

The Federal Reserve's Discount Window and TAF Programs: "Pushing on a String?"

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Background

- During the recent financial crisis, the Federal Reserve provided an unprecedented amount of liquidity to the banking sector in several ways, including through the Discount Window (DW) and the Term Auction Facility (TAF).
 - Extended over 30,000 (DW + TAF) loans with a par value of \$15 trillion during the crisis.
- The Federal Reserve envisioned that these liquidity facilities would encourage bank lending:
 - *“Together these actions should encourage term lending across a range of financial markets in a manner that eases pressures and promotes the ability of firms and households to obtain credit.”* (Federal Reserve Press Release announcing expansion of TAF auctions, Oct. 6, 2008.)
- It is not clear ex ante if a central bank can increase lending during a financial crisis or whether it is merely “pushing on a string.”

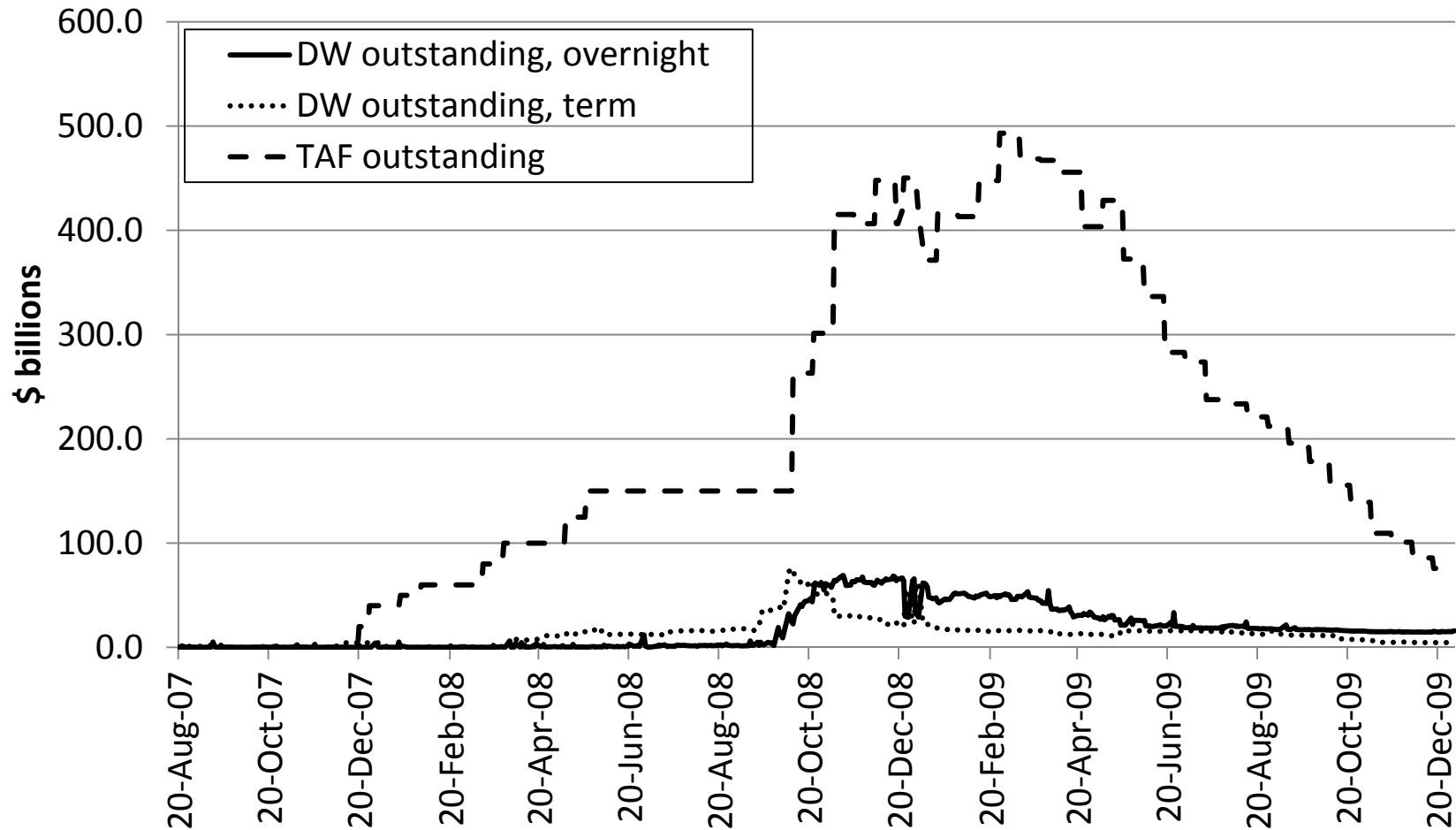
Background (cont'd)

- We ask three questions:
 - Q1: Which banks used funds from the Federal Reserve during the crisis?
 - Q2: Did these funds substitute for or complement other funding sources?
 - Q3: Did banks use these funds to increase their lending?
- We address these questions separately for small banks (\leq \$1 billion in Gross Total Assets) and large banks (GTA $>$ \$1 billion).
- Such questions could not normally be addressed because identities of banks receiving funds from the Federal Reserve traditionally have not been revealed (concern: information could cause a liquidity flight.)
- However, after the crisis, the Federal Reserve was required to disclose formerly-confidential data:
 - DW data released under Freedom of Information Act requests by Bloomberg News and Fox Business Network on Mar. 31, 2011.
 - TAF data released under the Dodd-Frank Act on Dec. 1, 2010.(see also Armantier, Ghysels, Sarkar, and Shrader 2011, Benmelech 2012, Boyson, Helwege, and Jindra 2013, Kleyменова 2013 for use of these data)

Overview of Facilities

- Discount window: Backup source of short-term funds for depository institutions in sound financial condition.
 - Historically overnight, no-questions-asked funds at “above market” rates.
 - Despite DW’s sound condition requirement and confidentiality, DW usage is often thought to be associated with a stigma (fear: regulators, creditors, or other banks may assume the worst if it becomes known the bank used DW).
- In response to the crisis, the Federal Reserve:
 - Made DW funds available on a term basis and reduced their cost:
 - Aug. 17, 2007: up to 30 days, ↓ from 100 to 50 basis points over target fed funds rate.
 - Mar. 16, 2008: up to 90 days, ↓ from 50 to 25 basis points over target fed funds rate.
 - Announced TAF on Dec. 12, 2007.
 - Bi-weekly auctions of 28-day or 84-day funds to depository institutions in generally sound financial condition.
 - TAF carried the same eligibility and collateral requirements as DW.
 - Designed to reduce stigma associated with DW usage.
 - Supporting evidence: some banks used TAF even when it was more costly than DW, and TAF did not come with prepayment privileges (unlike DW funds) (see Armantier, Ghysels, Sarkar, and Shrader 2011).

Discount window and TAF outstanding



- During most of the crisis, TAF outstandings dominated DW outstandings.
 - Both DW and TAF outstandings during the crisis dominate DW usage outside of the crisis.

Key Findings

- Q1: Which banks used funds from the Federal Reserve during the crisis?
 - Usage of DW and TAF was widespread:
 - 20% of small banks;
62% of large banks.
 - Maximum outstanding relative to assets on a given day was 48%.
 - Maximum outstanding by one bank on one day was \$60 billion.
 - Small banks receiving funds were weaker banks (less capital and higher portfolio risk), consistent with expectations.
 - Large banks receiving funds were generally not weaker.
 - This consistent with Boyson, Helwege, and Jindra (2013), who focus on listed institutions which are generally very large, and find that both weak and sound banks obtained funds from the Federal Reserve.

Key Findings (cont'd)

- Q2: Did these funds substitute for or complement other funding sources?
 - Focusing on statistical significance, we find that funds from the Federal Reserve were substitutes for some other funding sources (never complements) for both small and large banks.
 - Low economic significance (substitution far less than one-for-one).

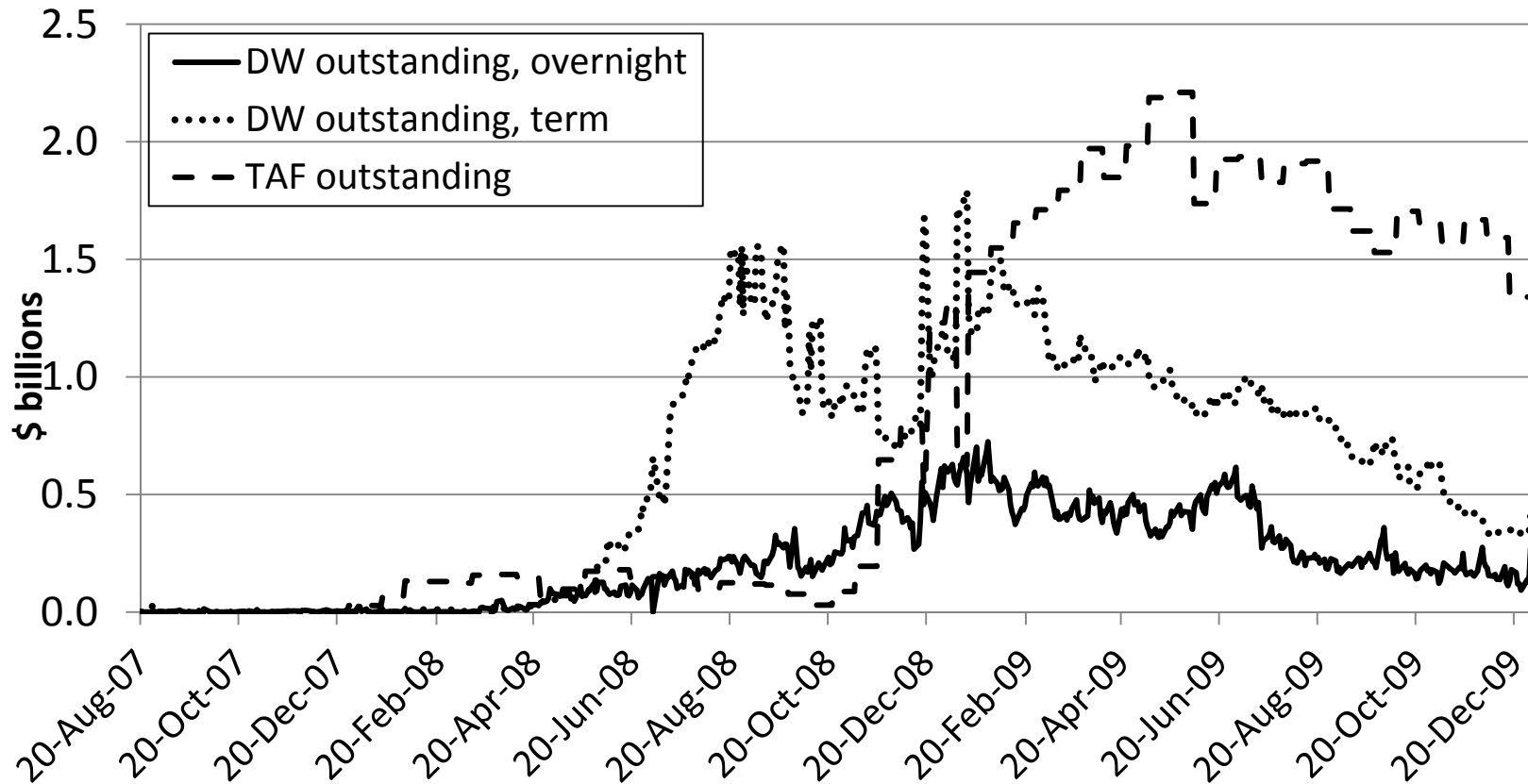
Key Findings (cont'd)

- Q3: Did banks use these funds to increase their lending?
 - For both small and large banks, an increase in DW and TAF usage is associated with increased lending.
 - The results hold when we use the matching technique of Carlson, Shan, Warusawitharana (2013) or nearest neighbor matching as a way of controlling for loan demand.
 - The effect is economically significant in magnitude.
 - The funds both enhanced the lending of expanding banks and reduced the decline at contracting banks.
 - Small banks used DW and TAF funds to increase lending to small businesses while large banks used them to increase lending to large businesses.
 - Loan quality improved only at small banks, while both types of banks left loan contract terms unchanged.

Data Description

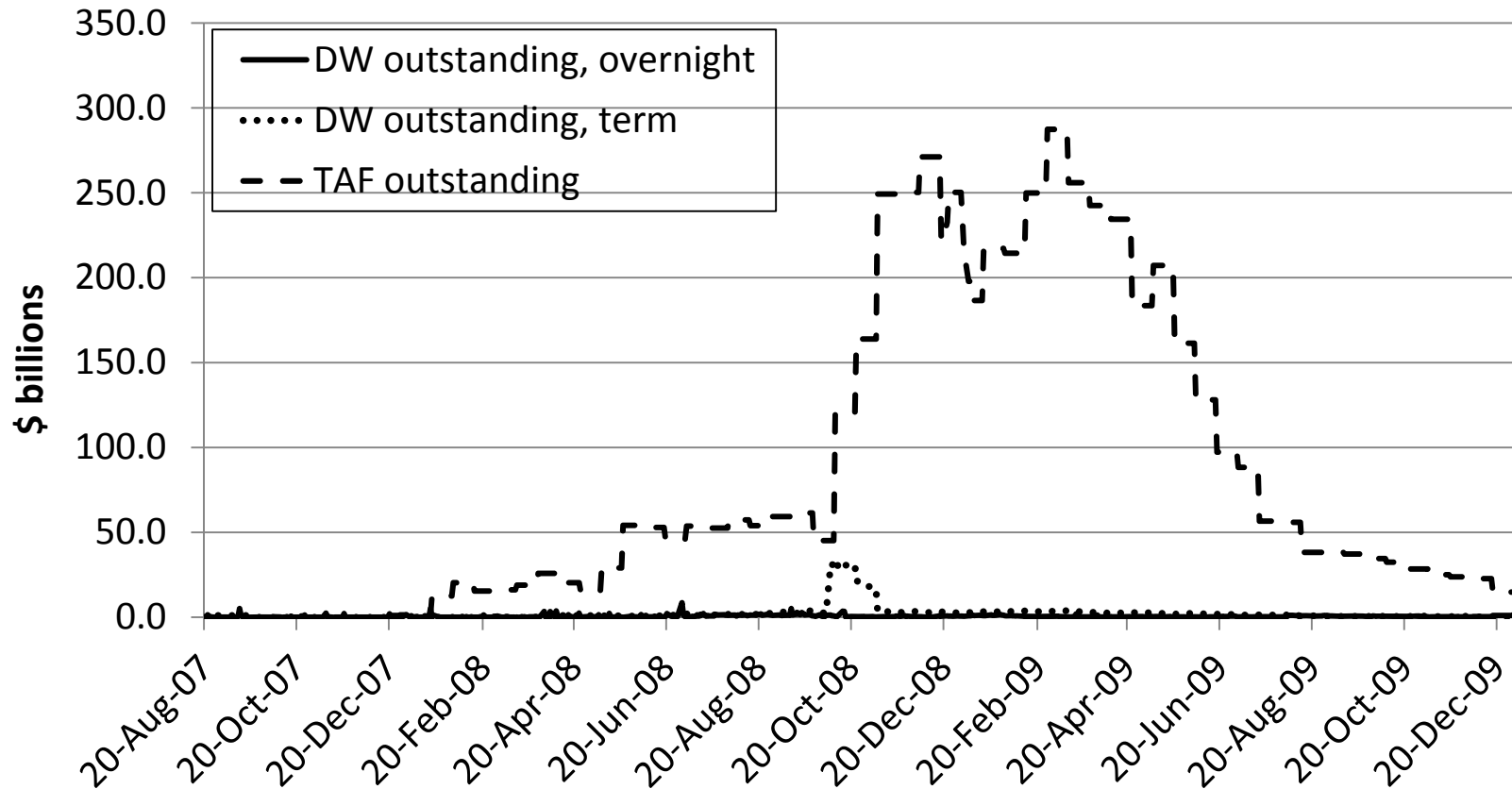
- Institution-level data on daily DW and TAF outstandings
 - Available: August 20, 2007 – March 11, 2010
 - Define the crisis period: August 20, 2007 – December 31, 2009
 - In early 2010, the Fed began rolling back expansions to the discount window and concluded the TAF auctions.
- Quarterly Call Report
 - Data on bank lending, other activities, and condition.
 - We had to drop a number of DWTAFF users that did not fill out Call Reports, mostly agencies and branches of foreign banks, who received substantial amounts of DWTAFF funds.
- Data on Troubled Asset Relief Program (TARP), Federal Home Loan Bank (FHLB) borrowing, state income growth
- Branch locations and deposit levels from the FDIC's Summary of Deposits

Composition of Usage: Small Banks (GTA<= \$1billion)



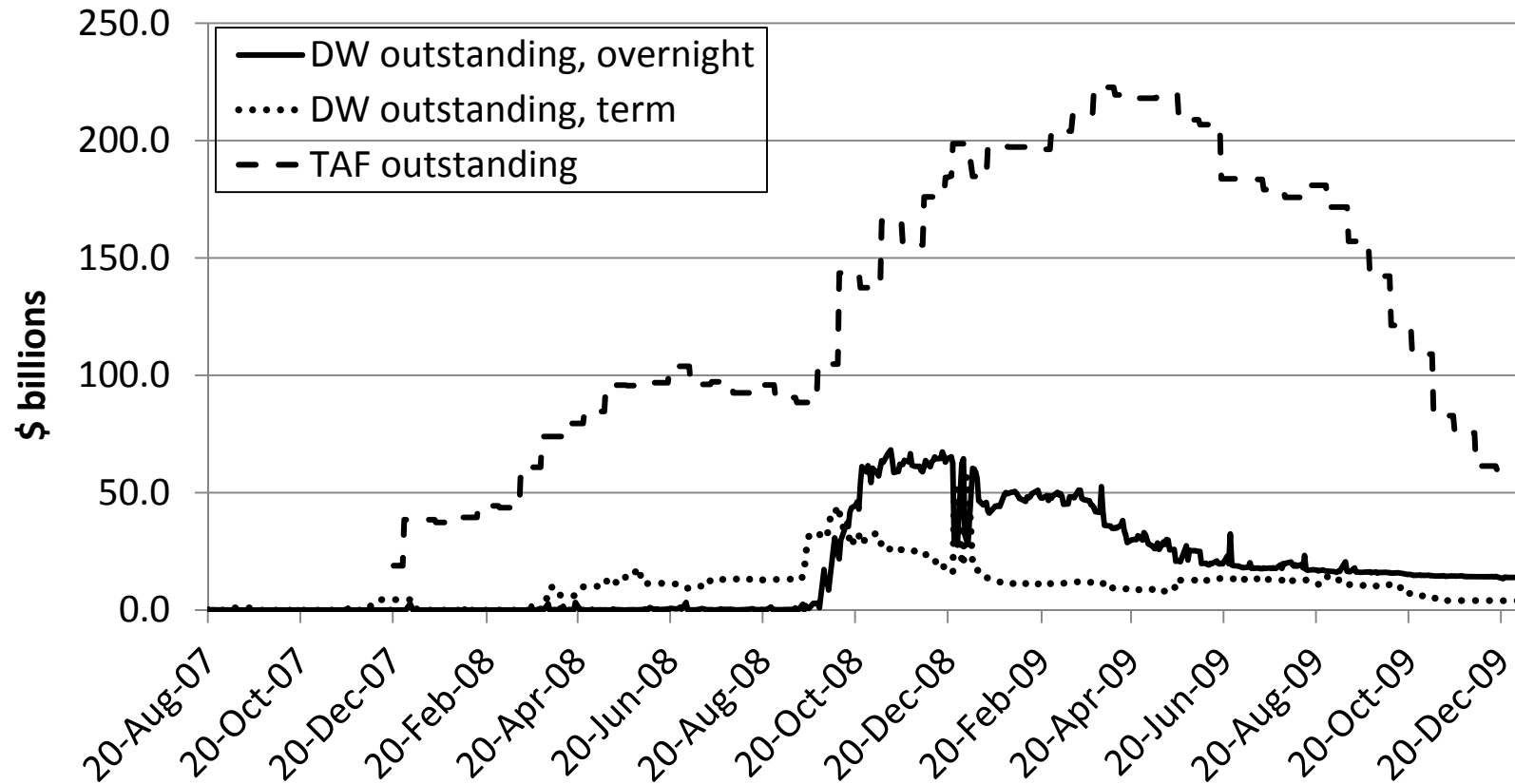
- By May 2008, term DW loans exceeded overnight funds and continued to be larger through the rest of the crisis.
- DW is large relative to TAF in the first half of the crisis, but by March 2009, TAF exceeded it.

Composition of Usage: Large Banks (GTA > \$1 billion)



- The amounts obtained are much greater than for small banks.
- By Jan. 2008, TAF usage dominated DW usage.
- TAF and DW usage essentially exploded in Oct. 2008. TAF usage continued to rise until March 2009 (and then fell to much lower levels), but DW usage dropped relatively quickly.

Composition of Usage: Non-commercial banks



- For non-commercial banks (mostly agencies and branches of foreign banks), TAF usage dominated DW usage shortly after its inception and TAF usage by these banks generally exceeded that of commercial banks that filled out Call Reports (exception: late October 2008 through April 2009).

Q1: Which banks used funds from the Federal Reserve?

(Table 3 Panel A)

	<i>Dependent var: = 1 if bank used DWTAFF during quarter</i>	
	Small banks	Large banks
log(GTA)	0.019***	0.080***
EQRAT	-0.076***	0.167
Stddev ROA	0.346	-9.561**
CRE / GTA	0.033***	0.311***
MBS / GTA	0.048***	0.395***
ROE	0.004	-0.038
Illiquidity	0.009	0.019*
BHC dummy	0.004*	0.005
Listed dummy	0.002	0.035
Foreign own dummy	-0.015**	0.005
OCC dummy	-0.002	0.004
FDIC dummy	-0.009***	-0.029
Income growth	0.101	1.351*
Observations	63301	5101
Pseudo R2	0.16	0.13

Coefficients of Federal Reserve districts and time FE are not shown for brevity

- Small bank users tended to have less capital and higher portfolio risk, consistent with greater need.
- Large bank users were generally not weaker.
 - May be due to: greater stigma for large banks, greater reliance on funding from disrupted capital markets, possibly better screening of weak large banks by the Federal Reserve, encouragement of healthy large banks to use the funds, or a preference for term funds instead of overnight federal funds.¹³

Q2: Did the funds substitute for or complement other funding sources? *(Table 4)*

<i>Dependent var :</i>	$\Delta(\text{DWTAf}) / \text{GTA}$		$\Delta(\text{DW}) / \text{GTA}$		$\Delta(\text{TAF}) / \text{GTA}$	
	Small banks	Large banks	Small banks	Large banks	Small banks	Large banks
$\Delta(\text{Core Deposits})/\text{GTA}$	-0.007***	-0.007	-0.003**	-0.002	0.000	0.000
$\Delta(\text{Fed Funds})/\text{GTA}$	-0.010	-0.011	-0.003	-0.003	0.000	-0.001
$\Delta(\text{Repos})/\text{GTA}$	-0.019	-0.031	0.000	-0.009	-0.001	-0.002
$\Delta(\text{Other Hot Money})/\text{GTA}$	-0.010**	-0.032***	-0.005***	0.000	0.000	-0.002***
$\Delta(\text{FHLB})/\text{GTA}$	-0.004	-0.022**	0.001	-0.001	-0.001**	0.000
$\Delta(\text{TARP})/\text{GTA}$	-0.048	0.036	-0.025**	0.008	0.000	0.000
Observations	4249	1396	4249	1396	4249	1396
R2	0.28	0.33	0.23	0.19	0.58	0.49

Coefficients of bank condition, economic environment, bank FE, and time FE are not shown for brevity

- Not causal; just to establish how DWTAf moves with other funding sources.
- Small banks:
 - DW substituted for some other funding sources (core deposits and other hot money).
- Large banks:
 - DW substituted for some other funding sources (other hot money and FHLB advances).
- Caveat: statistical significance, no economic significance (small coefficients).

Q3: Did banks use the funds to increase lending? (OLS)

(Table 5 Panel A and Panel B)

<i>Dependent var:</i>	$\Delta(\text{LOANS})$ /GTA	$\Delta(\text{ST_LOANS})$ /GTA	$\Delta(\text{LT_LOANS})$ /GTA	$\Delta(\text{CI_LNS})$ /GTA	$\Delta(\text{CRE_LNS})$ /GTA	$\Delta(\text{RRE_LNS})$ /GTA	$\Delta(\text{CONS_LNS})$ /GTA
Small banks:							
$\Delta(\text{DWTAF})/\text{GTA}$	0.918***	0.606***	0.349***	0.157***	0.386***	0.028	0.005
Observations	55889	55889	55889	55889	55889	55889	55889
R2	0.45	0.15	0.24	0.21	0.40	0.31	0.25
Large banks:							
$\Delta(\text{DWTAF})/\text{GTA}$	0.991***	0.354**	0.679***	0.159**	0.272***	0.098*	0.061
Observations	4255	4255	4255	4255	4255	4255	4255
R2	0.48	0.21	0.28	0.26	0.51	0.35	0.14

Coefficients of changes in other funding sources, bank condition, economic environment, bank FE, and time FE are not shown for brevity

- For both small and large banks, an increase in DW and TAF usage is associated with increased lending.
 - Holds for both short-term and long-term loans.
 - Holds for all loan subcategories except consumer loans and is statistically weak or insignificant for residential real estate (RRE) loans.

Carlson, Shan, Warusawitharana (2013) matching

- The OLS results do not necessarily pin down a supply-side effect (of DW and TAF usage on bank loan supply).
 - Control variables and fixed effects may not adequately control for loan demand.
- The CSW methodology is an innovative way of controlling for loan demand:
 - Uses data on branch networks from the Summary of Deposits to identify each bank's geographic footprint
 - Matches each bank to others operating in the same geographic area, effectively differencing out local or regional conditions that affect loan demand.
 - Importantly, it also controls for bank business model.
 - Concern: Banks with different business models might be differently affected by the economic environment even in the same location.

Carlson, Shan, Warusawitharana (2013) matching (cont'd)

Procedure:

1. Identify the operating area of each bank.
 - Geocode branch addresses from the Summary of Deposits
 - Find the deposit-weighted center of each bank's branch network (its coordinates)
 - Exclude from the sample banks that do not have 80% of their total deposits within a specified distance of the weighted center; the threshold varies inversely with the population density of the state (e.g. NJ: 50mi; WY: 750mi)
 - The center must correspond to the economic conditions faced by the bank. Likely not true for banks with geographically dispersed branch networks.
2. Form sets of "neighboring banks".
 - Must have their weighted centers within a particular distance of the weighted center of the reference bank; the cutoff again varies with the population density of the state.
 - Must be similarly sized, between one third and three times the size of the reference bank
3. Match banks 1-1 by business model characteristics.
 - Compute the distance between each bank and its neighboring banks based on nine business model characteristics (*next slide*)
 - Match each bank with one other bank by iteratively extracting pairs of banks with the lowest distances between them. (Each bank appears only once in the sample).
4. Run the baseline regression on paired, differenced data.

Carlson, Shan, Warusawitharana (2013)

Business Model Characteristics

1. Fraction of commercial and industrial loans
2. Fraction of residential real estate loans
3. Fraction of commercial real estate loans
4. Fraction of consumer loans
5. Managed liability to interest-bearing liability ratio
6. Securities to securities and loans ratio
7. Interest income to total income
8. Interest expense to total expense
9. Net interest margin

Q3: Did banks use the funds to increase lending? (CSW)

(Table 6 Panel A)

<i>Dependent var:</i>	$\Delta(\text{LOANS})$ /GTA	$\Delta(\text{ST_LOANS})$ /GTA	$\Delta(\text{LT_LOANS})$ /GTA	$\Delta(\text{CI_LNS})$ /GTA	$\Delta(\text{CRE_LNS})$ /GTA	$\Delta(\text{RRE_LNS})$ /GTA	$\Delta(\text{CONS_LNS})$ /GTA
Small banks:							
$\Delta(\text{DWTAF})/\text{GTA}$	0.998***	0.600***	0.430***	0.195***	0.493***	0.107*	0.183***
Observations	20594	20594	20594	20594	20594	20594	20594
R2	0.25	0.04	0.06	0.04	0.13	0.08	0.04

Coefficients of changes in other funding sources, bank condition, economic environment, bank FE, and time FE are not shown for brevity

- For small banks, results are similar to the OLS:
 - An increase in DW and TAF usage leads to increased lending.
 - DW and TAF usage increases lending in all sub-categories with a weak effect on RRE. Different from the OLS, the effect on consumer lending is statistically significant.
- The methodology cannot be applied to large banks given the restrictions placed on the sample in step 1 of the procedure.

Q3: Did banks use the funds to increase lending? (NN)

(Table 6 Panel B and Panel C)

<i>Dependent var:</i>	$\Delta(\text{LOANS})$ /GTA	$\Delta(\text{ST_LOANS})$ /GTA	$\Delta(\text{LT_LOANS})$ /GTA	$\Delta(\text{CI_LNS})$ /GTA	$\Delta(\text{CRE_LNS})$ /GTA	$\Delta(\text{RRE_LNS})$ /GTA	$\Delta(\text{CONS_LNS})$ /GTA
Small banks:							
$\Delta(\text{DWTAF})/\text{GTA}$	0.684***	0.412***	0.490***	0.276***	0.202*	0.060	0.014
Observations	26596	26596	26596	26596	26596	26596	26596
R2	0.24	0.04	0.06	0.03	0.14	0.09	0.06
Large banks:							
$\Delta(\text{DWTAF})/\text{GTA}$	0.884***	0.320	0.767***	0.151	0.216	0.119	0.054*
Observations	1678	1678	1678	1678	1678	1678	1678
R2	0.31	0.08	0.11	0.11	0.32	0.18	0.17

Coefficients of changes in other funding sources, bank condition, economic environment, bank FE, and time FE are not shown for brevity

- For both small and large banks, an increase in DW and TAF usage is associated with increased lending.
 - For small banks, the effects we find are sometimes smaller, sometimes larger than the CSW estimates.
 - For large banks, the effect on gross lending is smaller than in the OLS. Effects on C&I and real estate lending become statistically insignificant, while the effect on consumer loans gains significance.

Q3: Did banks use the funds to increase lending? (cont'd)

(Tables 8 and 9)

- Did the programs lead to higher loan growth for banks that were increasing their loans or less loan contraction for those that were reducing their lending, or both?
 - Both! (Bigger effect for the former.)
- Robustness:
 - Large bank findings robust to excluding too-big-to-fail banks.
 - Banks with GTA > \$50 billion or the 19 largest banks each quarter.
 - Results seem to be driven by privately-held (instead of listed) banks.
 - Listed banks generally have better access to other funding sources and may not need DWTAF as much to increase lending.

Q3: Did banks use the funds to increase lending? (cont'd)

(Table 10)

- Effects on lending to small and large businesses:
 - Imperfectly comparable to main results: June Call Reports provide data by loan (*not* firm) size; examine annual change June 08 – June 09 (*not* quarterly throughout the crisis).
 - Find: at small banks, small loans increased:

Dependent var:	$\Delta(\text{CI_LOANS})/\text{GTA}$	$\Delta(\text{CI_LOANS})/\text{GTA}$
Loan size class:	$\leq \$1$ million	$> \$1$ million
$\Delta(\text{DWTAF}) / \text{GTA}$	0.143**	0.041
Observations	6071	6071
R2	0.11	0.14

... while at large banks, loans with larger sizes increased:

Dependent var:	$\Delta(\text{CI_LOANS})/\text{GTA}$	$\Delta(\text{CI_LOANS})/\text{GTA}$
Loan size class:	$\leq \$1$ million	$> \$1$ million
$\Delta(\text{DWTAF}) / \text{GTA}$	-0.004	0.239**
Observations	484	484
R2	0.25	0.26

- Suggests: DW and TAF resulted in increased lending primarily to small businesses by small banks and to large businesses by large banks.

Q3: Did banks use the funds to increase lending? (cont'd)

(Table 11)

- Effects on the credit quality of loans and loan contract terms?
 - Use Federal Reserve's Survey of Terms of Bank Lending (STBL).
 - Quarterly survey of about 348 insured commercial banks: include all of the largest banks and a stratified sample of the smaller banks.
 - Asks banks about the credit quality and terms of individual commercial and industrial loans issued during the 1st business week of the 2nd month in each quarter.
 - Collect:
 - Loan risk ratings: range from 1 (minimal risk) to 5 (special mention or classified asset)
 - Interest rate premium: spread to comparable maturity Treasury
 - Collateral status (0/1)
 - For each bank in every quarter, we calculate the quarterly change in the dollar-year weighted average values of the three variables.
 - A loan that is 2x as large or 2x as long receives 2x the weight.

Q3: Did banks use the funds to increase lending? (cont'd)

(Table 11)

<i>Dependent var:</i>	Small banks:			Large banks:		
	$\Delta(\text{WA credit rating})$	$\Delta(\text{WA interest rate premium})$	$\Delta(\text{WA collateral status})$	$\Delta(\text{WA credit rating})$	$\Delta(\text{WA interest rate premium})$	$\Delta(\text{WA collateral status})$
$\Delta(\text{DWTAF}) / \text{GTA}$	-28.673**	1.936	-1.957	4.439	-0.832	-2.115
Observations	955	955	955	1013	1013	1013
R2	0.10	0.07	0.16	0.10	0.08	0.18

- Are banks receiving DW and TAF funds reaching into a safer or riskier pool of borrowers?
 - Find: DW and TAF usage is associated with safer loans (lower rating) for small banks; does not seem to affect riskiness of loans for large banks.
- What are the effects on loan contract terms?
 - Find: DW and TAF usage does not significantly affect the interest rate premium or collateral status.
 - Small-bank result is perhaps surprising: while they shift into safer borrowers, they do not give these borrowers better contract terms.

Q3: Did banks use DWTAf to liquefy their balance sheets?

(Table 12)

- The popular press often voiced a concern that banks were hoarding liquidity during the crisis, and some research supports this view (Berrospide, 2012).
 - We established: banks used DWTAf to increase lending.
 - Now address: did they use part of the funds to liquefy their balance sheets?
 - Find: small banks: yes (increased securities holdings, not cash holdings).
Large banks: no.

<i>Dependent var:</i>	Small banks:		Large banks:	
	$\Delta(\text{CASH}) / \text{GTA}$	$\Delta(\text{SECURITIES}) / \text{GTA}$	$\Delta(\text{CASH}) / \text{GTA}$	$\Delta(\text{SECURITIES}) / \text{GTA}$
$\Delta(\text{DWTAf}) / \text{GTA}$	0.109	0.283**	0.193	0.055
Observations	55889	55889	4255	4255
R2	0.18	0.22	0.24	0.27

Summary and Conclusion

- Q1: Which banks used funds from the Federal Reserve during the crisis?
 - DW and TAF use was widespread for both small and large banks.
 - Small-bank users were generally weaker, while large-bank users were not.
- Q2: Did these funds substitute for or complement other funding sources?
 - Some substitution and no complementarity for small and large banks.
 - Statistical significance, no economic significance.
- Q3: Did banks use these funds to increase their lending?
 - For both small and large banks, DW and TAF usage is associated with increased lending.
 - This is consistent with one of the main goals of the programs.
 - Results suggest that the Federal Reserve was not pushing on a string.

Policy Implications

- Our findings suggest that the Federal Reserve went beyond the traditional role of Lender of Last Resort (LOLR) by:
 - Providing liquidity to healthier banks, not just weak banks.
 - Setting an additional goal of increasing the flow of credit to firms and households through bank lending, and our findings suggest that the Federal Reserve was successful in achieving this goal.