# Reciprocal Lending Relationships in Shadow Banking

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## Motivation

- Literature has focused on relationship lending between banks and their borrowers (i.e., on the asset side of banks' balance sheet).

**Bank Balance Sheet**

| Assets | Liabilities |
|---|---|
| Loans | Retail Deposits |
| | Equity |

## Motivation (Cont.)

- As banks expand their balance sheets, their funding sources are not limited to retail deposits.

**Bank Balance Sheet**

| Assets | Liabilities |
|---|---|
| Loans | Retail Deposits |
| | Wholesale Funding |
| Financial Assets | Equity |

## Motivation (Cont.)

- This paper focuses on the liability side of banks' balance sheet, exploring the relationship between banks and their institutional creditors.

### Bank Balance Sheet

| Assets | Liabilities |
|---|---|
| Loans | Retail Deposits |
| | **Wholesale Funding**<br>Eurodollar time deposits; Repos;<br>Commercial paper; Negotiable CDs |
| Financial Assets | Equity |

## Motivation (Cont.)

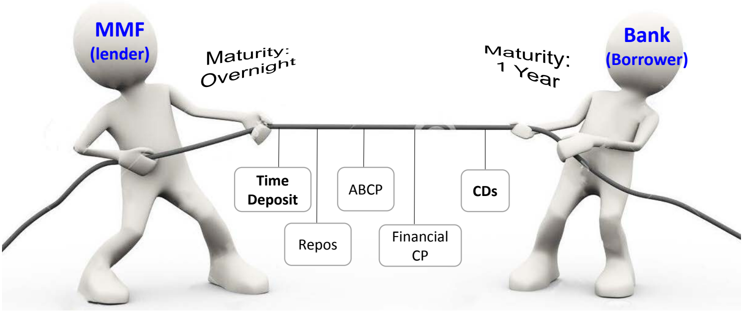
- Money market funds (MMFs) are key wholesale funding providers.
  - Prime MMFs in U.S. managed about $2 trillion as of October 2015.
  - Two-thirds of MMFs' money was lent to banks.
- Disruptions in funding markets between MMFs and banks could pose severe systemic risks. *Examples:*
  - MMF runs in 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**.

## Preview of Results

- MMFs and banks develop a **"bundling"** strategy across funding markets in face of contradictory regulations on liquidity.
- MMFs substantially increase their investments in **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
- Foreign banks that have been accommodative in the overnight market enjoy significantly **lower rates** on their long-term debt with MMFs.

## Contributions to Literature

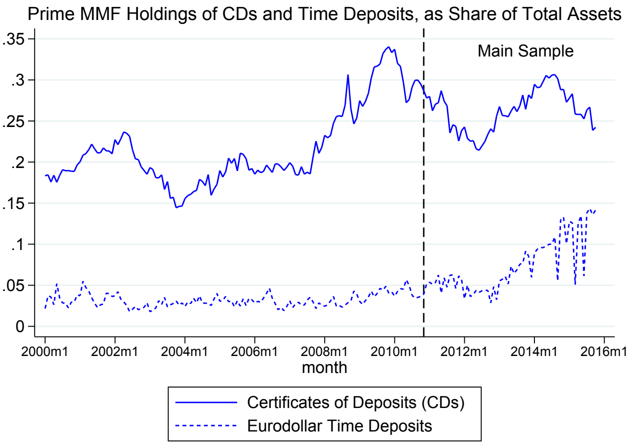
- Provides a completely new perspective on lending behaviors of MMFs. **[Chernenko and Sunderam (2014); Hu, Pan, and Wang (2015)]**
  - First to differentiate between long-term and short-term markets
  - First to document any reciprocal "bundling" across these markets
- Complements the literature on the crucial role of U.S. MMFs in funding global banks. **[Ivashina, Scharfstein, and Stein (2015)]**
- Adds to the general literature on relationship lending.
  - Existing papers on relationship lending focus on banks' lending to firms. **[Surveys: Boot (2000); Elyasiani and Goldberg(2004)]**
  - This paper explores the role of relationships when banks borrow.
- Contributes to the emerging literature on the unintended consequences of post-crisis regulations.**[Acharya (2012); Allen etc. (2012); Munyan (2015)]**

## “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: 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: Funding Amount (Cont.)

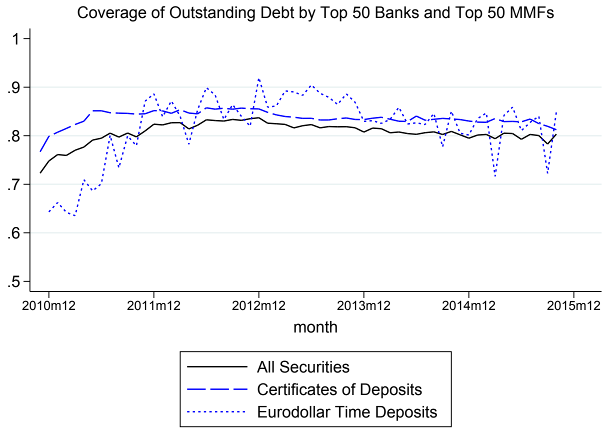
- There is significant bundling across CD and time deposit markets.
    - If a bank has accommodated a MMF at least once in the time deposit market over the past quarter...
    - the outstanding amount of long-term CDs between the two increases by about $12 million.
- MMFs are more likely to engage in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

## Reciprocal Lending in Funding Amount: Robustness

- Alternative Dependent Variables
  - Baseline: Change in CDs (with maturity over 1 month)
  - Alternative I: Change in CDs (with maturity over 2 months)
  - Alternative II: Change in all direct debt (with maturity over 1 month)
  - The "bundling" results remain strong and robust.
- Alternative Explanatory Variables
  - Baseline: Lagged time deposit dummy
  - Alternative: Lagged time deposit transaction amount
  - Obtain consistent and significant results.

# 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 |

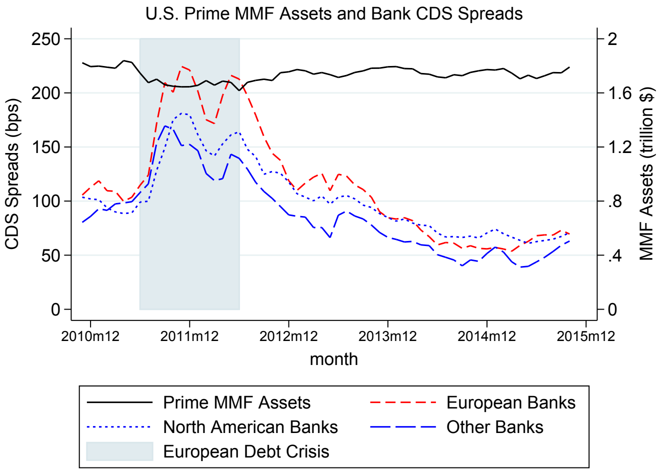
## Reciprocal Lending between Top Participants: Quarter-End Effects

- 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 |
| Year-Month Fixed Effect | Yes | Yes | Yes | Yes |
| Bank × Month Fixed Effect | No | No | Yes | Yes |
| Adjusted $R^2$ | 0.026 | 0.014 | 0.072 | 0.060 |
| Number of observations | 97,550 | 30,450 | 111,150 | 31,350 |

## Reciporal Lending: 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: Funding Costs (Cont.)

| | All Banks | Foreign Banks | Domestic Banks |
|---|---|---|---|
| **Dependent Variable: CD Yield$_{i,j,k,t}$** | | | |
| 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.