LECTURE 1:
LESSONS FROM THE FINANCIAL CRISIS

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April 2015
A Narrative of the Financial Crisis

1. A housing bubble inflates in the mid 2000’s. Homes are financed by mortgages that are increasingly securitized. Although the quality of mortgages deteriorates, the securities into which these mortgages are packaged (mortgage backed securities or MBS) are perceived to be safe and receive AAA-ratings.

2. Financial institutions such as banks and dealer banks retain substantial exposure to the real estate market, through direct holdings of commercial real estate, direct holdings of MBS, but also implicit guarantees of special investment vehicles they organize, which hold MBS and finance them with commercial paper.
3. Bad news about the housing market in the summer of 2007 surprises investors in AAA-rated MBS and precipitates a sequence of substantial disruptions in financial markets, such as the collapse of the asset backed commercial paper market. Aggressive liquidity interventions from the Federal Reserve, including lending to market participants against risky collateral, stabilize markets through the summer of 2008 despite continued bad news about housing.

4. In September 2008, several events, including a run on money market funds, nationalization of AIG, Fannie Mae, and Freddie Mac, and particularly the collapse of Lehman Brothers, trigger a massive financial crisis. Banks balance sheets contract because of massive losses on assets and withdrawal of short term financing, which prompts banks to liquidate assets in fire sales. The consequences of fire sales are exacerbated by uncertainty about bank solvency and government policy.
5. In response to their losses and to reduced availability of financing, banks cut lending to firms. The economy slides into a major recession.

6. Starting in October 2008, the government begins massive interventions in financial markets, including equity injections in banks, expansion of lending against risky collateral, but also direct purchases of long term agency bonds, which sharply reduce the supply of risky bonds in the market. The combination of government interventions eventually stabilizes the financial markets by the spring of 2009, although the real economy remains sluggish.
Although the narrative is standard, there are four broadly different interpretations

- A hundred year flood

- Moral hazard due to bailouts or agency problems inside banks (Rajan)

- Liquidity Crisis (Diamond-Dybvig, Bernanke)

- Neglected risks / wrong models
In this lecture, I will go through the standard narrative, focusing on some of the conceptual issues it raises.

Will particularly focus on the four theories, arguing that the evidence leads us to neglected risks to explain several puzzling features of the crisis.

This has substantial implications for modeling financial markets and institutions.
1. A housing bubble inflates in the mid 2000’s. Homes are financed by mortgages that are increasingly securitized. Although the quality of mortgages deteriorates, the securities into which these mortgages are packaged (mortgage backed securities or MBS) are perceived to be safe and receive AAA ratings.
US home values over time

Index of sale prices of standard existing homes, adjusted for inflation; Index 1890 = 100

The same $100,000 home in 1890 would have sold for $66,000 in 1920, $199,000 in 2006, and $114,000 at the recent trough, adjusted for inflation.

Source: Benmelech and Dlugosz (2009)
Outline of the Neglected Risk Model

- Investors assess risk historically and neglect low probability non-salient events
- A history of good performance of an asset (such as housing) makes the risk of a sharp price decline appear unrepresentative, and boosts the demand for securities exposed to that risk
- There are powerful incentives for financial engineers to create securities that cater to investor demand
- When investors believe securities are safe enough they will lever up these investments
- This creates risk for institutions and systemic risk
Perception of Safety

- AAA ratings based on incorrect models (see Jarrow et al., Coval et al.)
- Historical measures of volatility, risk point to safety of MBS, CDO’s
- Market price of risk in summer 2007 is low
- In expectations data, no one seems to expect the collapse of home prices
- Evidence supported by theory (diversification myth)

All points to a systematic mistake by both intermediaries and investors
<table>
<thead>
<tr>
<th>Name</th>
<th>Scenario</th>
<th>Probability</th>
<th>Cum Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Aggressive</td>
<td>11% HPA over the life of the pool</td>
<td>15%</td>
<td>1.4%</td>
</tr>
<tr>
<td>(2)</td>
<td>8% HPA for life</td>
<td>15%</td>
<td>3.2%</td>
</tr>
<tr>
<td>(3) Base</td>
<td>HPA slows to 5% by end-2005</td>
<td>50%</td>
<td>5.6%</td>
</tr>
<tr>
<td>(4) Pessimistic</td>
<td>0% HPA for the next 3 years 5% thereafter</td>
<td>15%</td>
<td>11.1%</td>
</tr>
<tr>
<td>(5) Meltdown</td>
<td>-5% for the next 3 years, 5% thereafter</td>
<td>5%</td>
<td>17.1%</td>
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</tbody>
</table>

**Table 2. Conditional Forecasts of Losses on Subprime Investments from Lehman Brothers.** This table shows that investors knew that subprime investments would turn sour if housing prices fell. The “meltdown” scenario for housing prices above implies cumulative losses of 17.1 percent on subprime-backed bonds; such losses would be large enough to wipe out all but the highest-rated tranches of most subprime deals. The table also shows that investors placed small probabilities on these adverse price scenarios, a fact that explains why they were so willing to buy these bonds.

Titanic: a AAA-rated ship

- When built, described as the safest, largest ship ever
- Insiders and financiers were on board: they believed it was safe
- Many lifeboats on board, enough for 1/3 of passengers. Consistent with regulation
- Sailed further south because of icebergs, but radio operators ignored warnings of icebergs nearby
- 1500 people died. Some rescue boats were not full. Almost all the crew died.
Investors imagined the crisis, but did not think it to be likely

However,

- Similar cycles of growing leverage, deterioration of quality of credit, and subsequent crashes, are common.
- Junk bonds, CMO’s in the 1990s
- Systematic evidence of Greenwood and Hanson
- Crises from leveraged risk taking even more common if we look internationally (Reinhart-Rogoff, Schularick-Taylor)
- Evidence of neglect of crash risk in these episodes (Baron-Xiong)
2. Financial institutions such as banks and dealer banks retain substantial exposure to the real estate market, through direct holdings of commercial real estate, direct holdings of MBS and CDO’s, but also implicit guarantees of special investment vehicles they organize, which hold MBS and finance them with commercial paper.
Why were financial institutions over-exposed to AAA-rated ABS?

- Gigantic share of risk stayed with banks.
- Banks’ subprime losses totaled $500 billion even before Lehman collapse.

Possible answers:

- Had to hold it as skin in the game and inventories (but sold much to their own proprietary desks – must have thought securities were safe)
- Counted on bailout (inconsistent with evidence: see below)
- Did not believe it was so risky (neglect of risk)
- Believed it was risky but had short horizons (agency)

The last two theories both consistent with massive bank exposure and top management ignorance about risk.
Alternative theory: agency problems

- Traders knowingly gambled and management does not fully understand risks. Or
- Management knowingly gambled, expecting a bailout.

However:

- Traders do not appear to have seen the crisis (Cheng, Raina, Xiong).
- Management seems unaware of exposures (UBS report, Citi Q3 2007 accounting litigation)
- Inconsistent with evidence on CEO incentives and behavior (Fahlenbrach and Stulz)
- Inconsistent with Goldman, JP Morgan getting out in 2007
- Inconsistent with basic misery banks went through post-crisis
Traders’ performance in personal housing transactions (Cheng, Raina, Xiong)

**Figure 4. Trading Performance Indices**

*Notes:* This figure plots the average performance index, defined as the initial-wealth-weighted average difference between the cumulative return on the self-financed trading strategy and the buy-and-hold return of the initial stock of houses, where 2000:I is taken as the initial quarter, for each group.
Banks: Market Cap

Market Value as of January 20th 2009, $Bn
Market Value as of Q2 2007, $Bn

Source: Bloomberg, Jan 20th 2009
3. Bad news about the housing market in the summer of 2007 surprises investors in AAA-rated MBS and precipitates a sequence of substantial disruptions in financial markets, such as the collapse of the asset backed commercial paper market. Aggressive liquidity interventions from the Federal Reserve, including lending to market participants against risky collateral, stabilize markets through the summer of 2008 despite continued bad news about housing.
The Mystery Period: Summer 2007- Summer 2008

- Bad news about housing and AAA-rated MBS starts to appear in summer 2007
- There are several bankruptcies of hedge funds and banks
- ABCP market collapses
- Some banks sharply reduce their MBS and CDO holdings but others largely stay put
- Banks raise capital but slowly
- Fed lends aggressively against risky collateral
- Everything points to a lack of concern
The Mystery Period: Summer 2007 - Summer 2008

Why was the response so timid?

- Home prices continue falling, they are not all the way down yet in summer 2007
- Bank accounting – with Fed complicity – hides losses
- Banks and regulators do not understand the exposure (UBS report)
- Biggest losses are in securities (CDO’s) understood least well
- Hard to believe, at this point, management could not figure out risks if it believed traders were hiding them
- Points to neglected risks and not just agency
4. In September 2008, several events, including a run on money market funds, nationalization of AIG, Fannie Mae, and Freddie Mac, and particularly the collapse of Lehman Brothers, precipitate a massive financial crisis. Banks balance sheets contract because of massive losses on assets and withdrawal of short term financing, which prompts banks to liquidate assets in fire sales. The consequences of fire sales are exacerbated by uncertainty about bank solvency and government policy.
Mechanism of crisis: massive losses on ABS, short term finance, and fire sales

- Losses on ABS, especially CDO’s, are gigantic. Losses on ABS CDO’s eventually account for 42% of total bank writedowns (Benmelech and Dlugosz)

- Short term finance is withdrawn

- Withdrawal leads to fire sales, liquidity dry-ups, which are the mechanisms of creation of systemic risk
Figure 2
Liquidity spirals
The figure shows the loss spiral and the margin/haircut spiral.
Evidence from He, Kang and Krishnamurthy (2010)

- Over interval 2007Q4 to 2009Q1, they estimate that:
  - Hedge funds and broker dealers reduce holdings of securitized assets by approx. $800B.
  - Insurance companies reduce holdings by $50B.
  - Commercial banks increase holdings by $550B.
  - The government (including Fed and GSEs) increases holdings by $350B.
“Massive forced selling by ratings-constrained and levered investors brought prices to levels that were far below fundamental value… PIMCO increased exposure to non-agency MBS at historically cheap levels.” (PIMCO, 2013)
Role of Short-term Debt

- Surely made things worse, but largely because MBS/CDO losses were so massive.
- What kind of short term debt withdrawal?
  - Repo
  - CP
  - Prime brokerage accounts
- Since repo is collateralized, there is no public pool of assets – this is not the usual bank run.
- Problems on liability side emerge only after problems on the asset side become severe.
US policy makers all argue the crisis was a standard liquidity crisis

- Bernanke: Can understand it with the Diamond-Dybvig model

- Also argue that “did everything they could” with Lehman, but could not legally save it because it might have been insolvent

- But if the problem is liquidity, it can be solved for free by guaranteeing liabilities, as with money market funds, etc.

- The crisis came from insolvency of financial institutions; Diamond-Dybvig is the wrong model
5. In response to their losses and to reduced availability of financing, banks cut lending to firms. The economy slides into a major recession.
Why did banks cut lending to firms?

- Usual credit supply channel
- Banks also hoarding cash
- Invest in projects or in securities oversold in fire sales
- There is evidence of hoarding cash and investing in securities
- But also reductions in demand for credit (Mian-Sufi)
6. Starting in October 2008, the government begins massive interventions in financial markets, including equity injections in banks, expansion of lending against risky collateral, but also direct purchases of long term agency bonds, which sharply reduce the supply of risky bonds in the market. The combination of government interventions eventually stabilizes the financial markets by the spring of 2009, although the real economy remains sluggish.
What was effective in government policy?

- Lending against risky collateral?
- Rescuing institutions (vs. failure to rescue Lehman)?
- Buying securities such as agency bonds?
- Guaranteeing money market funds?
- Fiscal policy?

Fire sales strongly favor soft ex post policies
Neglect of risk seems to be a key theme in crisis.

Suggests that ex ante policies, such as stress tests and limits on leverage, may be very helpful.

Fire sales seem to be another key theme, leading to desirability of ex ante hard policies and ex post soft policies.
Neglect of risk: how do we move forward?

- Understanding the psychology of neglected risk (to be discussed in Lecture 2)

- Measuring beliefs from surveys (e.g. Greenwood and Shleifer, 2014)

- Relating beliefs to extrapolation and bubbles (e.g. Barberis, Greenwood, Jin, and Shleifer 2014, 2015)
Fact 1: Expectations of future stock returns are highly correlated across different surveys, and with equity mutual fund flows.

<table>
<thead>
<tr>
<th></th>
<th>Gallup</th>
<th>CFO Survey</th>
<th>AAII</th>
<th>Investor Intelligence</th>
<th>Shiller</th>
<th>Michigan</th>
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<td>AAII</td>
<td>0.64</td>
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<td>Investor Intelligence</td>
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<tr>
<td>Shiller</td>
<td>0.39</td>
<td>0.66</td>
<td>0.51</td>
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<td>Michigan</td>
<td>0.61</td>
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<td>[0.003]</td>
<td>[0.922]</td>
<td>[0.003]</td>
<td>[0.395]</td>
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<td>Equity Fund Flows</td>
<td>0.70</td>
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<td>[0.068]</td>
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*p-value in brackets.*
Fact 2: Expectations of future stock returns are highly correlated with past returns.

Gallup: % optimistic - % pessimistic about next 12m aggregate stock market performance.
Fact 3: Expectations of future stock returns are strongly negatively correlated with model-based measures of expected returns (ER).

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<tbody>
<tr>
<td>Log(D/P)</td>
<td>-0.33</td>
<td>-0.44</td>
<td>-0.31</td>
<td>-0.19</td>
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<td>Campbell-Shiller (1988)</td>
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<td>cay</td>
<td>0.02</td>
<td>0.14</td>
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<td>-0.19</td>
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<td>Lettau-Ludvigson (2001)</td>
<td>[0.776]</td>
<td>[0.380]</td>
<td>[0.788]</td>
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<td>[0.988]</td>
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<td>-Surplus Consumption</td>
<td>-0.48</td>
<td>-0.53</td>
<td>-0.28</td>
<td>-0.05</td>
<td>-0.67</td>
<td>-0.74</td>
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<td>Campbell-Cochrane (1999)</td>
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*p-value in brackets.*
Illiquidity/fire sales: how do we move forward?

- Models in macroeconomics (e.g. Kiyotaki and Moore, 1997; Brunnermeier and Sannikov, 2014; Stein, 2012)

- Models of shadow banking and the financial crisis (e.g. Gennaioli, Shleifer, and Vishny 2013, 2015) that combine both neglect of risk and fire sales

- More generally, putting illiquidity at the core of understanding financial intermediation (to be discussed in Lecture 3)