Discussion of:

Rollover Risk and Market Freezes

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Bank of Korea International Conference
June 2009

The views expressed herein are my own and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.
Repurchase agreements ("repos")

- The repo market is a large part of the financial system
  - total size of repo market $\sim$ $12$ trillion
    (Source: Gorton and Metrick, 2009)
  - compared to total assets in U.S. banking system $\sim$ $10$ trillion

- Repo haircuts rose dramatically in 2007
  - higher haircuts $\Rightarrow$ less repo financing for a given portfolio
  - increase in haircuts is like an outflow of deposits (a "run")
  - leads to insolvency, other problems
Repo Haircuts, Various Structured Asset Classes, 2005-2008

Why did haircuts rise so much?

- Increased uncertainty about value of assets?
  - larger haircut needed to secure lender
  - generally not considered quantitatively plausible

- Increased liquidation cost for assets?
  - if lenders are stuck with collateral, may all try to sell at once
  - may or may not be quantitatively plausible

- This paper offers an alternative answer:
  - frequent rollovers and repeated default
The Model

- Three periods $t = 1, 2, 3$

- At each date, state is either $\begin{cases} L \text{ (low)} \\ H \text{ (high)} \end{cases}$

  - transition matrix: $\begin{bmatrix} p & (1 - p) \\ (1 - q) & q \end{bmatrix}$ with $p, q > \frac{1}{2}$

- Asset pays off at $t = 3$: $\begin{cases} V_L \\ V_H \end{cases}$ if state is $\begin{cases} L \\ H \end{cases}$ with $V_H > V_L$

Q: How much can be borrowed against this asset at $t = 1, 2$?
Contracts

- Consider date 2
  - want to promise $V_H$ in good state and $V_L$ in bad state
  - but only simple debt contracts are allowed

- A debt contract with default generates state-contingent payoffs
  - Allen & Gale (1998)
    - but default is costly: lender gets fraction $\lambda < 1$ of collateral value

- Under some conditions, the best contract sets face value equal to $V_H$
  - default occurs in state $L$, lender receives $\lambda V_L$
• Value of this debt at $t = 2$:

\[
B_2(H) = qV_H + (1 - q) \lambda V_L
\]

\[
= qV_H + (1 - q) V_L - (1 - q)(1 - \lambda) V_L
\]
• Value of this debt at $t = 2$:

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expected payoff \hspace{1cm} \text{expected default costs}
Value of this debt at $t = 2$:

\[
B_2(H) = qV_H + (1 - q) \lambda V_L \\
= qV_H + (1 - q) V_L - (1 - q)(1 - \lambda) V_L
\]

\[
\text{expected payoff} \quad \text{expected default costs}
\]

Similarly:

\[
B_2(L) = (1 - p)V_H + pV_L - p(1 - \lambda) V_L
\]

\[
\text{expected payoff} \quad \text{expected default costs}
\]
• Value of this debt at $t = 2$:

$$B_2(H) = qV_H + (1 - q)\lambda V_L$$

$$= qV_H + (1 - q)V_L - (1 - q)(1 - \lambda)V_L$$

expected payoff  expected default costs

• Similarly:

$$B_2(L) = (1 - p)V_H + pV_L - p(1 - \lambda)V_L$$

expected payoff  expected default costs

• Note: $B_2(H) > B_2(L)$ (because $p, q > \frac{1}{2}$)

• Also: $B_2(s) < E[V]$ unless $V_L = 0$
• Now consider $t = 1$
  
  - best contract sets face value $= B_2(H)$
  
  - default in $L$ at $t = 2$, lender receives $\lambda B_2(L)$

• Value of $t = 1$ debt:

$$B_1(H) = qB_2(H) + (1 - q) \lambda B_2(L)$$

$$= \underbrace{qB_2(H) + (1 - q) B_2(L)} - \underbrace{(1 - q)(1 - \lambda) B_2(L)}$$
Now consider $t = 1$

– best contract sets face value $= B_2(H)$

– default in $L$ at $t = 2$, lender receives $\lambda B_2(L)$

Value of $t = 1$ debt:

\[
B_1(H) = qB_2(H) + (1 - q) \lambda B_2(L)
\]

\[
= qB_2(H) + (1 - q) B_2(L) - (1 - q)(1 - \lambda) B_2(L)
\]

- expected payoff at $t = 2$
- expected default cost at $t = 2$
• Now consider $t = 1$

  - best contract sets face value = $B_2(H)$
  - default in $L$ at $t = 2$, lender receives $\lambda B_2(L)$

• Value of $t = 1$ debt:

  $$B_1(H) = qB_2(H) + (1-q)\lambda B_2(L)$$

  $$= \underbrace{qB_2(H) + (1-q)B_2(L)}_{\text{expected payoff at } t = 2} - \underbrace{(1-q)(1-\lambda)B_2(L)}_{\text{expected default cost at } t = 2}$$

  $$= \text{expected payoff at } t = 3$$

  minus expected default cost at $t = 3$
In general

- Conjecture:
  \[ B_n(s) = \text{expected final payout} - \text{expected total default costs} \]

- In other words:
  \[ \text{haircut} = \text{expected total default costs over life of asset} \]

- Or, very roughly:
  \[ \approx (\text{cost of default}) \cdot (\text{prob of default per period}) \cdot (\text{no. of periods}) \]

- Market freezes occurs when one of these increases
An example

- Set: $p = q = 0.99; \lambda = 0.9, V_H = 1, V_L = 0.95$
An example

- Set: $p = q = 0.99; \quad \lambda = 0.9, \quad V_H = 1, \quad V_L = 0.95$

- Mild bad news leads to dramatic rise in haircut
  - reason: default is now likely to occur in every period
Special cases

- In the “optimistic” information structure:
  - $L$ is an absorbing state $\Rightarrow$ default can only occur once
  - $V_L = 0$ (when default occurs, asset is worthless)
  - default cost $= (1 - \lambda) \cdot 0 = 0$
  $\Rightarrow$ debt capacity $=$ expected payoff

- In the “pessimistic” information structure:
  - $H$ is an absorbing state
  - default can occur many times (like example above)
  - result: debt capacity is low
Comments:

(1) How can we evaluate competing theories?

- One alternative explanation: sharp decrease in $\lambda$
  - if large borrower defaults, fire sale and sharp losses for lenders

- Here: $\lambda$ is constant, but \emph{frequency} of default increases sharply

- Which theory better explains the events of 2007-8?
  - what data should we look at to evaluate them?
  - perhaps: relationship between haircut and time to maturity?
(2) What policy implications does the model offer?

- **Ex ante**: want state-contingent payoffs without costly default
  - what are the frictions that prevent this?
  - can policymakers do anything to mitigate these frictions?

- **Ex post**: what government/central bank policies would be effective in dealing with a market freeze?
  - lending? If so, to whom?
  - large-scale asset purchases?
Conclusion

- Paper addresses an interesting and important question
  - why did haircuts on secured loans rise so much?

- Offers a model that can generate a market “freeze”
  - key feature: frequent rollovers and costly default
  - freeze occurs when repeated default becomes likely

- Would like to understand better:
  - evidence in favor of this mechanism
  - what policy implications the model offers