FIRE-SALE SPILLOVERS
AND SYSTEMIC RISK

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THE RISK OF FIRE-SALES
IN THE TRI-PARTY REPO MARKET

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AND SYSTEMIC RISK

The views expressed in this presentation are the authors’ and may not represent the views of the Federal Reserve Bank of New York or the Federal Reserve System.
Outline

- Overview of the US repo market
- What are fire sales and why are they a concern?
- A framework to think about fire sales
  - Pre- vs. post-default fire sales
- Measuring fire sale risk
Segments of the U.S. repo market

Bilateral cash
Investors:
• Hedge funds
• Asset managers
• others

$1.47 T

$ 2.31 T

$ 1.55 T

$ 0.24 T

Tri-party cash
Investors:
• MMFs
• Securities lenders
• others

Securities dealers

GCF

Tri-party repo market

Volumes as of September 2013

• PB clients
• Hedge funds
• others

Cash

Securities
Why are fire sales a concern?

- Fire sales are an externality and can spread systemic risk
- Rapid sales exert pressure on the prices of assets
  - Other institutions holding these assets see their capital eroded and may have to delever
  - Institutions using these assets as collateral could face margin calls and may be forced to sell assets
- Price declines can affect firms unrelated to the initial problem and other markets altogether
The U.S. TPR market is a particular concern

- Large size of portfolios financed in these markets
  - Large dealers’ books currently range between $100 and over $150 billion
  - Peak levels in excess of $400 billion

- Substantial amount of privately issued securities
  - About 18% of assets, almost $300 bil., as of Sep. 2013

- Some investors, such as MMFs and securities lenders, face liquidity pressures of their own
  - Could stop rolling over repos precipitously
  - May need to sell repo securities quickly after a dealer default
Collateral financed in the TPR market

**September 2008**
- Agency MBS: 35.4%
- US Treasuries and Strips: 21.3%
- Agency Debenture: 15.5%
- Fixed Income: 10.6%
- Other: 7.9%
- Agency CMOs: 4.9%
- Equities: 4.4%

**September 2013**
- US Treasuries and Strips: 39.1%
- Agency MBS: 36.6%
- Agency Debenture: 5.1%
- Fixed Income: 5.9%
- Other: 3.2%
- Agency CMOs: 4.3%
- Equities: 5.7%
Lessons from the crisis: not reassuring

- Instances of fire sales in the bilateral market:
  - Peloton
  - Thornberg
  - Carlyle

- Precipitous declines in TPR funding in a few cases
  - Bear Stearns
  - Lehman

- Worse was avoided with exceptional interventions
  - PDCF and TSLF
Pre- vs. post-default fire sales

- Pre-default fire sales relate to maturity transformation
  - Assets that cannot be financed may have to be sold
  - Similar to a bank run
  - The borrower may be “solvent but illiquid”

- Post-default fire sales occur after a borrower has defaulted when its counterparties sell their repo securities quickly
  - Repos benefit from an exemption from the automatic stay of bankruptcy
Need to address both pre- and post-default fire sales

- Addressing one risk can mitigate the other
  - …but may not eliminate it

- Reducing the risk of pre-default fire sale would make insolvency and post-default fire sale less likely
  - …but insolvency could be triggered by other factors (fraud)

- Reducing the risk of post-default fire sale would make runs and pre-default fire sales less likely
  - …but some investors may still be subject to their own liquidity pressures, which can lead to runs
Measuring fire sale risk

- Ideally, we would like to estimate the price impact of a sale of a given volume of securities in a short amount of time
  - This is complicated, probably highly non-linear, and state dependent
  - No standard econometric method

- Instead, we use indirect methods
  1. Days required to liquidate hypothetical tri-party repo portfolio
  2. Fire-sale losses after hypothetical shock to assets
Hypothetical tri-party repo portfolio

- We assume a portfolio of $150 Billion
- Asset breakdown reflects data for the whole market

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Dollar Value in Billions</th>
<th>Share of Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Treasuries and Strips</td>
<td>53.0</td>
<td>35.3%</td>
</tr>
<tr>
<td>Agency debt</td>
<td>7.8</td>
<td>5.3%</td>
</tr>
<tr>
<td>Agency MBS and CMO</td>
<td>66.3</td>
<td>44.2%</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>5.1</td>
<td>3.4%</td>
</tr>
<tr>
<td>Equities</td>
<td>8.3</td>
<td>5.5%</td>
</tr>
<tr>
<td>ABS</td>
<td>2.9</td>
<td>1.9%</td>
</tr>
<tr>
<td>All other</td>
<td>6.6</td>
<td>4.4%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>150</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Volume that can be liquidated without price change

- Reflects input from market participants and staff from NY Fed’s Market group staff
- Assumes normal market conditions

<table>
<thead>
<tr>
<th>Collateral Type</th>
<th>Amount that can be liquidated in one day without an adverse impact on market prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Treasuries and Strips</td>
<td>$7.5 billion</td>
</tr>
<tr>
<td>Agency debt</td>
<td>$2 billion</td>
</tr>
<tr>
<td>Agency MBS and CMO</td>
<td>$4 billion</td>
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<tr>
<td>Corporate bonds</td>
<td>$250 million</td>
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<tr>
<td>Equities</td>
<td>$500 million</td>
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<tr>
<td>ABS</td>
<td>$125 million</td>
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</table>
Days to liquidate

Long liquidation horizons, especially given conservative assumptions, suggest a high risk of fire sales

<table>
<thead>
<tr>
<th>Collateral Type</th>
<th>Days needed to liquidate segment of hypothetical portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Treasuries and Strips</td>
<td>8</td>
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<tr>
<td>Agency debt</td>
<td>3</td>
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<tr>
<td>Agency MBS and CMO</td>
<td>16</td>
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<tr>
<td>Corporate bonds</td>
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<tr>
<td>Equities</td>
<td>18</td>
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<tr>
<td>ABS</td>
<td>24</td>
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</table>
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FIRE-SALE SPILLOVERS AND SYSTEMIC RISK

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Fire-sale spillovers and systemic risk

- Quantify fire-sale spillovers as measure of systemic risk
  - Based on framework of Greenwood, Landier and Thesmar (2012)

- **Hypothetical scenario:**
  1. Shock hits one or more asset classes
  2. Dealers suffer losses from the asset shock
  3. To delever, dealers sell assets
  4. Asset fire sales have price impact
  5. Dealers suffer losses from the fire sale

- **Direct losses** → Like a stress test
- **Fire-sale losses** → Our focus
Potential losses over time (0.1% shock to all assets)
The measure and its components

\[ \frac{1}{e} \sum_i \left( a_i \times b_i \times \sum_k \ell_k a_k m_{ik} \times f \right) \]

contribution of dealer i

- **Size** \( a_i \) (total assets)
  - More sales \( \rightarrow \) deeper price impact \( \rightarrow \) larger fire-sale losses

- **Leverage** \( b_i \) (ratio debt to equity)
  - More levered \( \rightarrow \) larger initial losses \( \rightarrow \) more sales …

- **Connectedness** \( \sum_k \ell_k a_k m_{ik} \) (holds illiquid, widely held assets)
  - More illiquid \( \rightarrow \) deeper price impact \( \rightarrow \) larger fire-sale losses
  - Widely held \( \rightarrow \) more fire-sale spillovers to other dealers
Decomposition of fire-sale losses

<table>
<thead>
<tr>
<th>Percent of system equity (%)</th>
<th>Jan-11 = 100</th>
<th>Jul-08</th>
<th>Jan-09</th>
<th>Jul-09</th>
<th>Jan-10</th>
<th>Jul-10</th>
<th>Jan-11</th>
<th>Jul-11</th>
<th>Jan-12</th>
<th>Jul-12</th>
<th>Jan-13</th>
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<tr>
<td>-3%</td>
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<td>120</td>
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<td>6%</td>
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FS losses

Size Leverage Connectedness
Conclusion

- The risk of pre- and post-default fire sales is still a major concern for financial stability, notably in US TPR market

- Regarding pre-default fire sales:
  - The Fed can influence the practices of BHC-affiliated dealers to reduce their vulnerability to runs – but not IBDs
  - Other regulators can influence the behavior of lenders in this market in ways that reduce their propensity to run

- But we can’t completely eliminate run risk
  - A post-default solution is needed

- We need the market to come together to fix this problem
  - LTCM