What can we learn from the financial flows of the 2008-2009 crisis?

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• Two mainstream views of Great Recession
  • Starting point: decline in home prices
  • Ending point: decline in real activity

1. View: Transmission through household wealth
2. View: Induced credit-supply crunch
   2.1 How much did house price shock matter for lending and deposit making?
This Paper

House Price Shock

1) How large is the Fire Sale shock?
2) How large are direct losses?

Trad. banking sector

3) Only happens if banks face constraints: what are they?

Real economy via credit supply

Direct via equity losses

Indirect via shadow banks

Paper: use FF data to inform about (1) - (3)
1. **Magnitude of Flows**
   - How big was asset flow from shadow assets to traditional banks?
     - At most **$1.6 Trillion**: outflow from shadow banks roughly = inflow to traditional banks
     - Traditional banks: deposits and reserves go up
     - FED: absorbed MBS
   - How big were direct losses of banks?
     - Negligible if measured by book equity & sizeable by market equity ($450 billion)

2. **Bank Portfolio Problems**
   - What constraints are relevant?
     - No book equity constraints
     - No risk-based funding constraints
     - No market based constraints
     - Possibly sticky assets
Approach in Paper

Data:

- sectoral flows: learn about magnitudes
- micro-level: cross-section informs us about constraints
Approach in Paper

• Data:
  - sectoral flows: learn about magnitudes
  - micro-level: cross-section informs us about constraints

• Simple **accounting** framework to measure upper bound of shocks on banks

• **Discussion:** what types of constraints seem consistent w/ evidence?
Magnitude of Fire-Sale Shock
Conceptual definition:

- **Traditional banks**: originators of loans and creators of deposits
- **Shadow banks**: mimick asset or liability side of banks
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- **Shadow banks**: mimic asset or liability side of banks
  - Two types: **shadow asset banks** & **shadow liability banks**
Conceptual definition:

- **Traditional banks**: originators of loans and creators of deposits
- **Shadow banks**: mimick asset or liability side of banks
  - Two types: **shadow asset banks & shadow liability banks**
• Definition within financial accounts of the United States:
  • **Traditional banks (TB):** depository institutions
  • **Shadow asset banks (SAB):** SBD, GSE, Mortgage Pools, REITs, finance companies, asset-backed security issuers
  • **Shadow liability banks (SLB):** Money market mutual funds
• (Tedious) accounting
  • Balance sheet have to add up

• Steps:
  1. Quantify flows from shadow to traditional banks (indirect channel)
  2. Quantify traditional bank losses (direct channel)
  3. Analyze cross-sectional responses (constraints)
House price decline

- Saver:
  - Deposits
  - MMMF
  - Equity

- Bank:
  - Reserves
  - Deposits
  - Loans
  - Equity

- Shadow liability:
  - CP/Repo
  - MMMF

- Shadow asset:
  - MBS etc
  - CP/Repo

- Borrower:
  - Loans
  - MBS etc
  - Equity

Red arrow: House prices decline
Unwinding of shadow banking system

- **Saver**
  - Deposits
  - MMMF
  - Equity

- **Bank**
  - Reserves
  - Loans
  - Deposits
  - Equity

- **Shadow liability**
  - CP/Repo
  - MMMF

- **Shadow asset**
  - MBS and Co
  - CP/Repo

- **Borrower**
  - Loans not performing

- **House**
  - Loans
  - MBS etc

- **Loans not performing**
1) Direct losses traditional bank 2) Unwinding of shadow banking system

- Bank
  - Reserves
  - Deposits
  - Loans
  - Equity

- Saver
  - Deposits
  - MMMF
  - Equity

- Borrower
  - Loans
  - Equity
  - MBS etc

- Shadow liability
  - CP/Repo
  - MMMF

- Shadow asset
  - MBS etc
  - CP/Repo

- House
  - Loans
  - MBS etc

- Equity losses
- Loans not performing
- Run on MMMF
- Run on the REPO
- Collapse in ABCP
- MBS etc not performing
Fire Sale Shock: 1) How large? 2) Where did it go?

Saver

- Deposits
- MMMF
- +Deposits

Bank

- Reserves
- Deposits
- Loans
- Equity
- ?
- +Deposits

Shadow liability

- CP/Repo
- MMMF

Shadow asset

- MBS etc
- CP/Repo
- MBS etc ?

Borrower

- House
- Loans
- MBS ?

Run on MMMF
• (Tedious) accounting
  • Balance sheet have to add up

• Steps:
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Consolidate shadow bank balance sheets...

- **Shadow asset banks (SAB):** SBD, GSE, Mortgage Pools, REITs, finance companies, asset-backed security issuers
- **Shadow liability banks (SLB):** Money market mutual funds
- Gross positions useful for upper bound calculation

Compute change in financial asset position
△ in asset position b/w 07Q1-13q1

- Consolidate shadow bank balance sheets...
  - **Shadow asset banks (SAB):** SBD, GSE, Mortgage Pools, REITs, finance companies, asset-backed security issuers
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- Compute change in financial asset position

- Plain flow of funds series
  - Shadow asset banks: $-2,953$ billion
  - Shadow liability banks: $-46$ billion
  - Traditional banks: $1,785$ billion
Challenges

- Redefinitions (e.g. Goldman Sachs, Morgan Stanley, etc)
- No equity position of intermediaries in the Flow of Funds
- Aggregate data on MMMF adds prime & gov. funds
Data

- 2007q1-2013q1
- Financial Accounts (Flow of Funds)
- Bank level data on commercial banks
  - use Call reports to adjust trad. banks' assets for GS & MS
- Security broker-dealer level (FOCUS) / SEC filings
  - adjust SAB series for GS & MS
- Money market mutual funds (ICI)
  - use ICI data to find share of prime MMMF
- 10-Q SEC filings
  - From quarterly filings get (lower bound) losses BS, ML, GS, MS, L $56 billion
- Inflation adjusted (2009 $)
Quantify upper bound of asset flow to traditional banks

- Adjusted flow of fund series
  - Shadow asset: $-1,702 \text{ billion}$
    - accounts for $56$ billion losses & GS, MS redefinitions
  - Shadow liability: $-298$ billion
  - Traditional banks: $1,595 \text{ billion}$
    - upper bound on what traditional banks absorbed
What was absorbed?

Bank

+ Reserves  ???  +Deposits
Reserves  Deposits
Loans  Equity

Deposits increased by $2 Trillion
Fed Funds & Bonds & Other fell by $0.7 Trillion
What was absorbed?

++ Reserves + Deposits
Reserves Deposits
Loans Equity
Deposits increased by $2 Trillion
Fed Funds & Bonds & Other fell by $0.7 Trillion

Reserves increased by $1.7 Trillion
Mortgages + GSE fell by $0.4 Trillion
Deposits increased by $2 Trillion
Fed Funds & Bonds & Other fell by $0.7 Trillion
MBS up by $1 Trillion
Treas up by $0.9 Trillion
Programs gone

Reserves up by $1.7 Trillion
Currency up by $0.4 Trillion
- Upper bound, banks absorbed entire shadow assets decline
- In turn, FED absorbed shadow assets absorbed by banks
- Shows up in deposit flows and reserve flows
• (Tedious) accounting
  • Balance sheets have to add up

• Steps:
  1. Quantify flows from shadow to traditional banks (indirect channel)
  2. **Quantify traditional bank losses (direct channel)**
  3. Analyze cross-sectional responses (constraints)
Part II: Bank Wealth Shock
Quantify shock to traditional banks

Data:

- FR Y-9C filings for BHC
  - BHC consolidates banks’ position across different subdivisions
- Exclude 2009 entrants (e.g. GS, MS, ...)
- Merge with CRSP data
- Inflation adjusted
No crisis in book equity

- Flexibility to delay acknowledging losses on the books
## Real Change Since 2007 Q1

<table>
<thead>
<tr>
<th></th>
<th>2008 Q4</th>
<th>2009 Q4</th>
<th>2010 Q4</th>
<th>2011 Q4</th>
<th>2013 Q1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market</strong></td>
<td>-59%</td>
<td>-46%</td>
<td>-37%</td>
<td>-53%</td>
<td>-33%</td>
</tr>
<tr>
<td>Cap.</td>
<td>(-$808B)</td>
<td>(-$629B)</td>
<td>(-$502B)</td>
<td>(-$731B)</td>
<td>(-$457B)</td>
</tr>
<tr>
<td><strong>Book</strong></td>
<td>8%</td>
<td>18%</td>
<td>21%</td>
<td>25%</td>
<td>33%</td>
</tr>
<tr>
<td>Equity</td>
<td>($65B)</td>
<td>($143B)</td>
<td>($171B)</td>
<td>($201B)</td>
<td>($267B)</td>
</tr>
<tr>
<td><strong>S&amp;P 500</strong></td>
<td>-38%</td>
<td>-24%</td>
<td>-16%</td>
<td>-18%</td>
<td>0.67%</td>
</tr>
</tbody>
</table>
Part III: Bank Constraints
(Tedious) accounting
  - T-accounts have to add up

Steps:
  1. Quantify flows from shadow to traditional banks (indirect channel)
  2. Quantify traditional bank losses (direct channel)
  3. Analyze cross-sectional responses (constraints)
Discussion of possible constraints on traditional banks

- Shocks matter only when TB face constraints
Discussion of possible constraints on traditional banks

- Shocks matter only when TB face constraints

1. Book capital requirements
2. Equity issuance costs
3. Risk based funding constraints (margin)
4. Market based constraints (banks’ value affects leverage and ultimately size of bank)
5. Sticky balance sheet
3) Risk-based funding constraints imply pro-cyclical leverage - Data: countercyclical
4) Market based constraints predict stable leverage

Liabilities and Market Capitalization
Change in Logs Over Past Three Years

Market Capitalization (Log Differences)
Liabilities (Log Differences)

2006 Q1 2009 Q1
Change in Logs Over Past Three Years

○ 2006 Q1  + 2009 Q1
5) Sticky balance sheet: Illiquid liabilities

- Banks cannot easily liquidate certain liabilities (e.g. deposits)
- If only liabilities left are illiquid, then can’t delever quickly
5) Sticky balance sheet: Illiquid liabilities

- Banks cannot easily liquidate certain liabilities (e.g. deposits)
- If only liabilities left are illiquid, then can’t delever quickly
- Focus only on “liquid” liabilities, i.e. repo
  - Dynamic equity elasticity of liquid liabilities like repo would be high
    - But, $\eta_{\text{Repo}}$ follows same pattern (sizable pre-crisis, negligible post-crisis)
5) Sticky balance sheet: Illiquid assets

- If illiquid assets are a problem, banks should liquidate their more liquid assets

- Hard to test because of confounds
- Same banks which face market losses may also face liquidity concerns

- Liquid assets may also be less risky (overlevered banks seek lower risk)
- $\eta_{Cash}$ is positive pre-crisis and negative post-crisis
- Asymmetric information problems in selling MBS, mortgages, loans, etc.
Conclusion

• Two numbers: measure size of implosion of shadow-banks and losses to traditional banks.

• Modeling Constraints:
  • Different constraints: need second generation macro-banking models
  • Illiquid assets and dynamic debt overhang
Back-up slides
4) Equity Issuance Costs
Book equity & market cap. of Top 4

USD Billion

Equity Market Capitalization Preferred Equity

Bank of America

Citigroup

J.P. Morgan

Wells Fargo

Equity Market Capitalization Preferred Equity

USD Billion

2000q1 2004q1 2008q1 2012q1 2000q1 2004q1 2008q1 2012q1

Bank of America Citigroup

J.P. Morgan Wells Fargo

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3) Cross-sectional test for market-based constraints

- Estimate *dynamic equity elasticity of liabilities*

\[ \Delta \log \text{Liabilities}_{it} = \eta \Delta \log \text{Market Equity}_{it} + \delta_t + \xi_{it} \]

- \( \eta \) tells us how an equity shock affects liabilities
- If banks fully respond to maintain stable leverage, then \( \eta = 1 \)
## Dynamic equity elasticity (three year window)

<table>
<thead>
<tr>
<th></th>
<th>(1) Liabilities (3 Year)</th>
<th>(2) Loans (3 Year)</th>
<th>(3) Repo (3 Year)</th>
<th>(4) Cash (3 Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆ Log Market Cap.</td>
<td>0.458***</td>
<td>0.490***</td>
<td>0.567**</td>
<td>0.367***</td>
</tr>
<tr>
<td></td>
<td>(0.0296)</td>
<td>(0.0310)</td>
<td>(0.183)</td>
<td>(0.0790)</td>
</tr>
<tr>
<td>Post * ∆ Log Market Cap.</td>
<td>-0.441***</td>
<td>-0.452***</td>
<td>-0.450*</td>
<td>-0.556***</td>
</tr>
<tr>
<td></td>
<td>(0.0331)</td>
<td>(0.0347)</td>
<td>(0.202)</td>
<td>(0.0883)</td>
</tr>
<tr>
<td>Post</td>
<td>0.176***</td>
<td>0.197***</td>
<td>0.182</td>
<td>0.383***</td>
</tr>
<tr>
<td></td>
<td>(0.0289)</td>
<td>(0.0304)</td>
<td>(0.160)</td>
<td>(0.0773)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.107***</td>
<td>0.133***</td>
<td>0.187</td>
<td>-0.139*</td>
</tr>
<tr>
<td></td>
<td>(0.0206)</td>
<td>(0.0216)</td>
<td>(0.115)</td>
<td>(0.0551)</td>
</tr>
<tr>
<td>Observations</td>
<td>630</td>
<td>629</td>
<td>463</td>
<td>626</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.303</td>
<td>0.321</td>
<td>0.035</td>
<td>0.151</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Asymmetric dynamic equity elasticity

- $\eta$ is sizable pre-crisis, and near zero post-crisis
  - Perhaps banks “want to” delever, but asymmetric adjustment costs make it costly
Asymmetric dynamic equity elasticity

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- What’s illiquid?
  - Liabilities
  - Assets

- Banks can also raise equity to counteract shocks
  - ZLB on dividends
  - Frictions raising equity
Asymmetric dynamic equity elasticity

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  - Liabilities
  - Assets

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  - ZLB on dividends
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- Examine these different possibilities
Deposits as a Share of Liabilities

Share with Deposit Ratio of One
2006 Q1: 0.00
2009 Q1: 0.00
2012 Q1: 0.00
Deposits as a Share of Liabilities (Weighted by Liabilities)

Share with Deposit Ratio of One
2006 Q1: 0.00
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Density

Deposits as a Share of Liabilities

2006 Q1
2009 Q1
2012 Q1