Wedndesday Lecture 1
Repo Runs

August 8, 2012
Gorton and Metrick, “The Run on Repo”
Haircuts

From Gorton and Metrick, Table II, Panel D

<table>
<thead>
<tr>
<th>Assets</th>
<th>2007 Q1-2</th>
<th>2007 Q3-4</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-AAA ABS-Auto/CC/SL</td>
<td>0.0%</td>
<td>0.9%</td>
<td>9.5%</td>
</tr>
<tr>
<td>AA-AAA ABS-RMBS/CMBS</td>
<td>0.0%</td>
<td>1.8%</td>
<td>17.1%</td>
</tr>
<tr>
<td>&lt; AA ABS-RMBS/CMBS</td>
<td>0.0%</td>
<td>3.7%</td>
<td>18.6%</td>
</tr>
<tr>
<td>Unpriced ABS/MBS/All subprime</td>
<td>0.0%</td>
<td>7.7%</td>
<td>68%</td>
</tr>
<tr>
<td>AA-AAA CDO</td>
<td>0.0%</td>
<td>8.3%</td>
<td>53.5%</td>
</tr>
<tr>
<td>Unpriced AA-AAA CDO/CLO</td>
<td>0.0%</td>
<td>10.5%</td>
<td>57.3%</td>
</tr>
</tbody>
</table>
Overview of Martin, Skeie, von Thadden

- General model applicable to MMMFs, hedge funds, ABCP conduits, SIVs and investment banks
- Many non-banks are involved in maturity transformation, using short term funding backed by long term assets (Gorton and Metrick)
- These structures share fragility of banks, e.g., Bear Sterns
- Sunspot equilibria in repo markets (Diamond and Dybvig, Qi)
- Fragility depends on microstructure of repo markets
  - tri-party repo features fixed haircuts and the “unwind”
  - DvP features “first come, first served” and variable haircuts (Gorton and Metrick)
Results

- Unlike in the Diamond-Dybvig or Allen-Gale models, banks can survive runs because (a) they have capital and (b) they can lower investment.
- Ultimately, the cause of failure is a coordination failure (panic).
- The tri-party repo market is less stable because of the unwind.
- Flexible haircuts in the bilateral repo market can be a source of robustness.
**Primitives I**

- **Time:** There is an infinite sequence of dates indexed $t = 0, 1, \ldots$
- **Assets:** There are two assets, a liquid asset (‘cash’) and an illiquid asset
- **Returns:** One unit of the safe asset yields one unit of the good at the next date; $I$ units invested in the illiquid asset produces $F(I) = R \min \{I, \bar{I}\}$ units of the good two periods later
- **Agents:** There is a continuum of ex ante identical investors (e.g., MMMF) and a finite number of dealers (e.g., investment banks)
Primitives II

- **Overlapping generations:** A new generation of investors is born at each date and lives for three periods

- **Endowments:** A new investor has one unit of the good when born and wants to consume in the future

- **Liquidity shocks:** At each date 1, a fraction $\alpha$ of the middle-aged investors become impatient and want to consume immediately; the complementary fraction $1 - \alpha$ want to delay consumption

- **Information:** There is no aggregate uncertainty but investors’ types are private information
Steady-state equilibrium

- The repo contract: \((r, Q, k)\)
- Properties of steady state without runs:
  - returns are independent of maturity;
  - all dealers offer the same return, which satisfies
    \[(1 - \alpha) \beta^2 r^2 + \alpha \beta r = 1\]
  - dealers do not hold cash, investment is maximal \(I = \bar{I}\) and all dealers make positive profits;
  - borrowing satisfies
    \[b_i \leq \frac{(1 + \beta) \beta^2 R\bar{I}}{1 - \alpha + \beta}\]
    and collateral satisfies
    \[
    \frac{1}{\beta R} \leq k_i \leq \frac{(1 + \beta) \beta \bar{I}}{(1 - \alpha + \beta) b_i}
    \]
Surviving runs

- If there is a run, a dealer has two sources of liquidity: profits and funds for reinvestment.
- He can pay off the investors iff

\[ R\bar{I} - \left( r + (1 - \alpha) r^2 \right) b_i \geq 0 \]

- Substituting for \( r \) we get the liquidity constraint

\[ \beta^2 R\bar{I} \geq (1 - \alpha + \beta) b_i \geq 0 \]

- The liquidity constraint is tighter if
  - borrowing is higher
  - investment capacity is lower
  - productivity \( R \) is lower
Repo runs in the tri-party market

- Collateral cannot be varied in the short run
- The clearing bank “unwinds” the previous evenings repos, sends cash to investors and takes possession of the collateral
- The payoffs from a run are given as follows:

<table>
<thead>
<tr>
<th></th>
<th>other roll over</th>
<th>investors run</th>
</tr>
</thead>
<tbody>
<tr>
<td>roll over</td>
<td>$\hat{r}_i$</td>
<td>$\gamma Rk_i$</td>
</tr>
<tr>
<td>run</td>
<td>$r$</td>
<td>$r$</td>
</tr>
</tbody>
</table>
The collateral constraint

- Investors will roll over their repos if and only if

\[ r \leq \gamma Rk_i \]

Call this the *collateral constraint*

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**Theorem**

*In the tri-party repo market, a run on a dealer can occur and bankrupt the dealer if and only if the liquidity constraint and the collateral constraint are both violated.*

\[ \beta^2 R\bar{I} \geq \frac{1 - \alpha + \beta}{\gamma (1 + \beta)} b_i \]

are both violated.
Likelihood of runs

- The collateral constraint is more likely to be violated
  - the lower is $\gamma$
  - the higher is borrowing $b_i$
  - the lower is the dealer’s investment capacity $\bar{I}$
  - the lower is the dealer’s productivity
Bilateral repos

- Bilateral repos are for longer terms than tri-party repos
- There is greater opportunity to adjust the amount of collateral to prevent a run
- The maximum value of collateral per unit borrowed is

\[
\bar{k} = \frac{\bar{l}}{\left(r + (1 - \alpha) r^2\right) b_i - R\bar{l}}
\]

- First come, first served constraint

\[
\varphi = \frac{R\bar{l}}{\left(r + (1 - \alpha) r^2\right) b_i}
\]
Likelihood of runs

- The payoffs from a run are

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<tr>
<td>$\hat{r}_i$</td>
<td>$\gamma Rk_i$</td>
</tr>
<tr>
<td>$r$</td>
<td>$\varphi r + (1 - \varphi) \gamma Rk_i$</td>
</tr>
</tbody>
</table>

- In the bilateral repo markets, a run on a dealer $i$ can occur and bankrupt the dealer if and only if the dealer’s collateral constraint

$$\beta^2 R\bar{I} \geq \frac{1 - \alpha + \beta}{1 + \gamma \beta} b_i$$

is violated.
Conclusion

- Institutions matter
- Haircuts can help markets clear (Geanakoplos)
- Was the financial crisis “only” a sunspot?