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Emergence and Fragility of Repo Markets

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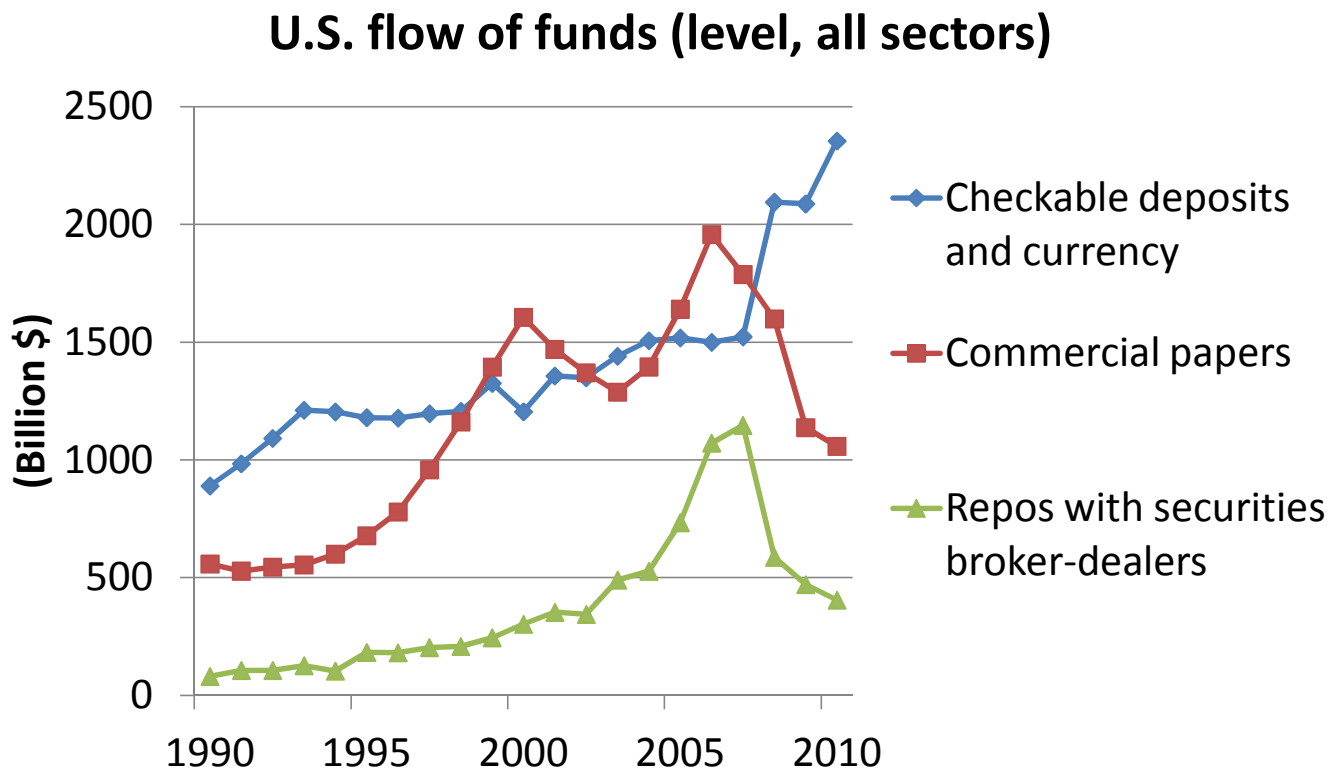
(The views expressed herein are those of the author, and should not be interpreted as those of the Bank of Canada.)

1. Introduction

Repos are one of the primary instruments in the money market.



Most of repo collateral is safe bonds.

Composition of Tri-Party Repo Collateral (Jul '09- Jan '10):

Agency debt	53.8 %
US Treasury securities	28.9 %
Non-Fed eligible securities	17.5 %

Source: Copeland, Martin and Walker (2010).

Why do cash investors need repos when they can simply buy and resell safe bonds in spot transactions?

The outline of this paper

My answer: Cash investors need repos because bond markets are OTC markets.

I present a model to illustrate this result.

The model also indicates repos are fragile: In addition to an equilibrium with repos, there exists another equilibrium in which cash investors stop entering into repos all at once.

I analyze the effects of the PDCF and a CCP on a repo-market collapse in the model.

2. A basic model of cash investors

An overlapping generations model

In each period, a unit continuum of risk-neutral investors are born with cash endowments ("young").

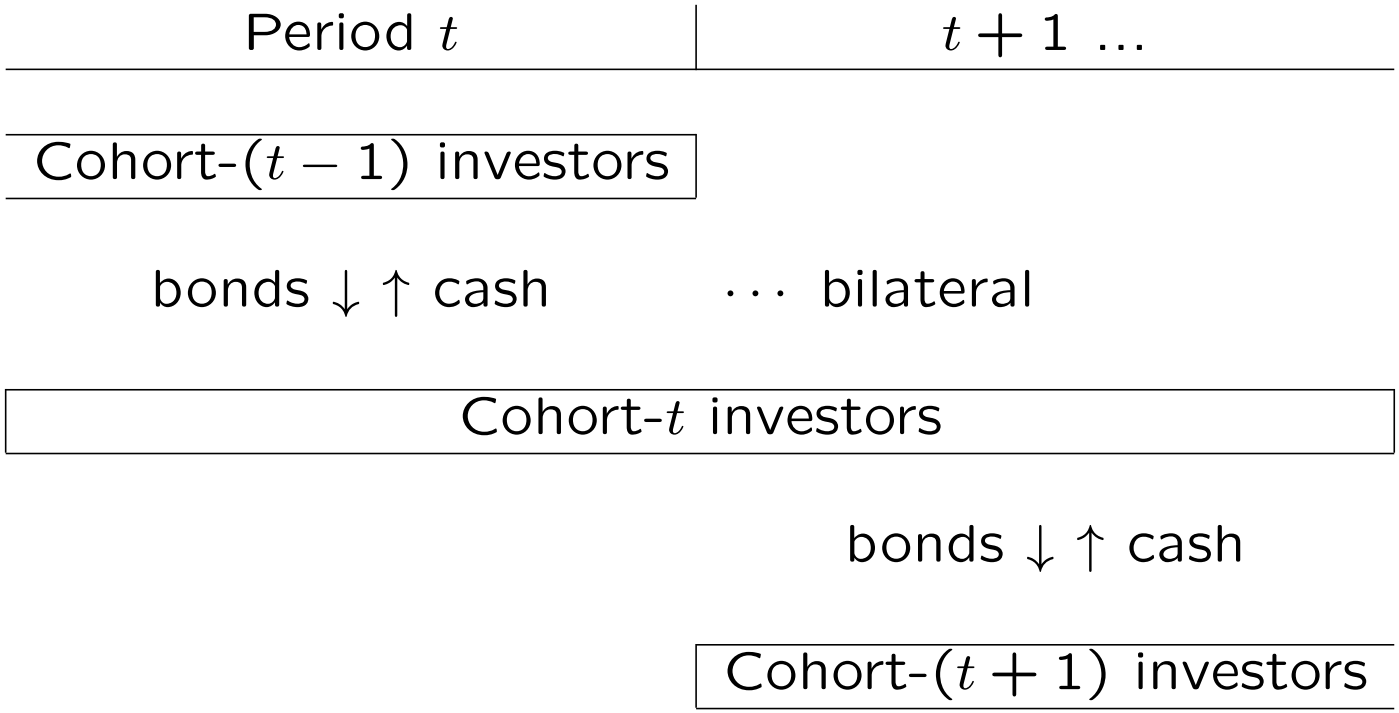
They consume cash in the following period and exit ("old").

Two instruments for cash investments

- T-bills: Fixed rate of return.
- Bonds (Lucas' trees): Constant dividends every period. Fixed supply. Traded in an OTC market.

Investors aim to earn a bond return equal to, or higher than, the T-bill rate.

The basic structure of the bond market



- An investor buys bonds when young, and resells them when old.
- An OTC bond market: each pair of a young and an old investor trade bonds bilaterally.

Bond-liquidation cost due to bilateral bond trade

The terminal payoff for an old investor:

$$\overbrace{c_{i,t}}^{\text{Consumption}} = \overbrace{d + p_{BR,t}}^{\text{Gross return on a bond}} + \overbrace{(1+r)(e_I - p_{BR,t-1})}^{\text{Gross return on T-bills}}$$

Bilateral bond sale from an old investor in cohort $t-1$ to a young investor in cohort t:

$$\max_{p_{BR,t}} (p_{BR,t} - 0)^{0.5} [E_t(d + p_{BR,t+1}) - (1+r)p_{BR,t}]^{0.5}$$

$$\Rightarrow p_{BR,t} = \frac{0.5 E_t(d + p_{BR,t+1})}{1+r} < \frac{E_t(d + p_{BR,t+1})}{1+r}.$$

Intuition: Old investors cannot postpone their cash consumption. As a result, a young investor can negotiate down the price of bonds sold by an old investor.

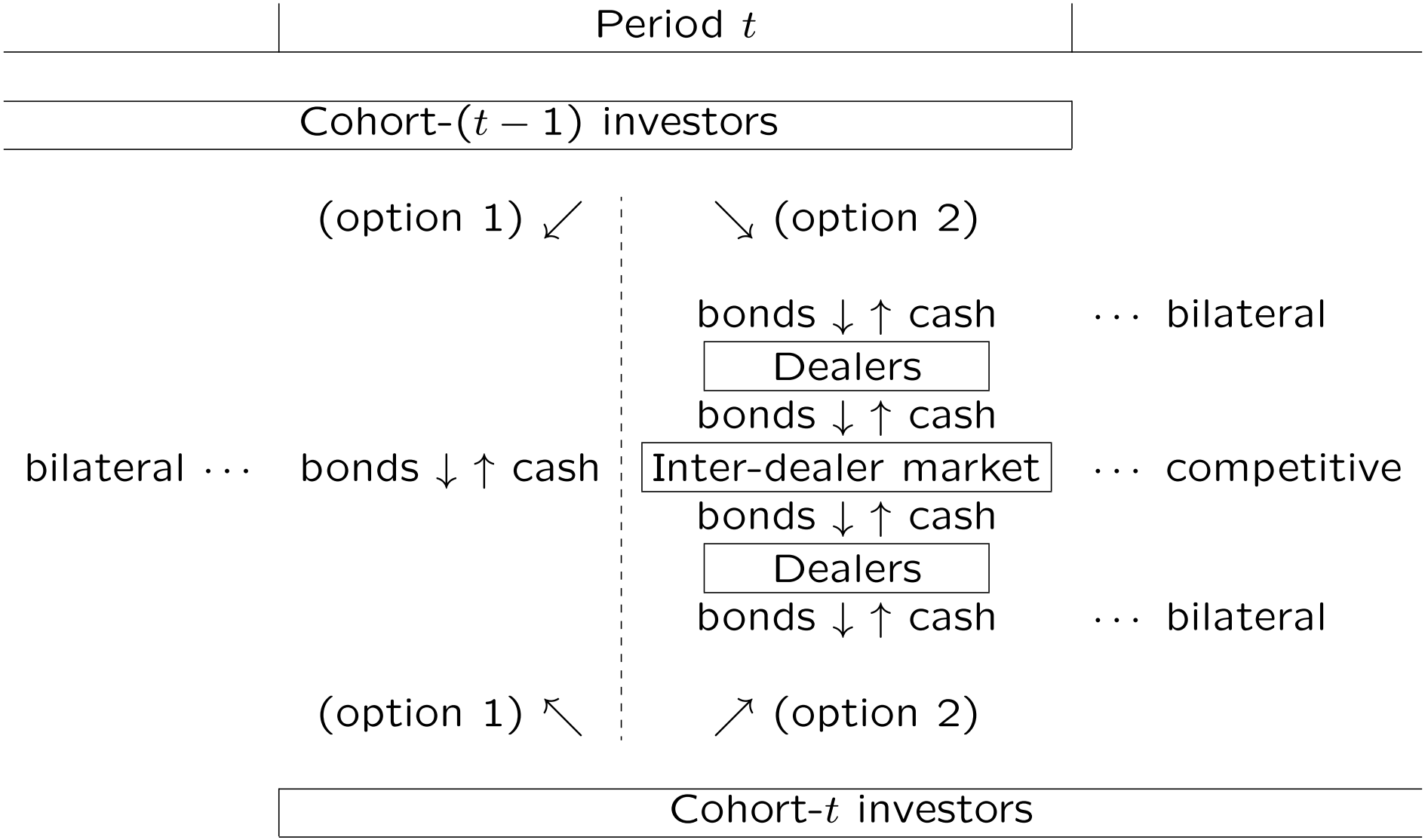
3. Emergence of repos due to bond-liquidation cost

Introduce dealers into the basic model

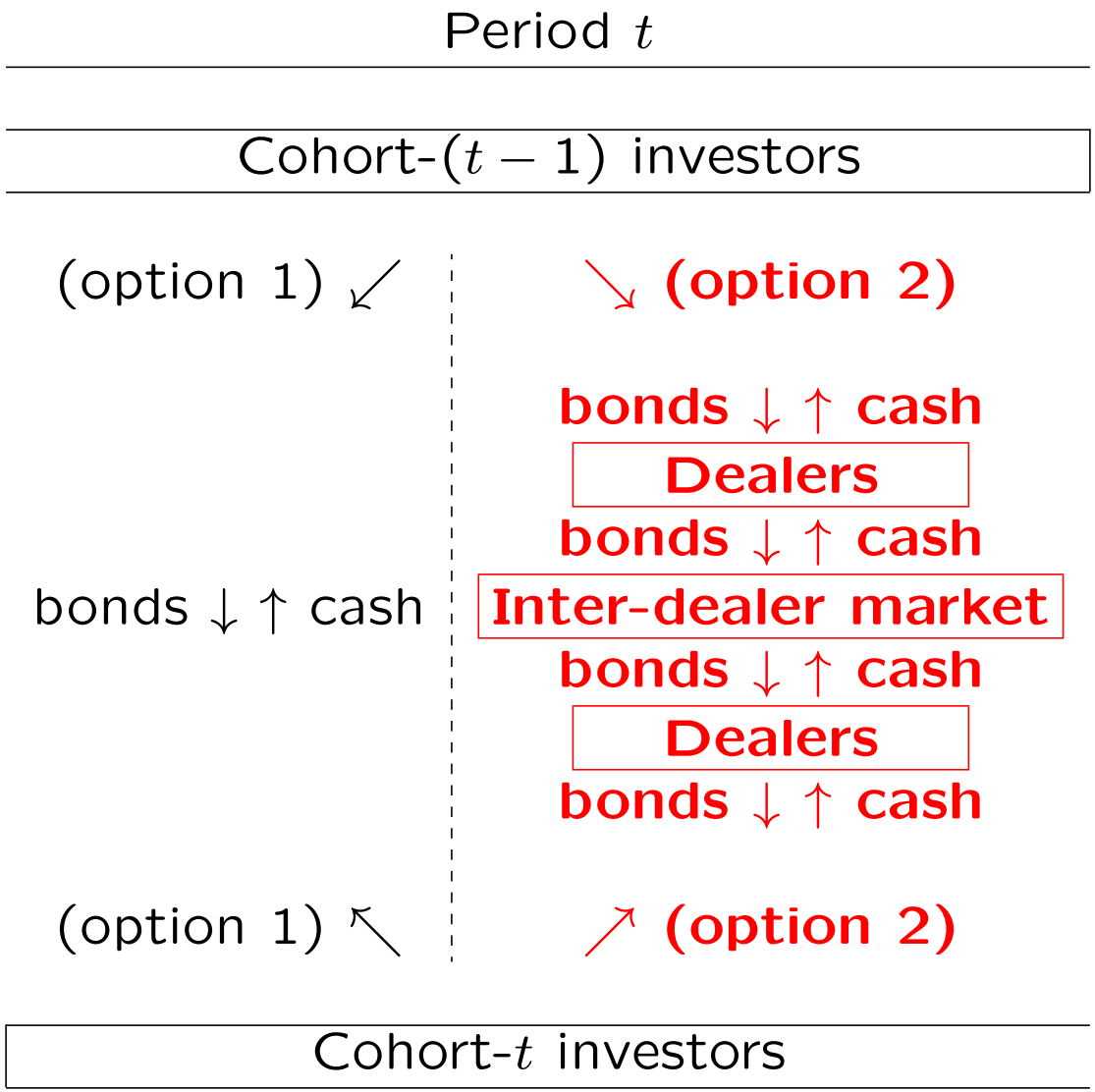
Add a unit continuum of risk-neutral, infinite-lived dealers.

- OTC bond markets by dealers for young investors (i.e., bond buyers) and old investors (i.e., bond sellers).
- Competitive inter-dealer markets for bonds and overnight loans.

The bond market structure



No direct trade between investors in the presence of dealers



- Direct trade (option 1):

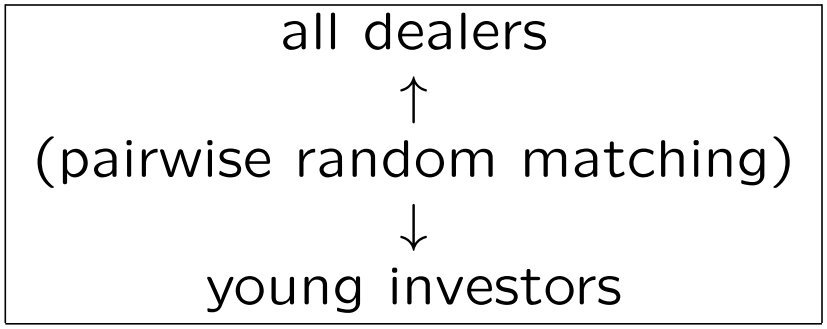
  Random matching between the old and the young.

  $\Rightarrow$ The matching probability is zero if no investor chooses option 1.

  $\Rightarrow$ Every investor chooses option 2 in this equilibrium.

- There exists another equilibrium in which every investor chooses option 1. (Described later.)

Dealer market for young investors (i.e., bond buyers)



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- The short side in the market matches for sure.

  $\Rightarrow$ Every young investor can meet a dealer, and vice versa.

- Terms of trade: price, quantity, and whether to arrange a repo.

Dealer market for old investors (i.e., bond sellers)

old investors with repos	old investors w/o repos
↑	↑
(pre-specified matching)	(pairwise random matching)
↓	↓
dealers with repos	all dealers

- A dealer with a repo can also trade with an old investor w/o a repo, if matched.

  $\Rightarrow$ Even w/o a repo, an old investor can meet a randomly chosen dealer for sure.

- A repo can be renegotiated ex-post.

  $\Rightarrow$ Pledgeable repurchase price = Bond price w/o a repo.
  A repo lets an investor to meet the same dealer again.

What does a repo do?

Old investors cannot postpone their cash consumption.

$\Rightarrow$ Dealers negotiate down the price of old investors' bonds.

$\Rightarrow$ Ex-ante, it is mutually optimal if a dealer sells bonds with a repo to a young investor at a reduced price:

- the investor can earn a high bond return;
- the dealer can avoid losing the opportunity to repurchase bonds at a discounted price later.

The bond return $<$ the T-bill rate, if an investor bought bonds through spot trade.

An endogenous repo margin

Price of bonds sold with a repo $<$ Inter-dealer bond price.

(Inter-dealer bond price $=$ the bond acquisition cost for dealers.)

Dealers finance the margin by the current profit from re-purchasing old investors' bonds at a discounted price.

4. Fragility of repos

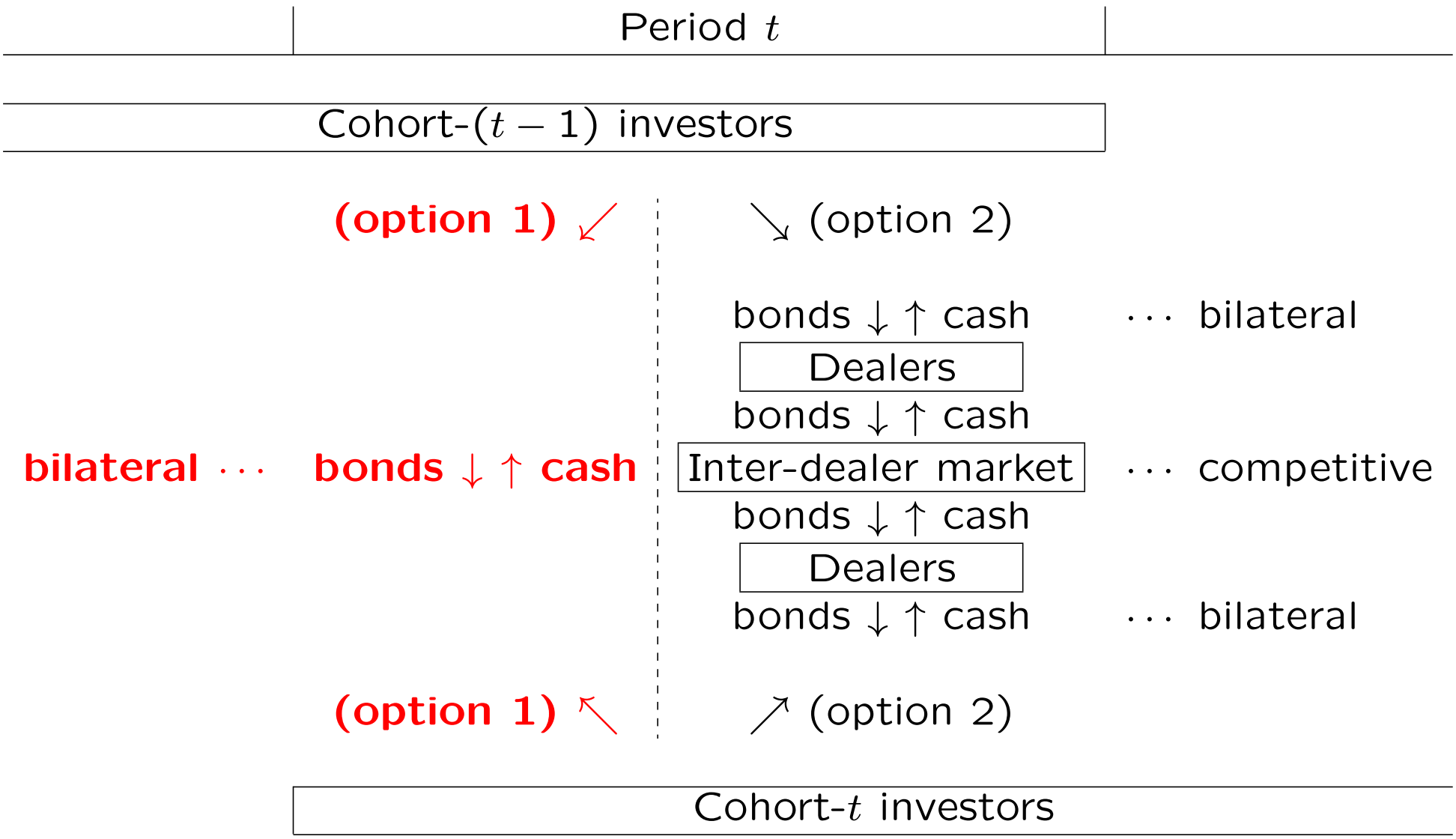
There exists another equilibrium in which repos disappear as investors shift to direct trade between them all at once.

Empirical motivation: the concern over a collapse of the U.S. tri-party repo market in March 2008.

Anecdotal evidence:

- An interview with Fed Chairman Ben Bernanke in the Financial Crisis Inquiry Report;
- Adrian et al. (2009) report increases in haircuts even for safe collateral such as Treasury securities during the period.

A repo-market collapse in the model



Each agent's incentive in a disappearance of repos

Young investors can negotiate down the price of old investors' bonds if they can trade with old investors directly.

No cash inflow from young investors to dealers causes:

- A decline in the inter-dealer bond price;
- An increase in the inter-dealer interest rate.

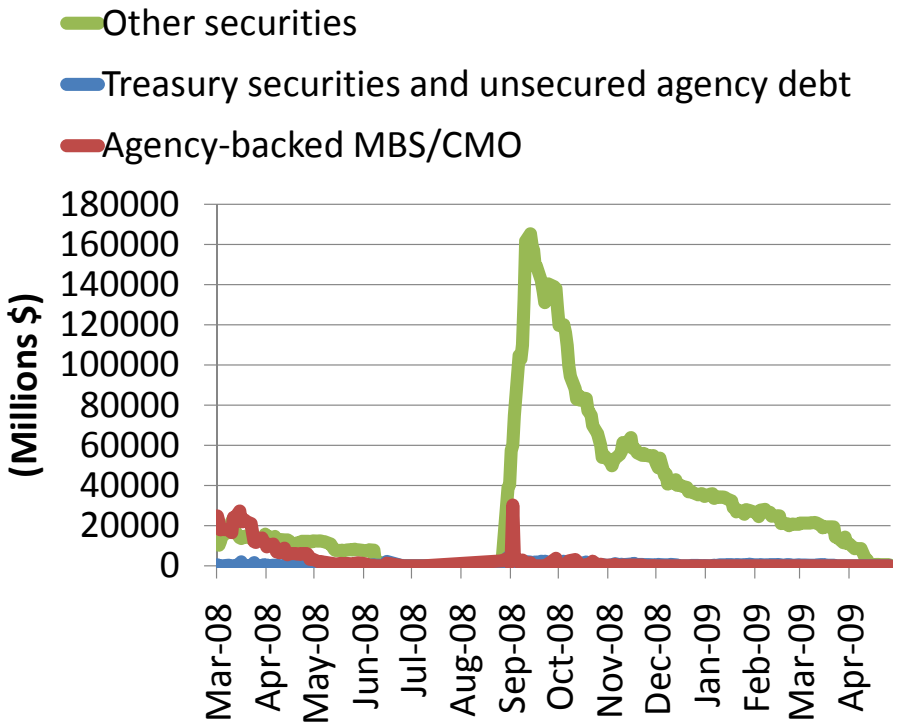
$\Rightarrow$ Dealers cannot repurchase bonds at a high price.

Old investors seek for direct trade with young investors in search of market liquidity.

5. Policy implications

The Primary Dealer Credit Facility (PDCF)

The PDCF was introduced in March 2008 after the Bear Stearns' collapse:



In the model, the PDCF would prevent a disappearance of repos by averting cash shortage in the inter-dealer markets.

A central counterparty (CCP)

A CCP: a clearing house that interposes itself between the two parties in a financial market transaction.

The CPSS (2010) at the BIS recommends introducing a CCP as a safeguard against a repo-market collapse.

Two features of a CCP:

- Novation;
- Loss-mutualization among CCP participants through their clearing funds.

Introduce a CCP into the model

Model a CCP as a coalition of investors in the same cohort.

$\Rightarrow$ The CCP does not change bargaining outcomes in a given equilibrium (simplification.)

Novation: If a young investor enters into a repo with a dealer, the CCP guarantees the repurchase price for the investor.

Loss-mutualization: The young investor submits cash to the CCP as clearing funds.

The CCP prevents a disappearance of repos

Suppose the economy is in the equilibrium with repos.

Can the economy unexpectedly shift to the equilibrium without repos in the next period?

The guaranteed repurchase price induces old investors to return to their CCP in any circumstance.

$\Rightarrow$ No old investor seeks for direct trade with a young investor even if young investors stop trading with dealers.

$\Rightarrow$ Young investors contact dealers and enter into repos.

6. Conclusions

- Bilateral (OTC) bond trade leads to an endogenous bond-liquidation cost for cash investors.
- The bond-liquidation cost induces dealers and cash investors to arrange repos.
- The bond-liquidation cost also provides incentive for cash investors to stop entering into repos in a repo-market collapse.
- The PDCF and a CCP prevent a repo-market collapse by averting cash shortage for dealers through different channels.