Repo Runs

Antoine Martin  David Skeie  Ernst-Ludwig von Thadden

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1 The views expressed herein are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System.
Two key events in recent crisis: Falls of Bear and Lehman
Common feature: Loss of tri-party repo financing similar to a bank run
But: run on investment rather than commercial banks
This paper:
- Develop a theory of the fragility of wholesale financing
- Investigate the role of market microstructure for stability
- Show similarities and differences with traditional bank runs
Introduction

The Tri-Party Repo Market

- A repo is the sale of a security, coupled with the promise to repurchase the security at a specific future date
- The tri-party repo market is particularly important in the US because of
  - its size
  - its role as a funding market of last resort
- Key source of short-term funds for investment banks, mostly overnight
- Key destination of short-term investment for institutional funds
Introduction

The Tri-Party Repo Market (continued)

- Participants: Dealers - Investors - Clearing banks
- The role of the clearing bank makes the tri-party repo market very different from other repo markets
- Clearing banks facilitate the handling of collateral, provide intra-day financing
- Clearing banks “unwind” repos every morning
  - Unwind provides liquidity and reduces transactions costs
  - Investors are not subject to “roll over” risk
  - Increases fragility
Introduction
The Tri-Party Repo Market: Some Numbers

- Outstanding borrowing volume in the US tri-party repo market
  2002: $700bn
  Peak (2008): $2,700bn
  Today: $1,900bn

- Size of largest individual portfolio (mostly overnight)
  Peak: $400bn
  Today: $250bn
Introduction

Deposit-based and Repo-based Banking

The traditional banking model:

- **households seek**
  - yield and liquidity
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→ maturity transformation

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The repo market:

- large investors seek - yield and liquidity
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The repo market:

- large investors seek yield and liquidity
- repo dealers (broker/dealers) borrow short-term and finance long-term fixed-income portfolios
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Deposit-based and Repo-based Banking

The traditional banking model:
- households seek yield and liquidity
- commercial banks offer demand deposit contracts and finance long-term illiquid assets
- deposit demand satisfies the Law of Large Numbers, leading to maturity transformation

The repo market:
- large investors seek yield and liquidity
- repo dealers (broker/dealers) borrow short-term and finance long-term fixed-income portfolios
- repo outflows satisfy the Law of Large Numbers, leading to maturity transformation
A Model of the Repo Market

Set up

- OLG model of liquidity provision with infinite horizon
- One physical good that can be consumed, stored, or invested
- Agents: “dealers” and “investors”
- Investors: Continuum of mass \( N \) “born” at every date \( t \), endowed with 1 unit of good
  - live for 3 periods, can store the good 1 : 1
  - privately learn in \( t + 1 \) whether they are patient or impatient
  - We assume Law of Large Numbers holds
A Model of the Repo Market

Dealers

- $M$ dealers, infinitely-lived, risk-neutral
- Have access to a long-term technology (investment in securities), subject to decreasing returns to scale
- It is costly to transfer securities to investors or other dealers
- Investor funds are scarce and dealers compete for these funds (offer interest rate $\tilde{r}$)
- Dealers cannot commit to repay investors and must offer collateral ($\kappa$)
Dealers choose a borrowing and investment policy and investors choose a lending policy such that

- no dealer prefers another borrowing and investment policy
- no investor prefers another lending policy, given the behavior of all others.

**Proposition**

A unique steady state equilibrium exist where

- All dealers make strictly positive profits
- Borrowing is indeterminate, below some level that depends on collateral
- Collateral is indeterminate within bounds
Questions:

1. Under what conditions will a dealer survive the collective decision of patient middle-aged investors not to continue lending and of young investors not to provide new funds?
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Individual Dealer Runs without Asset Sales

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   - Because dealer make profit, they can use the available cash to meet unexpected investor demand

2. When is such a collective decision self-enforcing for the investors?
   - Depends on collateral (focus on strict incentives to run)
Fragility
The US Tri-Party Repo Market

1. The clearing bank “unwinds” the previous evening’s repos:
   1. CB sends cash to all investors of each dealer, extinguishing the investors’ exposure to the dealers
   2. At the same time, CB takes possession of the collateral
   3. CB provides collateralized intraday financing to the dealers

2. Some assets mature, reducing the CB’s exposure to the dealer

3. Dealer offers new repo contracts to investors

4. New and patient middle-aged investors decide whether to engage in new repos with a dealer

5. A dealer unable to repay its debt to CB is bankrupt
Fragility

Game between investors:

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<td>don’t</td>
<td>( \bar{r} )</td>
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Equilibria:

- (invest, invest)
- (don’t, don’t) is strict equilibrium iff \( \bar{r} > \kappa_i \)
- \( \bar{r} > \kappa_i \) defines the collateral constraint
Fragility

**Proposition**

_In the tri-party repo market, a run on a dealer can occur and bankrupt the dealer if the dealer’s liquidity constraint and collateral constraint are both violated._
**Fragility**

**Tri-Party Repo Without Unwind**

1. The dealer offers a new repo contract
2. New and patient middle-aged investors decide whether to engage in new repos with a dealer
3. A dealer unable to repay its debt to last period’s repo investors is bankrupt

Two differences compared to unwind:

- Individual investors are repaid iff the dealer can repay everybody
- New and middle-aged investors are in different situations: new investors hold cash, middle-aged investors hold a repo.
Fragility

- Game between middle-aged patient investors:

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- (invest, invest) is unique equilibrium that survives deletion of weakly dominated strategies
Lemma

If middle-aged patient investors reinvest, investing is a dominant strategy for new investors.

Proposition

When there is no unwind, there are no strict incentives to run on dealers.

Intuition: Roll-over of repos becomes similar to roll-over of a bond issue, which is not fragile
Fragility

Bilateral Repo Markets

- Settlement of bilateral repos create a first-come-first-serve constraint.
- Consider “Fed-eligible” securities: settlement through Fedwire Funds Service®, is DvP, triggered by the sender of securities.
- Once triggered: reserves are automatically deducted from the Fed account of the institutions receiving the securities and credited to the Fed account of the institution sending the securities.
Fragility

Timing:

1. Dealers offer new repo contracts
2. New and patient middle-aged investors decide whether to engage in new repos with a dealer.
3. Investors are repaid in the order in which they send back their collateral, until the dealer runs out of cash. From that point on, investors receive their collateral. Any investor who chooses to invest receives his collateral.

Note: Timing is the same as tri-party without unwind but the settlement process is different.
Fragility

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Proposition

In bilateral repo markets, a run on a dealer can occur and bankrupt the dealer if the dealer’s liquidity constraint and collateral constraint are both violated.
Fragility

- With bilateral repos, we allow dealers to offer more collateral in response to a run
- Increasing haircuts makes bilateral repo market more resilient than tri-party repo market
- We don’t provide a deep explanation for the differences between tri-party and bilateral repo markets, but our assumptions are consistent with observed differences
- Under these assumptions, our model can account for different outcomes in the two markets
  - haircuts moved very little in tri-party but moved a lot in bilateral repo market
  - Loss of funding in tri-party was precipitous
Repo haircuts: Tri-party

Median Haircuts by Asset Type

Non Fed-Eligible
Other Fed-Eligible
US Treasuries and Strips
Agency Debentures
Agency MBS

Source: FRBNY Calculations
Repo haircuts: DvP vs Tri-party

Differences in Median Haircuts

Source: FRBNY Calculations
Lehman's Tri-Party Book

Note: Stacked graph.
Cash Investors in Lehman Brothers

Lehman Bankruptcy

Number

9/2/08 9/6/08 9/10/08 9/14/08 9/18/08 9/22/08 9/26/08

0 10 20 30 40 50 60 70 80

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Conclusion

- We build a model of a financial institution that borrow short-term and invests into long-term marketable assets.
- We endogenize the profits of this institutions
- We provide conditions for this institution to be illiquid
- If the institution is illiquid, runs can occur depending on the microstructure
  - We show that current reforms of the tri-party repo market should make that market less fragile
  - We also study microstructure for bilateral repos, MMMFs, and traditional banks
- Under some conditions asset sales can help an illiquid dealer
- Our model makes predictions about the type of dealers we should expect to be safe from a market run