The Flight from Maturity

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Understanding Crisis Dynamics

• Why did the failure of Lehman Brothers make the financial crisis dramatically worse?

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

• We argue that risk built up during the crisis as market participants tried to recover/preserve the moneyness of money market instruments.

• 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.
Money Markets in a Crisis

• Summary of model results:
  – Most money market spreads increase because crisis is not diversifiable. Some spreads decrease in a flight to quality.
  – Bank wants to borrow long, but lenders want to lend short.
    • Lenders want option to exit; borrowers want to lock in loans to avoid rollover risk.
  – \( \rightarrow \) Maturities shorten; term structure of spreads becomes upward sloping.
  – Banks want to avoid having to sell assets; do not want to sell at fire sale prices if haircuts rise or CP does not roll.
  – \( \rightarrow \) Haircuts increase last.
  – These dynamics are repeated: forest getting drier and drier. Lehman was the match.
  – Test chronology.
Spreads

• $r_{ti}^{\tau}$ 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

- General Collateral Repo
- A/2P Nonfinancial Cp
- A/2P Financial Cp
- A/1P nonFinancial Cp
- <AA ABS-RMBS / CMBS
- AA-AAA ABS-Auto / CC / SL
- AA-AAA ABS-RMBS / CMBS
- AA-AAA CDO
- AA-AAA CLO
- BBB+/A Corporates
- Unpriced ABS / MBS / All Sub-prime
- Unpriced CLO / CDO

- Before Crisis
- During Crisis
Money Market Spreads

First repo break

Second repo break

A2_P2_Nonfinancial
AA_Asset_backed
AA_Financial
AA_Nonfinancial
Fed_Fund
GC
LIBOR
_AAA_ABS_RMBS__CMBS
_AA_AAA_Corporates

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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.
### Real Sector
- VIX
- S&P 500
- JPM HY Index
- DJ CDX.IG

### Subprime
- ABX
- HEL

### Financial Firms
- Financial CDS

### Interbank Money Markets
- Fed Fund
- LIBOR
- OIS
- Commercial Paper
- A2/P2 Nonfinancial
- AA Asset-backed
- AA Financial
- AA Nonfinancial

### Repo Categories
- GC
- <AA ABS-RMBS / CMBS
- A-AAA ABS-Auto / CC / SL
- AA-AAA ABS-RMBS / CMBS
- AA-AAA CLO
- AA-AAA Corporates
- BBB+ / A Corporates
<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: Unsec1
- Aug. 13, 2007: GC Repo1
- July 27, 2007

2008
- Aug. 14, 2008: Repo2
- Sept. 12, 2008
- Aug. 13, 2008: ABCP1
- Sept. 15, 2008: Lehman Fails
- Oct. 16, 2008: ABCP3
- Dec. 15, 2008: ABCP3, GC Repo3, Unsec3

Lehman Fails

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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
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.
LIBOR Spread Term Structures (bps)

- Overnight
- One-month
- Three-month

Dates:
- 2007/7/23
- 2008/8/14
- 2008/12/15
<table>
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<tr>
<th>Breaks in Repo Haircuts</th>
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<tr>
<td></td>
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<tr>
<td>First Break</td>
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<tr>
<td>Second Break</td>
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<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
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
The build-up of fragility

- Repo spreads, August 14, 2008
- Repo term structure slope, August 14, 2008
- Repo Haircuts, September 9, 2008
- Term structure of unsecured MM instruments, September 12, 2008
- *Lehman Bankruptcy, September 15, 2008*
- Unsecured Money Market Shock (CP, fed funds, LIBOR), September 12, 2008
- CP Issuance, Short/Long Ratio, September 26, 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.