The Flight from Maturity

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Explaining the Crisis

• How can a small shock cause a large crisis?


↓

?

Ben Bernanke: “13 of the most important financial institutions in the United States, 12 were at risk of failure within a period of a week or two.”
Standard Narrative

• Standard view: Two shocks—“if not for Lehman . . . “

• Incoherent: Lehman must have been vulnerable. Why?
This paper

• Why did the failure of Lehman Brothers make the financial crisis dramatically worse?
• We argue that risk built up endogenously during the crisis as market participants tried to preserve the moneyness of money market instruments.
• A crisis is a process in which risk builds up.
• We test model predictions by providing a formal chronology of the crisis.
Private Money Market Instruments

• Secured: repo
  – GC repo
  – Repo backed by privately-created bonds

• Unsecured: CP, ABCP, Fed Funds, LIBOR
  – Issuers screened, either by bank regulatory authorities or by market participants

• When “moneyness” questioned, it can be re-created by: tighter screening of issuers, higher haircuts, better collateral, shorter maturities.
Model

Crisis Phases

- Anxious
- Crisis
- Runs
- Depression
Summary of Model Results

• Anxious banks want to borrow long, but Anxious lenders want to lend short.
  - Lenders want option to exit; borrowers want to lock in loans to avoid rollover risk.

• → Maturities shorten; term structure of spreads becomes upward sloping.

• Forest getting drier and drier. Lehman was the match.

• There can be a run if Anxious lenders exit to avoid expected future losses.

• Test chronology.
Spreads

• \( r_{t,i}^{\tau} \) is the annualized rate of return at time \( t \) for money market instrument \( i \) with maturity \( \tau \).

• Define: \( \theta_{t,i}^{\tau} \equiv r_{t,i}^{\tau} - r_{t,FF}^{\tau} \) as the spread between the rate on money market instrument \( i \) and the Federal Funds target rate at date \( t \) for maturity \( \tau \).
Overnight Money Market Spreads Before the Crisis
Overnight Money Market Spreads Before and During Crisis

Before Crisis vs During Crisis

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Money Market Spreads

First repo break

Second repo break

Fed_Fund
GC
LIBOR
A2_P2_Nonfinancial
AA_Asset_backed
AA_Financial
AA_Nonfinancial
A_AAA_ABS_Auto__CC___SL
AA_AAA_ABS_RMBS___CMBS
AA_AAA_CLO
BBB_AAA_Corporates
_AA__ABS_RMBS__CMBS
AA_AAA_Corporates
Breakpoints in Panels

• Bai (2010): Consider a panel of N series, as follows:
  \[ Y_{it} = \mu_{i1} + \sigma_{i1} \eta_{it}, \quad t = 1,2, \ldots, k_0 \]
  \[ Y_{it} = \mu_{i2} + \sigma_{i1} \eta_{it}, \quad t = k_0+1, \ldots T \]
  \( i = 1,2, \ldots, N \)

where \( E(\eta_{it})=0 \) and \( \text{var}(\eta_{it})=1 \), and for each \( i \), \( \eta_{it} \) is a linear process; there are other assumptions as well.

• The breakpoint, \( k_0 \) in means and variances is unknown. Consistent estimation requires that there are breakpoints in either the means or the variances (or both).
Breakpoints (cont.)

• Monte Carlo experiments show that panel can be very small, e.g., one series.
• Once the breakpoint date is found, Chow tests confirm.
• No power against gradual change. Nothing here about gradual vs. sudden change.
Panels

• We group the data series into five different panels with recognizable economic content:
  (1) the real sector of the economy;
  (2) the subprime housing sector;
  (3) financial firms;
  (4) the unsecured money markets; and
  (5) the secured money markets.

• We further divide the financial firms to consider including and excluding Lehman. We also consider subsets of the real sector and subprime, as well.
<table>
<thead>
<tr>
<th>Real Sector</th>
<th>Repo Categories</th>
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</thead>
<tbody>
<tr>
<td>VIX</td>
<td>GC</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>&lt;AA ABS-RMBS / CMBS</td>
</tr>
<tr>
<td>JPM HY Index</td>
<td>A-AAA ABS-Auto / CC / SL</td>
</tr>
<tr>
<td>DJ CDX.IG</td>
<td>AA-AAA ABS-RMBS / CMBS</td>
</tr>
<tr>
<td>Subprime</td>
<td>AA-AAA CLO</td>
</tr>
<tr>
<td>ABX</td>
<td>AA-AAA Corporates</td>
</tr>
<tr>
<td>HEL</td>
<td>BBB+ / A Corporates</td>
</tr>
<tr>
<td>Financial Firms</td>
<td></td>
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<tr>
<td>Financial CDS</td>
<td></td>
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<td>Interbank Money Markets</td>
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<tr>
<td>Fed Fund</td>
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<td>LIBOR</td>
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<td>OIS</td>
<td></td>
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<tr>
<td>Commercial Paper</td>
<td></td>
</tr>
<tr>
<td>A2/P2 Nonfinancial</td>
<td></td>
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<tr>
<td>AA Asset-backed</td>
<td></td>
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<tr>
<td>AA Financial</td>
<td></td>
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<td>AA Nonfinancial</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Description</th>
<th>Num. of Securities</th>
<th>Break Point</th>
<th>Lower bound</th>
<th>Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repo</td>
<td>6</td>
<td>2007/7/23</td>
<td>2007/7/20</td>
<td>2007/7/25</td>
</tr>
<tr>
<td>Financial CDS: Include Lehman</td>
<td>10</td>
<td>2007/7/23</td>
<td>2007/7/23</td>
<td>2007/7/24</td>
</tr>
<tr>
<td>Real Sector: VIX, S&amp;P 500, JPM HY Index, DJ CDX.IG</td>
<td>6</td>
<td>2008/1/3</td>
<td>2008/1/3</td>
<td>2008/1/10</td>
</tr>
</tbody>
</table>
Breakpoints (cont.)

• Multiple breakpoints: After the first breakpoint is located, the two subsamples can be investigated further for other breakpoints, and so on.
Money Markets: Crisis Chronology for Spreads

2007
- July 23, 2007: Repo1
- Aug. 6, 2007: ABCP1
- Aug. 13, 2007: Unsec1
- Aug. 14, 2008: GC Repo1

July 27, 2007
- July 27, 2007: ABCP1
- Aug. 6, 2007: Unsec1
- Aug. 13, 2007: GC Repo1

2008
- Aug. 14, 2008: Repo2
- Sept. 12, 2008: GC Repo2
- Sept. 15, 2008: ABCP2
- Sept. 15, 2008: Unsec2
- Oct. 16, 2008: Lehman Fails

- Oct. 16, 2008: ABCP3
- Oct. 16, 2008: GC Repo3
- Oct. 16, 2008: Unsec3

Dec. 15, 2008
- Dec. 15, 2008: ABCP3
- Dec. 15, 2008: GC Repo3
- Dec. 15, 2008: Unsec3
The Flight from Maturity

• Only CP has issuance data by maturity.
  – But issuer mix is changing as low quality issuers are forced to exit.

• $\theta_{t,i}^{\tau} \equiv r_{t,i}^{\tau} - r_{t,FF}^{\tau}$ is the spread between the rate on money market instrument $i$ and the Federal Funds target rate at date $t$ for maturity $\tau$.

• $\Phi_{t,i}^{\tau_2,1} \equiv \theta_{t,i}^{\tau_2} - \theta_{t,i}^{\tau_1}$, where $\tau_2 > \tau_1$, is the slope of the term structure of spreads (various maturities).

• Slope flat in normal times, but increases in crisis.
Short/Long Issuance Ratio,
AA Asset-Backed CP
Counterparty Risk (bps) and CP Maturities

- LIBOIS Three-month Spread
- Short-long Ratio, 30 Day Rolling
Term Structure of Spreads

- Maturities endogenous, to be consistent with “moneyness” – so the term structure should be flat during normal times.

- If dealers want to borrow long (pay a higher spread) and lenders will only lend short (a lower spread), then term structure steepens.
<AA  ABS-RMBS / CMBS Repo Spread Term Structures (bps)
<table>
<thead>
<tr>
<th>Breaks in Repo Haircuts</th>
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</thead>
<tbody>
<tr>
<td><strong>Break point</strong></td>
</tr>
<tr>
<td>First Break</td>
</tr>
<tr>
<td>Second Break</td>
</tr>
<tr>
<td>Third Break</td>
</tr>
</tbody>
</table>
Average Haircut on Structured Products

- Non-Subprime-Related Index
- Subprime-Related Index

First Break
Second Break
Third Break/Lehman
**Start of crisis**

- **Subprime Shock (ABX, HEL), Jan. 4, 2007**
- **CP Issuance, Short/Long Ratio, June 13, 2007**
- **Repo Shock, July 23, 2007**
  - Repo term structure of spreads, July 23, 2007
- **Unsecured Money Market Shock (CP, fed funds, LIBOR), August 8, 2007**
  - Term structure of unsecured MM instruments, August 8, 2007
- **Repo Haircuts, October 23, 2007**
- **Real Effects, January 3, 2008**

**Fed announces the Term Auction Facility, Dec. 12, 2007**
Build-up of Fragility

- Third break in financial firms CDS, June 26, 2008
- Run on IndyMac, July 8, 2008
- OTS closes IndyMac, July 11, 2008
- Repo, August 14, 2008
  Repo term structure slope, August 14, 2008
- Repo, August 14, 2008
  Repo term structure slope, August 14, 2008
- Govt. takeover of Freddie and Fannie, Sept. 7, 2008
Build-up of Fragility

- Fourth break in financial firms CDS, Sept. 11, 2008
- Unsecured money market spreads (CP, fed funds, LIBOR), and the term structures of their spreads, September 12, 2008
- Repo Haircuts, September 15, 2008
  *Lehman Bankruptcy, September 15, 2008*
- TARP becomes law, Oct. 3, 2008
Summary

• A financial crisis is not a “shock.”
  – Fragility builds up during the preceding credit boom (Gorton and Ordonez).
  – But, fragility also builds up during the crisis.
• A “crisis” is the result of an endogenous build-up of fragility.
• A key element is the shortening of maturity during the crisis.
• “Tail risk” is endogenous.