Reciprocal Lending Relationships in Shadow Banking

Yi Li

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Motivation

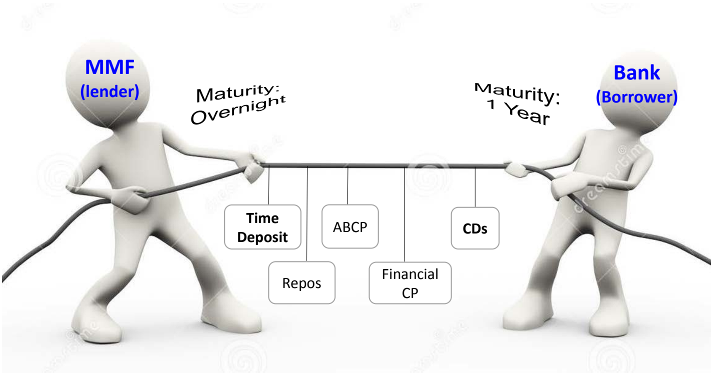
- Money market funds (MMFs) are key wholesale funding providers.
  - Prime MMFs in U.S. managed about $2 trillion as of October 2015.
  - Two-thirds of MMFs' money was lent to banks.
- Disruptions in funding markets between MMFs and banks could pose severe systemic risks. *Examples:*
  - MMF runs in the asset-back commercial paper market
  - MMF runs in the tri-party repo market
- Post-crisis regulations apply stricter liquidity rules on both MMFs and banks.
  - Generate inevitable tensions between the lender (i.e., MMF) and the borrower (i.e., bank).

What Are The Tensions?

- MMFs lend money to banks in many different markets, with maturities ranging from overnight to one year.
- Post-crisis regulations aim at limiting financial institutions' liquidity risks.
- Regulations on MMFs (the 2010 SEC Reforms)
  - Discourage MMFs from investing in long-term debt.
  - Motivate MMFs to engage in more overnight lending.
- Regulations on banks (Basel III: LCR, NSFR)
  - Promote stable long-term funding.
  - Implicitly punish overnight borrowing.

What Are The Tensions? (Cont.)

- Both under stricter liquidity rules, MMFs and banks lean toward opposite ends of the maturity spectrum...



How to Resolve The Dilemma?

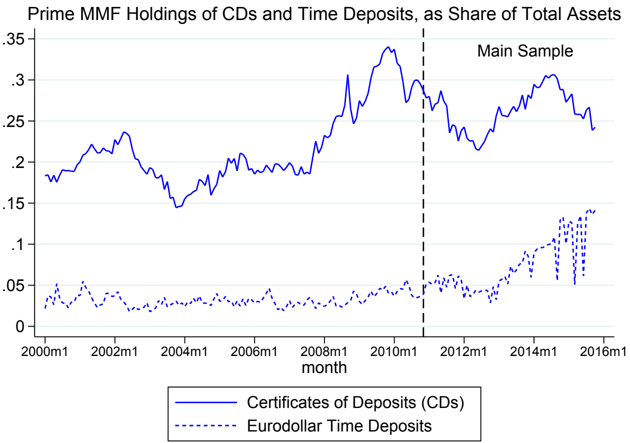
- MMFs and banks may have incentives to develop a **mutually beneficial relationship** and trade **in a reciprocal manner**.
- On the borrowing side:
  - Banks may be willing to tolerate some overnight borrowing as a "means to an end," in exchange for long-term funding from MMFs.
- On the lending side:
  - MMFs may be willing to provide some long-term funding, in exchange for access to overnight investments.
- A MMF and a bank may negotiate a "suite of contracts" consisting of various funding instruments, i.e., **"bundling" across markets**.

"Bundling" What? Two Key Markets of Interest

- Negotiable CDs
  - Maturities up to 1 year
  - Major market for banks to obtain longer-term funding from MMFs.
- Eurodollar Time Deposits
  - (Mostly) overnight, used by both foreign and U.S. banks
  - 3-4 times larger than the federal funds market
  - U.S. prime MMFs are the dominant lenders (80%-90%).
    - To improve liquidity levels.
    - To manage daily cash buffers.

"Bundling" What? Two Key Markets of Interest (Cont.)

- In the post-crisis period, **CDs** make up about 27% of MMF assets, and **time deposits** make up about 8%.



Data and Hypotheses

- Main Dataset
  - **Form N-MFP**: Month-end security-level holdings of MMFs, Nov 2010-Oct 2015
  - Construct a dataset of **fund-bank pairs** at monthly frequency
- Hypotheses
  - A MMF rewards a bank who has recently accommodated the MMF in the overnight market
    - by increasing long-term funding to the bank
    - by reducing the long-term funding costs of the bank
  - Such reciprocal relationship is stronger for foreign banks.
    - Foreign banks depend on MMFs for stable dollar funding more than U.S. banks do.

Regression Models

- Dependent Variable: **Change in Long-Term CD**$_{i,j,t}$
- Explanatory Variable of Interest: **Time Deposit Dummy**$_{i,j,t-1}$
    - Time Deposit Dummy$_{i,j,t-1}$=1 if bank j has accommodated fund i at least once in the past three months.
- Controlling for
    - Traditional Relationship Measures
        - Fund-Bank Exposure$_{i,j,t-1}$
        - Dependence on Bank$_{i,j,t-1}$, Dependence on Fund$_{i,j,t-1}$
        - Num of Fund Counterparties$_{j,t-1}$, Num of Bank Counterparties$_{i,t-1}$
    - Fund Charateritics (Flows, AUMs, maturities, yields)
    - Fixed Effects: Bank, Fund, Year-Month.

Reciprocal Lending Reflected in Funding Amount

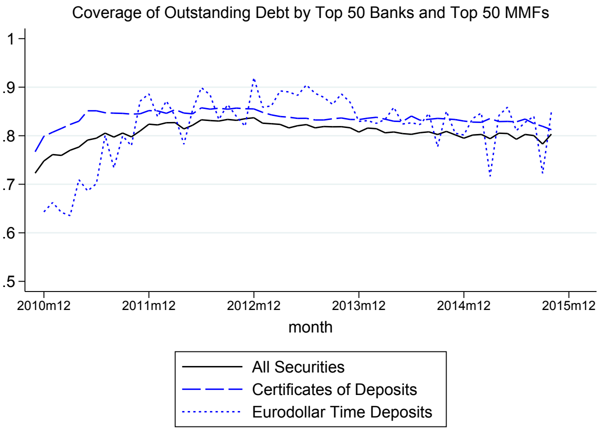
Dependent Variable: Change in Amount of Longer-Term CDs			
	All Banks	Foreign Banks	Domestic Banks
Time Deposit Dummy$_{i,j,t-1}$	11.633***	12.833***	4.229**
	(4.71)	(4.72)	(2.51)
Dependence on Bank$_{i,j,t-1}$	-1.156***	-1.485***	-0.346***
	(-5.84)	(-5.80)	(-3.72)
Dependence on Fund$_{i,j,t-1}$	-1.617***	-2.019***	-0.757**
	(-3.75)	(-3.93)	(-2.14)
Num of Fund Counterparties$_{j,t-1}$	-0.148***	-0.157***	-0.092*
	(-4.53)	(-4.53)	(-1.77)
Num of Bank Counterparties$_{i,t-1}$	-0.109	-0.105	-0.154
	(-0.38)	(-0.34)	(-0.79)
Fund Characteristic Controls	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Year-Month Fixed Effect	Yes	Yes	Yes
Adjusted R^2	0.013	0.015	0.013
Number of observations	304,100	250,606	53,494

Reciprocal Lending Reflected in Funding Amount (Cont.)

- There is significant bundling across CD and time deposit markets.
    - If a bank has accommodated a MMF at least once in the time deposit market over the past quarter...
    - the outstanding amount of long-term CDs between the two increases by about $12 million.
- MMFs are more likely to engage in reciprocal lending with foreign banks than with U.S. banks.
- These results hold under a variety of robustness checks.

Reciprocal Lending between Top MMFs and Top Banks

- Select top 50 MMFs and top 50 bank borrowers (39 foreign, 11 domestic)
- Construct a monthly dataset of all possible fund-bank pairs (2,500 per month)
- Coverage: 81% of total funding, 84% CDs, 82% time deposits



Reciprocal Lending between Top Participants: Funding Amount

Dependent Variable: Change in Amount of Longer-Term CDs			
	All Top 50 Banks	Foreign Banks	Domestic Banks
Time Deposit Dummy$_{i,j,t-1}$	35.504***	37.840***	17.413***
	(5.81)	(5.72)	(4.06)
Dependence on Bank$_{i,j,t-1}$	-6.902***	-7.862***	-2.439***
	(-4.93)	(-4.98)	(-2.91)
Dependence on Fund$_{i,j,t-1}$	-2.465***	-3.623***	-0.842*
	(-3.36)	(-4.35)	(-1.96)
Num of Fund Counterparties$_{j,t-1}$	-0.537***	-0.500**	-0.394
	(-2.98)	(-2.61)	(-1.61)
Num of Bank Counterparties$_{i,t-1}$	-0.154	0.012	-0.495
	(-0.23)	(0.02)	(-1.28)
Fund Characteristics Controls	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Year-Month Fixed Effect	Yes	Yes	Yes
Adjusted R^2	0.019	0.024	0.014
Number of observations	142,500	111,150	31,350

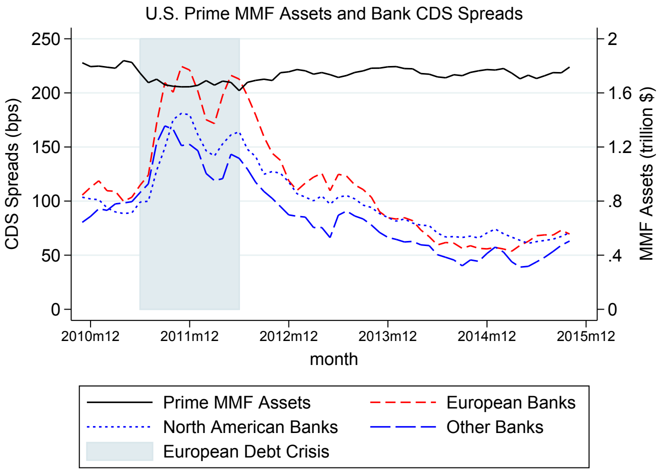
Reciprocal Lending between Top Participants: Quarter-End Effects

- MMFs usually find it more difficult to park their cash at quarter-ends.
- The reciprocal effects of a quarter-end accommodation should be stronger than regular month-end.

Dependent Variable: Change in Amount of Longer-Term CDs			
	All Banks	**Foreign Banks**	**Domestic Banks**
Time Deposit Dummy$_{i,j,t-1}$	31.599***	33.652***	13.414**
	(5.11)	(5.10)	(2.49)
Qtr-End Time Deposit Dummy$_{i,j,t-1}$	7.194*	7.823*	6.584
	(1.77)	(1.76)	(1.07)
Fund-Bank Relationship Controls	Yes	Yes	Yes
Fund Characteristic Controls	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Year-Month Fixed Effect	Yes	Yes	Yes
Adjusted R^2	0.019	0.023	0.014
Number of observations	142,500	111,150	31,350

Reciprocal Lending between Top Participants: European Debt Crisis

- European sovereign debt crisis: June 2011-June 2012



Reciprocal Lending between Top Participants: European Debt Crisis (Cont.)

- Reciprocal lending relationships remained stable during the crisis.

Dependent Variable: Change in Amount of Longer-Term CDs			
	All Banks	**Foreign Banks**	**Domestic Banks**
Time Deposit Dummy$_{i,j,t-1}$	34.609***	35.638***	20.079***
	(5.89)	(5.64)	(3.59)
Time Deposit Dummy$_{i,j,t-1}\times$ Crisis$_t$	1.012	5.704	-5.234
	(0.17)	(0.85)	(-1.64)
Crisis$_t$	-12.936***	-16.290***	-0.266
	(-4.34)	(-4.15)	(-0.27)
Fund-Bank Relationship Controls	Yes	Yes	Yes
Fund Characteristic Controls	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Adjusted R^2	0.017	0.021	0.008
Number of observations	142,500	111,150	31,350

Reciprocal Lending: Ruling out Alternative Stories

- What if MMFs' investment decisions in all markets are based on banks' credit risk levels?
  - Solution I: Control for banks' credit risks, proxied by CDS spreads.
  - Solution II: Control for the bank×month two-way fixed effects.

Dependent Variable: Change in Amount of Longer-Term CDs				
	Foreign	**Domestic**	**Foreign**	**Domestic**
Time Deposit Dummy$_{i,j,t-1}$	23.872***	29.326***	32.399***	16.839***
	(3.07)	(4.01)	(6.20)	(4.08)
TD$_{i,j,t-1}$×CDS Spread$_{j,t-1}$	0.161**	-0.099***		
	(2.07)	(-2.79)		
CDS Spread$_{j,t-1}$	-0.248***	-0.002		
	(-4.06)	(-0.20)		
Fund-Bank Controls	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes	Yes
Month Fixed Effect	Yes	Yes	Yes	Yes
Bank × Month Fixed Effect	No	No	Yes	Yes
Adjusted R2	0.026	0.014	0.072	0.060
Number of observations	97,550	30,450	111,150	31,350

Reciporal Lending Reflected in Funding Costs

- Do MMFs reward accommodative banks with lower long-term funding costs?
  - Yes, but **only to foreign banks**.
- Methodology: Regress CD Yield on its potential determinants
  - Filter: Size of CD $>$ \$1 million, Maturity of CD $>$ 30 days
  - Winsorize CD yields at the top and bottom 5 percent level
- Robustness: Results for foreign CDs **remain strong** if
  - Apply no filter on CD size and maturity
  - Apply looser wisorization (i.e. 1% level)
  - Extend sample period to Jun. 2017
  - Control for bank credit risks
  - Control for two-way fixed effects

Reciporal Lending Reflected in Funding Costs (Cont.)

Dependent Variable: CD Yield$_{i,j,k,t}$			
	All Banks	**Foreign Banks**	**Domestic Banks**
Time Deposit Dummy$_{i,j,t-1}$	-0.878***	-0.864***	0.723
	(-9.02)	(-8.71)	(1.55)
log(CD Size$_{i,j,k,t}$)	-0.444***	-0.445***	-0.634***
	(-9.13)	(-8.74)	(-4.59)
log(CD Maturity$_{i,j,k,t}$)	3.382***	3.305***	3.248***
	(45.15)	(43.79)	(33.72)
Relationship Controls	Yes	Yes	Yes
Fund Characteristic Controls	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes
Bank Fixed Effect	Yes	Yes	Yes
Year-Month Fixed Effect	Yes	Yes	Yes
Adjusted R^2	0.595	0.600	0.573
Number of observations	218,346	199,714	18,632

Summary of Results

- MMFs and banks develop a "bundling" strategy across funding markets in face of contradictory regulations on liquidity.
- MMFs substantially increase their purchases of long-term debt issued by banks who've recently accommodated MMFs' overnight investment needs.
  - Robust after controlling for bank credit risks and traditional relationship measures
  - Not weakened during the European sovereign debt crisis
  - Stronger between MMFs and foreign banks
  - Not explained by alternative stories
- Foreign banks that have been accommodative in the overnight market enjoy significantly lower rates on their long-term debt with MMFs.

Summary of Results (Cont.)

- This paper reveals novel yet sophisticated relationship management in shadow banking.
    - Investment decisions across multiple markets are made collectively in a reciprocal manner.
- My findings are consistent with anecdotal evidence.
    - MMFs have indicated that relationship management is an important part of their investment decision process.
    - Similarly, some banks have mentioned that they accommodate MMFs in the overnight market to "maintain a good relationship" with them.

Contributions of The Paper

- Provides a completely new perspective on lending behaviors of MMFs.
    - First to differentiate between long-term and short-term markets
    - First to document any reciprocal "bundling" across these markets
- Complements the literature on the crucial role of U.S. MMFs in funding global banks.
- Adds to the general literature on relationship lending.
    - Existing papers on relationship lending focus on banks' lending to firms.
    - This paper explores the role of relationships when banks borrow.
- Contributes to the emerging literature on the unintended consequences of post-crisis regulations.

Potential Concerns for "Bundling"

- Bundling helps alleviate the conflicting effects of post-crisis regulations on MMFs and banks.
- However, when MMFs and banks develop a mutual understanding that overnight accommodations help promote long-term funding...
  - They are more likely to transact with the same counterparties in both the short-term and long-term markets.
- Over time, both the lending side and the borrowing side may start to consolidate and become less diversified.
- Further research is needed to address the concern that bundling may lead to consolidation of the industry and a "too-big-to-fail" situation in the market.