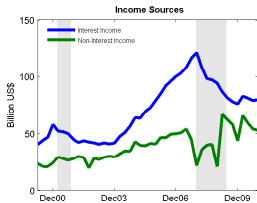
Bank Holding Company Balance Data



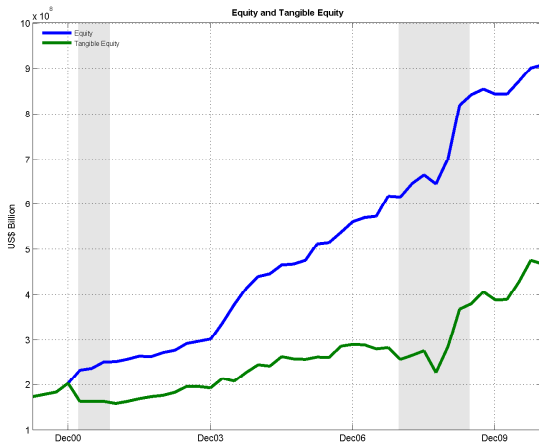
Bank Holding Company Income Statement



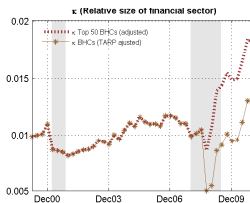
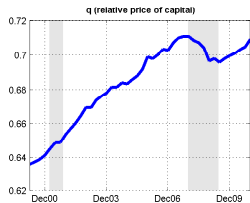
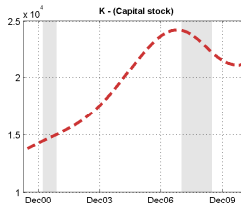
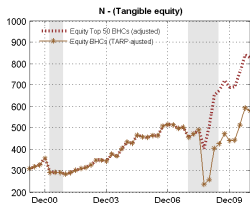
Bank Holding Company Income Statement



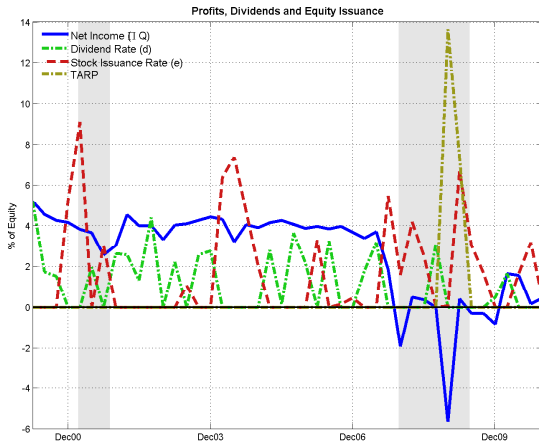
Equity and Tangible Equity



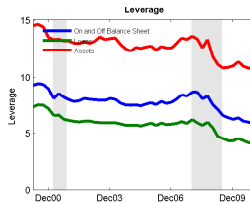
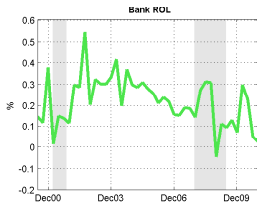
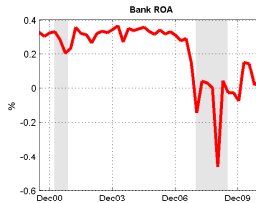
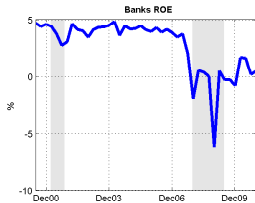
Size of the financial sector



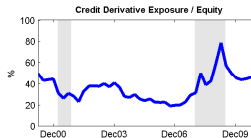
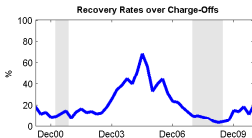
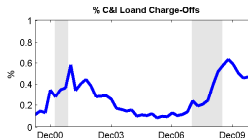
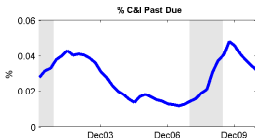
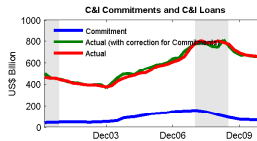
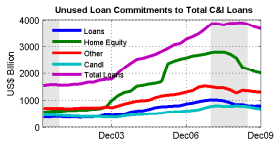
Capital Injections



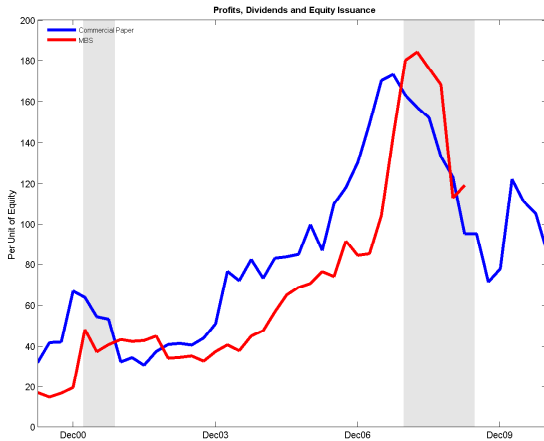
Key Bank Indicators



Bank Commitments

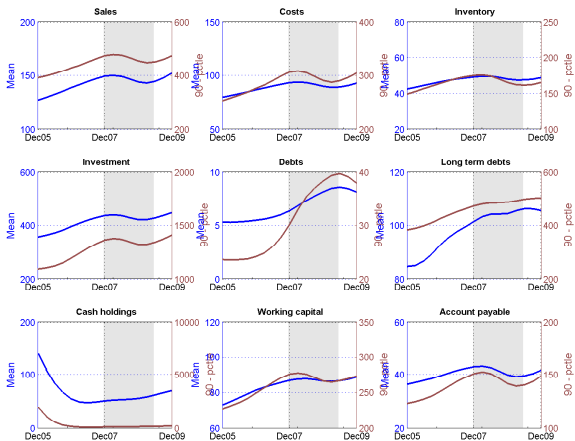


CP and MBSs

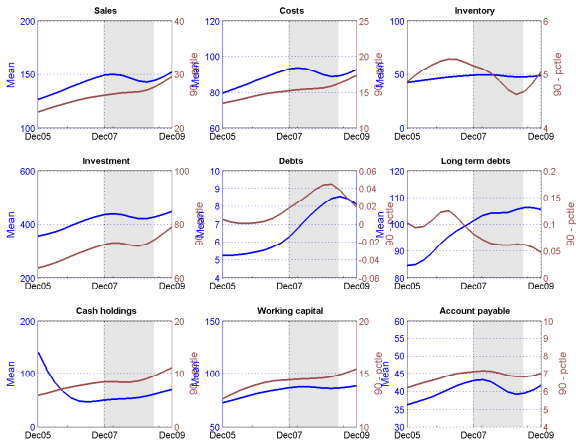


What can we observe from the firm's side?

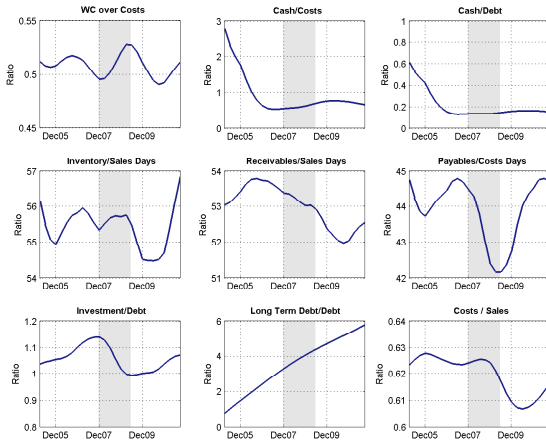
Compustat - Average Firm and 90th Pctile



Compustat - Average Firm and 10th Pctile

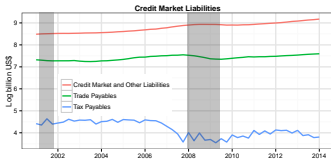
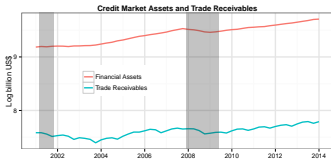
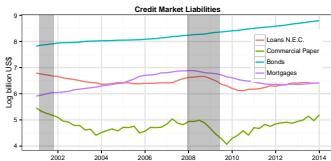
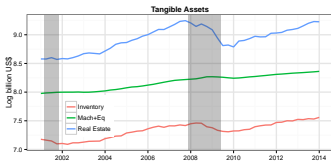
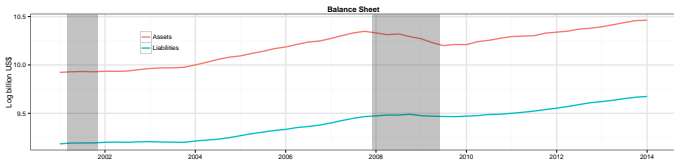


Compustat - Key Ratios



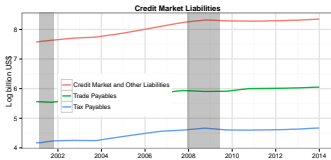
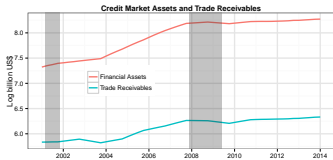
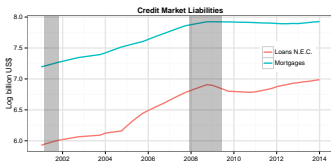
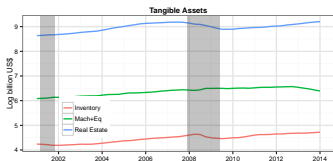
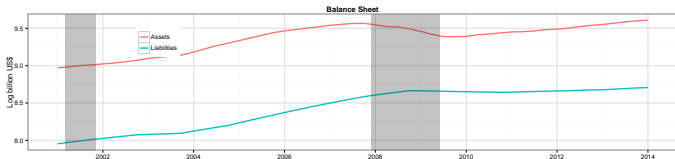
Flow of Funds - Corporate Businesses

Nonfinancial Corporate Business



Flow of Funds - Non Corporate Businesses

Nonfinancial Non-Corporate Business



TARP

- On October 3, 2008 Bush signed an emergency Act of Congress establishing the Troubled Asset Relief Program (TARP)
- TARP committed \$700 billion of government funds to rescue financial institutions
- The initial plan was for the government to purchase troubled assets, primarily MBSs
- After the program was established, the Treasury decided to use most of the funds for equity injections: instead of purchasing assets of financial institutions, it purchased shares in the institutions themselves
- The treasury became a major shareholder in many large financial institutions

Monetary and Fiscal Policy

- From September to December 2008 the Federal Reserve cut its target for the federal funds rate from 2 percent to almost zero. The target is still near zero.
- When Obama took office in January 2009, he signed the fiscal stimulus plan of 2009
- As mentioned before, the stimulus package:
 - increased federal government spending by about \$499 billion
 - reduced taxes by about \$288 billion

TALF

- In November 2008, the Fed established the Term-Asset-Backed Loan Facility (TALF)
- The Fed lent to financial institutions such as hedge funds to finance purchases of securities backed by bank loans
- The goal was to ease the credit crunch by encouraging the securitization process (that had broken down)
- The Fed accepted the securities purchased under the program as collateral and its loans were without recourse—that is, the Fed took on the risk that the securities would fall in value

The Zero Lower Bound

- Starting in October 2008, monetary policy was constrained by the simple fact that the Fed's target for the federal funds rate was basically zero
- A nominal interest rate cannot fall below zero because nobody would make a loan in return for negative nominal interest
- In 2009-2010 this zero-lower bound problem (also known as a liquidity trap) prevented the Fed from stimulating the economy through usual means

Quantitative Easing

- Quantitative easing is an unconventional monetary policy used occasionally when the interest rate is at the zero lower bound (Japan in the 1990s)
- The Fed expands the size of its balance sheet by creating money which it uses to buy securities, thereby increasing the money supply
- That is, rather than focusing on targeting the Fed funds rate, the Fed changes its focus to the quantity of the monetary base
- This policy also raises the prices of the financial assets bought (thereby lowering their yield)
- Its not effective if banks simply sit on this cash and do not lend it out

Quantitative Easing

- In November 2008, the Fed began purchasing massive amounts of mortgage-backed securities
- In this first round of QE the Fed purchased \$600 billion in MBSs
- It expanded that goal in March 2009 to \$1.7 trillion of Treasury debt, MBSs, and debt backed by Fannie and Freddie
- The goal was
 - to increase the money supply
 - to drive down interest rates on these securities and ultimately reduce rates on the mortgages behind the securities
- Further purchases were halted since the economy had started to improve and holdings started falling naturally as debt matured

QE2

- In November 2010, the Fed announced it would increase quantitative easing, buying \$600 billion of Treasury securities by the end of the second quarter of 2011
- Unlike the first round of QE, this time the Fed is buying only (long-term) Treasuries
- The idea is to flatten the yield curve by having the Fed buy more long-term rather than short-term bonds
- If the Fed does so in large quantities, long-term interest rates might decline, spurring an increase in consumption and investment

The Aftermath

The Financial Crisis eases

- Stock prices rose during 2009-2010
- After losses in 2008, some financial institutions, including Merrill, Goldman, and Citigroup returned to profitability in 2009
- Many financial institutions bought back the stock they had sold to the government under TARP
- In the end, the government made money on many of these transactions, selling the stock back at higher prices than it paid
 - A government audit of TARP in 2010 estimated that it will eventually cost taxpayers \$40 billion, a small fraction of the \$700 billion put into the program
- However, high unemployment (about 10%) still persists