

Are the Bailouts of Wall Street Complements or Substitutes?

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Abstract The Term Securities Lending Facility (TSLF) lent \$2.3 trillion worth of general collateral to 18 investment houses in exchange for riskier securities. Treasury collateral was in high demand in 2008 and 2009 as repo markets shunned lower quality collateral. This paper finds a negative and significant relationship between participating in the TSLF and having funds from the Troubled Asset Relief Program (TARP) and other Federal Reserve lending programs. Thus, it appears that the TSLF was a substitute for other bailouts. In addition, dealers with higher paid CEOs were more likely to borrow in the next TSLF auction cycle.

Keywords Bailout · Banks · Capital Purchase Program (CPP) · CEO pay · Discount window · Dodd–Frank Wall Street Reform Act of 2010 · Emergency lending

JEL G01 · G18 · G2 · G24 · G28

Introduction

This is the first study to find evidence that the various bailouts of Wall Street were substitutes for one another. We find that assistance from the Federal Reserve's emergency lending programs and discount loans or the Troubled Asset Relief

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Program (TARP) bailouts were associated with a significantly lower chance that a major investment bank would borrow U.S. Treasuries from the Federal Reserve through its Term Securities Lending Fund (TSLF). This contradicts the previous findings of Wilson and Wu (2011a, b) which found that TARP recipients were significantly more likely to sell commercial paper to the Federal Reserve and accept FDIC debt guarantees during the crisis years of 2008 and 2009.

We think that, in part, the difference in our results stems from the way our paper measures TARP participation. Prior studies looked at whether or not a bailout participant ever participated in an emergency program or TARP. Instead, our measure of participation is whether or not TARP money was received prior to receiving a TSLF loan. The way the present study is conducted is more conducive to showing how the sources of funding can be substitutes. TARP recipients may be more likely to receive other forms of government assistance at some point, as prior studies have argued, but TARP recipients may slack off on other emergency forms of assistance while they have TARP capital injections. Prior work showed that firms receiving bailouts were more likely to get multiple bailouts. In contrast, this study shows that when such firms have access to multiple bailouts, they may cut back on one source of bailout financing if they tap more of another bailout fund.

In addition, this is the first study to test how CEO pay was associated with the propensity for firms to obtain the Federal Reserve's emergency assistance. We find that higher stock and total compensation is significantly positively correlated with obtaining TSLF emergency loans.

This is the first paper to examine which factors are associated with the likelihood of participating in the Federal Reserve's TSLF program. This program lent out securities worth in excess of \$2.3 trillion dollars.¹ Thus, this paper adds to a growing literature analyzing the propensity for firms to take emergency loans from the Fed during the financial crisis. Wilson and Wu (2011a) and Duygan-Bump et al. (2013) are other examples of papers that have looked at the likelihood of potential Federal Reserve bailout recipients' accepting of Fed assistance. Those papers studied the Commercial Paper Funding Facility (CPFF) and the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), respectively.

The TSLF and the CPFF dwarfed the much-studied bank investment program, the Capital Purchase Program (CPP), of the TARP in terms of the value of loans extended. The TSLF and CPFF extended loans of \$2,319 billion and \$738 billion, respectively. The TARP CPP bank investment program only passed out \$205 billion. Even the relatively "small" AMLF extended loans in excess of the funds committed from the CPP. It passed out \$217 billion; yet, numerous studies have analyzed the propensity of banks to participate in the smaller TARP CPP. Examples of these studies are Bayazitova and Shivdasani (2012), Cadman et al. (2012),

¹ Because no dollars changed hands in the TSLF program, it had no effect on the money supply and was unrelated to open market operations, which involve the buying and selling of Treasuries with currency. The TSLF program only exchanged securities, and thus, it did not impact bank reserves as Flemming et al. (2009) explain.

Cornett et al. (2013), Duchin and Sosyura (2012), Li (2011), Ng et al. (2010), and Taliaferro (2009).

The Fed's TSLF program auctioned loans of up to \$200 billion of U.S. Treasury securities per month to primary dealers since its inception in March 2009 through August 2009.² At any given time, there are about 20 primary dealers who trade with the New York Federal Reserve as part of the Federal Reserve's open market operations. Primary dealers generally are the largest securities dealers and investment banks. The TSLF loans were collateralized loans in which dealers exchanged less liquid and potentially riskier collateral for U.S. Treasury securities. These loans or Treasuries had no effect on the money supply and thus were not part of open market operations. These loans of U.S. Treasuries to primary dealers were typically for 28 days.

The amount of Treasuries offered was reduced to \$75 billion in July 2009 in response to declining demand for these auctions.³ The last auction that lent Treasury securities to primary dealers was held in July 2009, and the last loan was repaid on August 14, 2009. Nevertheless, the program did not officially end until February 1, 2010.⁴

The minimum fees for loans in exchange for U.S. government backed schedule 1 collateral was 10 basis points, and the minimum fee for Treasury loans in exchange for the riskier schedule 2 collateral was 25 basis points.⁵ Nevertheless, actual fees were set by the auction. Our analysis shows the median fee of the auctions which lent Treasuries was the 25 basis points, the minimum fee for the schedule 2 auctions. Yet, the highest fee paid in a TSLF auction was 322 basis points per annum. Bidding was accepted in increments of 1/100th of a basis point. In addition, primary dealers could bid to borrow Treasuries from the Fed in increments of no less than \$10 million. Finally, no dealer was allowed to borrow over 20 % of the Treasuries offered in each auction.⁶

This program was announced on March 11, 2008, as the repo markets rejected Bear Stearns' attempts to roll over its short term liabilities. Yet, the first auction was not held until March 27, 2008, after the Federal Reserve assisted acquisition of Bear Stearns by J.P. Morgan Chase. The types of collateral which were acceptable for TSLF auctions were revised over the course of the program. Originally, the type 2 collateral was focused on real estate bonds—agency collateralized mortgage backed obligations (CMOs) and AAA or Aaa rated residential or commercial mortgage backed securities, (RMBS) and CMBS. Yet, other types of asset-backed securities were permitted.⁷

² Board of Governors of the Federal Reserve, March 11, 2009, "Press Release, Federal Reserve Announces Expansion of Its Securities Lending Program," accessed online on March 19, 2012, <http://federalreserve.gov/newsevents/press/monetary/20080311a.htm>.

³ Board of Governors of the Federal Reserve, June 25, 2009, "Press Release, Federal Reserve Announces Extensions of and Modifications to A Number of Its Liquidity Programs," accessed online on March 19, 2012, at <http://www.federalreserve.gov/newsevents/press/monetary/20090625a.htm>.

⁴ Board of Governors of the Federal Reserve, January 27, 2010, "Press Release, January 26–27 Federal Open Market Committee meeting statement," accessed online on March 19, 2012, <http://www.federalreserve.gov/newsevents/press/monetary/20100127a.htm>.

⁵ Federal Reserve Bank of New York, March 20, 2008, "Press Release, New York Fed Announces Modifications to Terms and Conditions of Term Securities Lending Facility," accessed online on March 19, 2012, at <http://www.newyorkfed.org/newsevents/news/markets/2008/rp080320.html>.

⁶ Federal Reserve Bank of New York, June 25, 2009, "Term Securities Lending Facility: Program Terms and Conditions," accessed online on March 19, 2012, at http://www.newyorkfed.org/markets/tslf_terms.html.

⁷ Federal Reserve Bank of New York, March 20, 2008, "Press Release, New York Fed Announces Modifications to Terms and Conditions of Term Securities Lending Facility," accessed online on March 19, 2012, at <http://www.newyorkfed.org/newsevents/news/markets/2008/rp080320.html>.

Eligible schedule 2 collateral was expanded on the eve of Lehman Brothers' Chapter 11 bankruptcy filing. (Lehman Brothers was a primary dealer and the largest bankruptcy filing in U.S. history as measured by pre-bankruptcy assets on September 15, 2008.) All AAA-rated debt securities including corporate bonds, municipal bonds, collateralized debt securities (CDOs), and collateralized loan obligations (CLOs) were added as acceptable collateral for primary dealers to post in exchange for U.S. Treasuries in the TSLF.⁸ At this acute phase of the financial crisis, auction frequencies were increased from every two weeks to every week and the amount of schedule two collateral increased from \$125 billion per month to \$150 billion per month.

In the next section, we discuss the problems in the repo market in 2007 to 2009 and the effectiveness of the TSLF in reducing these stresses. Next, we describe our data set of TSLF auctions and primary dealers. Then, we discuss the hypotheses that we test in our results section. Riskier primary dealers, with higher paid CEOs, that were more dependent on short-term funding, which had tapped the TSLF previously, were significantly more likely to borrow Treasuries in the next TSLF auction. There was a positive association between the riskiness of the collateral accepted in the auction and a dealer's chances of participating in that round of the TSLF. Yet, there was a negative and significant association between an investment bank's receipt of TARP funds and its obtaining TSLF bailout assistance. Thus, it seems that this particular Fed bailout of Wall Street was a substitute for the TARP bailout.

Dislocation in the Repo Market

In this section, we discuss the dislocation in the repo market that encouraged the Fed to launch its TSLF program, which marked an unprecedented assistance to Wall Street investment banks. Traditionally, the Fed's lending was restricted to commercial banks through the discount window.

A repo is sale and repurchase agreement. It is an important source of short-term financing for banks and financial institutions. With a repo contract, one party sells a security in exchange for cash with an agreement to repurchase the same security at the end of the contract at a pre-specified price. The pre-specified buy-back price is higher than the original sale price of the security. In the tri-party repo market, a clearing broker that is not otherwise involved in the loan holds the collateral and provides valuation services.

Repo markets have grown rapidly over the last 30 years. Hördahl and King (2008) report that repo markets have doubled in size between 2002 and 2007. The gross amount of repos outstanding at year-end 2007 was roughly \$10 trillion, representing about 70 % of United States national income or GDP. The securities used in repo contracts serve as collateral for cash borrowing. A repo against a basket of U.S. government securities is known as general collateral (GC) repo. In the event that the security lender cannot fulfill the repurchase obligation, the party that provided cash becomes the legal owner of the security. The credit quality of the collateral decides the market risk of a repo contract. To protect the cash provider from this market risk, repo features an initial margin (referred

⁸ Board of Governors of the Federal Reserve, September 14, 2008, "Press Release: Board Announces Several Initiatives to Provide Additional Support to Financial Markets," accessed online on March 19, 2012, at <http://www.federalreserve.gov/newsevents/press/monetary/20080914a.htm>.

to as “haircut”) where the cash borrowed against the security is less than the market value of the security. The amount of haircut is lower for high quality securities.

Gorton and Metrick (2012) document that between the first half of 2007 to 2008, the repo spread increased from 6 basis points to 248 basis points, and the repo haircut increased from 0 % to 27.2 % for the average of nine assets of different credit qualities. Not surprisingly, they found that assets with lower credit qualities had the highest increase. The sub-prime MBS had the highest increase in repo haircut. These increases began in the second half of 2007, but the largest increases took place in 2008. With time series analyses, they further investigated what factors lead to the increase in repo rate and haircut. The repo spread was found significantly related to increases in counter party risk, while the increase in repo haircut is significantly related to the uncertainty about collateral values.

Fleming et al. (2009) found that agency mortgage backed security (MBS) repos spreads over U.S. Treasury repos have historically averaged between 7 and 8 basis points, but the spreads between MBS repos and general collateral (Treasury) repos averaged 62 basis points in February 2008 and widened to a peak of 210 basis points. These spreads narrowed after the first TSLF auction on March 27, 2008.⁹

There is no data on the total withdraw in the repo market. Gorton (2010) explains that the increase in repo haircut has a similar effect to withdrawing money from the banking system. Increasing haircut rate from 0 % to 20 % for a \$10 trillion repo market has similar effect to withdrawing \$2 trillion from the banks. Sorkin (2009, p. 281) argues that the last straw for the doomed primary dealer and investment bank Lehman Brothers was its inability to post an additional \$5 billion in collateral to its rival JP Morgan Chase. Copeland et al. (2011) report that the collateral posted on the tri-party repo market had dropped from \$2.5 trillion in July 2008 to \$1.5 trillion in July 2009.

There is mixed evidence that the TSLF may have helped alleviate the strain on the repo market and interest rate spreads. Hrung and Seligman (2011) found that, for every estimated \$1 billion increase in Treasury collateral from TSLF, the federal funds-repo spread narrowed by roughly 1.2 basis points. Thus, the greater supply of Treasury collateral from the TSLF may have pushed up general collateral repo rates. Yet, Wu (2008) is less enthusiastic about the TSLF program’s effectiveness in reducing interest rate spreads. That study finds that there was a positive and significant increase in the LIBOR-OIS spread after the announcement of the TSLF program.

Data

As part of a large data release mandated by the Dodd-Frank Wall Street Reform Act of 2010,¹⁰ the Federal Reserve disclosed the details of its \$2.3 trillion worth of U.S.

⁹ This was prior to the passage of Housing and Economic Recovery Act (HERA) in July 2008. This act gave the U.S. Treasury secretary authority to inject funds into the government sponsored agencies (GSEs) Fannie Mae and Freddie Mac, signalling explicit federal support for their debt. Paulson (2010, pp. 155, 169–170) writes that he got to use the “bazooka” in the HERA legislation on the Sunday of Labor Day weekend, September 8, 2008, when the government began funding the restructured agencies with taxpayer dollars. At this point, schedule 1 collateral, agency debt, became much safer.

¹⁰ Jeannine Aversa, December 1, 2010, “Fed Names Recipients Of Aid — Startling Report Documents Trillions Of Dollars Used To Prop Up Global Financial System,” *Associated Press*.

Treasury securities loaned to 18 primary dealers. We obtained the loan amounts, dates, and collateral posted from the Federal Reserve's Dodd-Frank-mandated disclosures.

The Federal Reserve Bank of New York held weekly auctions which allowed primary dealers to borrow U.S. Treasury securities for less liquid collateral such as agency securities and highly rated corporate, asset-backed, and municipal securities. We obtained the list of primary dealers over time from the Federal Reserve. We only looked at the results of auctions that had at least one successful bidder.

According to Fig. 1, the market value of U.S. Treasuries lent in this program peaked at \$275.4 billion in October 1, 2008, during the height of the crises after the collapse of Lehman Brothers. Appendix A has a table of all the primary dealers eligible for this program and the amounts borrowed through the TSLF. The Troubled Asset Relief Program (TARP) was not passed and signed into law until October 3, 2008. While there were 559 different loans made through weekly and bi-weekly TSLF auctions, there were 877 instances where eligible primary dealers did not obtain U.S. Treasury securities through TSLF auctions, which had at least one winning bidder. In Table 1, we see that about two-thirds of these auctions accepted schedule 2 collateral. Schedule 1 collateral consists of Treasury securities, agency securities, and agency mortgage-backed securities. Schedule 2, or type 2 collateral, included investment-grade corporate, municipal, mortgage-backed, and asset-backed securities.

We used credit default swap (CDS) data to measure the firm's credit risk. We obtained credit default swap data from Markit. A credit default swap (CDS) buyer pays a spread to insure against an issuer defaulting on a bond. We looked at the CDS spreads on the day prior to the loan date for each one of the eligible primary dealers in a given auction. Most issuers have multiple types of CDS insurance written on their bonds. For any given issuer on any given day, CDS contracts vary by currency, maturity, bond seniority, and what constitutes a default event. For consistency we used CDS spreads for U.S. dollar denominated, senior unsecured bonds, with maturities of 4 years. (We would have had to reduce our number of observations if we had chosen CDS with shorter maturities for lower seniority bonds.) In most cases, we used the

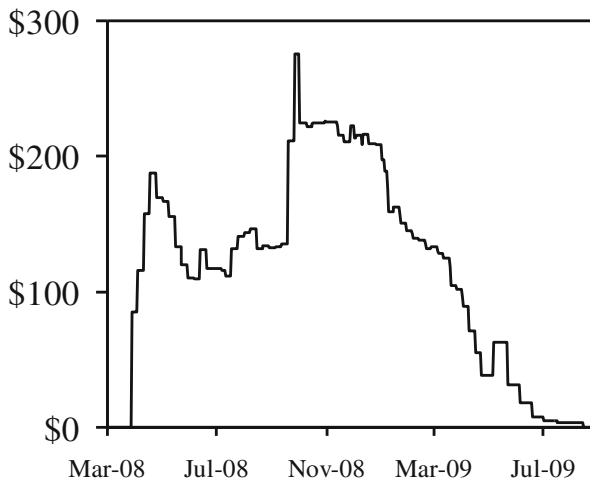


Fig. 1 U.S. Treasuries lent out by the Federal Reserve to primary dealers over time as part of the Term Securities Lending Fund (TSLF) in billions of dollars. *Source:* Federal Reserve

Table 1 Summary statistics

Independent variable	Mean	Median	Min.	Max.	Stand. dev.	Num. of obs.
Type 2 collateral auction dummy	0.664	1	0	1	0.472	1436
Credit default swap spread	1.68 %	1.20 %	0.29 %	14.53 %	1.41 %	1351
30-day implied volatility index	82.47 %	77.56 %	19.47 %	245.38 %	40.68 %	1111
Financial commercial paper spread less lending fee	0.49 %	0.55 %	-3.05 %	2.04 %	0.77 %	1436
LIBOR spread less lending fee	1.69 %	1.31 %	0.48 %	5.08 %	0.94 %	1436
Mortgage repo spread less lending fee	-0.12 %	-0.12 %	-2.92 %	0.96 %	0.53 %	1149
Total assets in billions	\$1,821	\$1,781	\$26	\$3,879	\$949	1355
Liquidity ratio	57.10 %	63.96 %	139.61 %	87.94 %	20.42 %	1346
Common equity over total assets	3.87 %	3.24 %	0.73 %	8.72 %	1.92 %	1168
Tangible common equity (TCE) ratio	2.32 %	2.11 %	0.14 %	6.80 %	1.12 %	1156
Return on equity (ROE)	2.97 %	2.97 %	0.19 %	8.10 %	1.79 %	570
Return on assets (ROA)	0.10 %	0.09 %	0.02 %	0.39 %	0.06 %	586
Market to book ratio	0.882	0.870	0.001	4.505	0.568	1149
Foreign firm dummy	0.568	1	0	1	0.495	1436
TARP capital dummy	0.172	0	0	1	0.378	1436
Non-TSLF fed loans over total assets	0.98 %	0.49 %	0.00 %	54.67 %	1.87 %	1355
TSLF loans over total assets	0.47 %	0.19 %	0.00 %	3.90 %	0.66 %	1355
CEO salary in millions	\$0.882	\$0.800	\$0.050	\$2.867	\$0.355	620
CEO stock compensation in millions	\$14.507	\$13.000	\$0.000	\$66.780	\$11.503	616
CEO options compensation in millions	\$3.170	\$0.809	\$0.000	\$26.669	\$4.229	614
Total CEO compensation in millions	\$26.491	\$24.307	\$0.072	\$91.375	\$16.008	616

default event definitions more popular in North America, but for some issuers and on some dates CDS spreads for U.S. dollar denominated, 4-year, senior unsecured bonds only had spreads for the default definitions more prominent in Europe and Asia. Over this period, the average CDS buyer had to pay 120 basis points to insure the senior unsecured bonds of a primary dealer.

An alternative measure of the firm's riskiness is the Black and Scholes (1973) implied volatility of its stock options. From ivolatility.com, we obtained the weighted average of the primary dealer's implied volatility of its stock options expiring in 30 days from the loan date. Stock option volatility is a function of overall asset volatility. Since Merton (1974) argues that debt defaults are increasing in asset volatility, we would expect that both CDS spreads and implied volatilities are positively correlated. The average eligible borrower had an implied volatility of 30 day options of 82.5 % in our sample.

We included several macroeconomic measures of short term funding stress. From the St. Louis Federal Reserve, we obtained three-month financial commercial paper rates, three-month LIBOR rates, and three-month U.S. Treasury bill rates. The spreads over Treasuries on the loan date were subtracted from the borrowing fee for each auction. ICAP provided overnight mortgage repo rates. These are repurchase agreements collateralized by non-agency commercial and residential mortgage backed

securities, CMBS and RMBS. The mortgage repo spread less the lending fee was that rate, less the 3-month Treasury, less the lending fee for the TSLF auction. The yields on the LIBOR and mortgage repos blew out during the financial crisis of 2007 to 2009. In contrast, general collateral repo yields shrank as fears about the quality of mortgage assets and the solvency of large banks were questioned. This rally in treasury-backed repos and the fall in value of mortgage repos and LIBOR loans represented a massive flight to quality during the financial crisis.

Accounting data were obtained from the Compustat North America and global databases. We used quarterly accounting data for the quarter prior to the TSLF loan date. The median eligible TSLF borrower had \$1.6 trillion in total assets. The liquidity ratio in Table 1 is debt in current liabilities, plus accounts payable, all divided by total liabilities. These current liability measures were selected because the data items were relatively common in a sample with over half of its observations, 56.8 %, coming from foreign headquartered banks. This is a measure of investment banks' reliance on short-term funding. The average bank had a liquidity ratio of 57.1 %. Thus, over half the liabilities for the average bank eligible for TSLF were short-term. The average bank had tangible common equity (TCE) ratios, which exclude intangible assets from the calculation of bank capital, of only 2.3 % of total assets. Thus, leverage was on average 40-to-1 by this TCE measure.

Market capitalization data, loans outstanding from other Federal Reserve lending programs besides the TSLF, and TSLF loans outstanding on the day prior to the loan date were obtained from Bloomberg.¹¹ For the TSLF-eligible banks that were not tracked by Bloomberg, we calculated market capitalization based on the shares outstanding in the most recent form 10-Q and the stock price on the day prior to the TSLF auction's loan date. The Fed loans outstanding were scaled by total assets, and the market capitalizations were scaled by book common equity. The non-TSLF loans outstanding averaged about 1 % of total assets, while TSLF loans outstanding averaged about half that.

Primary dealers with headquarters outside the United States were classified as foreign firms. Over half the dealer observations were foreign dealers. The foreign firm dummy equals one for banks that were headquartered outside the U.S. and zero, otherwise.

We used U.S. Treasury transaction reports to determine if the primary dealer had Troubled Asset Relief Program (TARP) funds outstanding by the loan date. Thus, primary dealers that had not yet received TARP funds by the loan date, or banks that had repaid their TARP preferred stock by the loan date were classified as not having TARP. Thus, the dummy variable would equal zero in that instance. If a dealer had TARP obligations outstanding by the loan date, they would be recorded as having TARP funds. In the latter case, the TARP dummy would equal 1. About 17 % of our primary dealer observations had TARP funds at a given TSLF loan date.

CEO salary, stock compensation, options compensation, and total compensation were obtained from Execucomp. The annual CEO pay data was lagged 1 year from the

¹¹ See Bob Ivry, Bradley Keoun and Phil Kuntz, Nov 27, 2011, "Secret Fed Loans Gave Banks \$13 Billion Undisclosed to Congress," *Bloomberg Markets Magazine*, accessed online on March 19, 2012, at <http://www.bloomberg.com/news/2011-11-28/secret-fed-loans-undisclosed-to-congress-gave-banks-13-billion-in-income.html>.

prior quarter. Thus, if a primary dealer's Q3 2008 accounting data was used for a particular observation, then that primary dealer's CEO pay data would come from 2007. The average observation had a CEO with total compensation of \$26.5 million. Most of that compensation \$14.5 million was in the form of stock incentives. A smaller portion, \$3.2 million, came from stock option compensation.

Hypotheses

We discuss several hypotheses in this section. Lower quality collateral repos such as mortgage repos had much higher spreads than higher quality, general collateral repos, which were backed by Treasury securities. Schedule 1 collateral, Treasury, agency debt, and agency-guaranteed mortgage-backed securities, are explicitly or implicitly backed by the full faith and credit of the U.S. taxpayers. Thus, in times of stress, schedule 1 collateral will be more acceptable in repo transactions than schedule 2 collateral. Thus, more dealers will desire to win Treasuries in schedule 2 collateral auctions than in schedule 1 collateral auctions.

Hypothesis 1 (collateral)

H₀: Primary dealers are more likely to participate in and thus win Treasuries in schedule 2 collateral auctions.

Wilson and Wu (2011a, b), and Pana and Wilson (2012) find that larger banks and credit unions are more significantly more likely to be successful in obtaining bailout assistance from the Federal Deposit Insurance Corporation's (FDIC) Temporary Liquidity Guarantee Program (TLGP), the Federal Reserve's Commercial Paper Funding Facility (CPFF), or the U.S. Treasury's Troubled Asset Relief Program (TARP), respectively. Thus, we expect a similar with this Federal Reserve's TSLF program.

Hypothesis 2 (systemic risk)

H₀: Larger dealers as measured by total assets are more likely to obtain Treasuries through the TSLF.

Wilson and Wu (2011a, b) find that banks that accept bailouts from the TARP are significantly more likely to obtain FDIC guarantees from the TLGP or sell commercial paper to the Fed in the CPFF, respectively. We expect this positive correlation between bailout programs will continue with the TARP and other bailout programs of the Fed.

Hypothesis 3 (bailout)

- a. *H₀: Banks with TARP bailout funds outstanding are more likely to obtain Treasuries in the TSLF auctions.*
- b. *H₀: Banks with non-TSLF emergency loans from the Fed are more likely borrow in TSLF auctions.*
- c. *H₀: Banks with TSLF loans outstanding are more likely to win TSLF auctions.*

Bebchuk and Fried (2005) argue that weak boards allow CEOs to set their own pay. Thus, CEO pay may be inversely related to relative performance. There is evidence that higher CEO pay is associated with accepting bailout funds. Wilson and Wu (2011b) finds that higher paid CEOs and CEOs paid more than their peer group were significantly more likely to accept federal debt guarantees from the FDIC. Highly paid CEOs may both be more likely to accept bailouts and to repay bailouts when executive pay restrictions loom. Wilson and Wu (2012) find that banks with the higher paid CEOs were significantly more likely to give up the heavily subsidized TARP capital early. Cadman et al. (2012) find that, controlling for other factors, higher paid CEOs avoided accepting TARP funds and the executive pay restrictions that went with it. Since there were no executive pay restrictions in the TSLF or any other Fed emergency lending program, we expect that all components of CEO pay will be positively associated with borrowing Treasuries from the Fed.

Hypothesis 4 (CEO pay)

H₀: Higher CEO pay is associated with a greater propensity to borrow Treasuries from the Fed's TSLF.

For clarity we limit our primary hypotheses to four, but there are many other predictions that we would like to test which we do not raise to the level of hypotheses. For example, riskier dealers with higher credit default swap (CDS) spreads and higher implied volatilities are expected to be more likely to win Treasuries in TSLF auctions. Collateralized repo borrowing will be more important for borrowers and primary dealers, who present more credit risk to lenders. Thus, we would expect the primary dealers with the greatest credit risk will take advantage of the TSLF auctions of general collateral

TSLF auctions held when the flight to quality is most severe will have the greatest number of dealers borrowing U.S. Treasuries. Thus, when the short-term borrowing spreads over U.S. Treasuries widen, primary dealers are more likely to borrow from the Fed. If a bank has more short-term debt and liabilities, it will need to roll over more short-term debt. Thus, it will be more likely to be a winning bidder in a TSLF auction for general collateral.

Primary dealers with greater weakness in their accounting ratios will find it harder to finance themselves without high quality collateral. Moreover, dealers that have depressed stock prices as measured by market to book ratios will find collateralized borrowing more attractive than other forms of financing. In either case, we predict that financially weak primary dealers will be more likely to win U.S. Treasuries in the TSLF auctions. Thus, we expect that primary dealers with lower capital ratios, lower profitability ratios, and lower market to book ratios will be more likely to borrow Treasuries from the TSLF.

Finally, foreign headquartered banks will want to avoid the stigma of federal government assistance more than U.S. based dealers. Further, foreign banks will finance fewer of their assets with U.S. dollars and will have less need for U.S. Treasury collateral.

Results

Table 2 compares the averages of the control variables for primary dealer-auction observations which win TSLF auctions and eligible dealers which do not obtain

Treasuries in these auctions. Most of the hypotheses receive support from the t-tests. TSLF auctions for the lower quality collateral, type 2 collateral auctions, have significantly more dealers borrowing Treasuries from the Fed. This supports the collateral hypothesis, hypothesis 1. Riskier dealers, as measured by higher CDS spreads or stock option implied volatilities, are significantly more likely to obtain TSLF loans. The greater difference between the spreads for financial commercial paper, LIBOR, and mortgage repos over TSLF borrowing fees were associated with significantly higher propensity to participate in the TSLF. The systemic risk hypothesis, hypothesis 2, also is supported as larger dealers, as measured by total assets, are more likely to participate in TSLF loans. Dealers with more short-term liabilities were more likely to borrow Treasuries from the Fed.

TSLF auction winners were significantly weaker financially as measured by lower common equity and tangible common equity ratios. Yet, financial weakness is not always associated with greater TSLF borrowing, because dealers obtaining TSLF loans had significantly higher returns on equity (ROE). Market-to-book ratios were significantly lower for TSLF borrowers. Thus, financial weakness, as measured by lower capital or market-to-book ratios, was associated with primary dealers that borrowed Treasuries from the Fed.

Foreign firms were significantly less likely to obtain TSLF loans. Yet, the bailout hypothesis, hypothesis 3, has only mixed support from the t-tests of means in Table 2. The null hypothesis of higher CEO pay for TSLF borrowers is generally supported. TSLF borrowers paid their CEOs significantly more in aggregate, in stock compensation, and in options compensation. The typical TSLF borrower paid its CEO \$8.8 million more than non-TSLF borrowers. Yet, there was no significant difference between CEO salaries of TSLF borrowers and the CEO salaries of primary dealers which did not borrow Treasuries from the Fed.

The failure of the null hypothesis 3a about TARP recipients' being more likely to obtain TSLF loans contradicts findings from previous bailout studies. In those studies of other Fed and FDIC bailouts, TARP recipients were significantly more likely to get bailouts from the Fed and FDIC. The null hypothesis 3a can be rejected because there is no significant difference between TARP recipients and non-TARP recipients in obtaining TSLF loans. This is in sharp contrast to the results in Wilson and Wu (2011a, b). Both those studies about banks' propensities to sell commercial paper to the Fed or to obtain FDIC debt guarantees find that those bailouts complemented the TARP bailout. That is, Wilson and Wu (2011a, b) find that TARP recipients were more likely to sell their commercial paper to the Fed and to issue FDIC guaranteed debt, respectively. Yet, those two studies measure participation in the Fed and FDIC bailouts differently. If a bank ever borrowed commercial paper from the Fed as in Wilson and Wu (2011a) or if a bank had FDIC debt guarantees outstanding at the end of 2010 as in Wilson and Wu (2011b), then those banks were said to participate in those respective programs. In contrast, in the present paper, TSLF participation is not measured over the life of the program; instead, bailout participation is measured in each TSLF auction. Here we find that being bailed out in the TSLF is a substitute for being bailed out by the TARP. Thus, if a dealer has TARP

Table 2 Tests of means of primary dealers which do and do not borrow U.S. Treasuries from the Federal Reserve in the Term Securities Lending Fund (TSLF)

Independent variable	Mean for TSLF borrower (Y=1)	Mean for non-borrowers (Y=0)	Diff.	Num. of data points where Y=1	Num. of data points where Y=0	T-stat.	Two-tailed P-value	Pred. sign
Type 2 collateral auction dummy	0.7209	0.6283	0.0926	559	877	3.639	0.000	+
Credit default swap spread	1.81 %	1.59 %	0.22 %	550	801	2.810	0.005	+
30-day implied volatility index	86.43 %	79.58 %	6.85 %	470	641	2.783	0.005	+
Financial commercial paper spread less lending fee	0.62 %	0.41 %	0.20 %	559	877	4.943	0.000	+
LIBOR spread less lending fee	1.79 %	1.63 %	0.15 %	559	877	2.971	0.003	+
Mortgage repo spread less lending fee	-0.08 %	-0.15 %	0.07 %	559	877	2.507	0.012	+
Total assets in billions	\$2,026	\$1,681	\$346	550	805	6.693	0.000	+
Liquidity ratio	57.31 %	55.27 %	2.04 %	550	796	1.806	0.071	+
Common equity over total assets	3.45 %	4.24 %	-0.79 %	550	618	-7.193	0.000	-
Tangible common equity (TCE) ratio	2.04 %	2.56 %	-0.52 %	540	618	-8.004	0.000	-
Return on equity (ROE)	3.36 %	2.66 %	0.70 %	250	320	4.738	0.000	-
Return on assets (ROA)	0.101 %	0.104 %	-0.003 %	250	336	-0.623	0.532	-
Market to book ratio	0.8444	0.9164	-0.072	550	559	-2.147	0.032	-
Foreign firm dummy	0.5063	0.6078	-0.1015	559	877	-3.802	0.000	-
TARP capital dummy	0.1771	0.1688	0.0083	559	877	0.408	0.683	+
Non-TSLF fed loans over total assets	1.04 %	0.94 %	0.10 %	550	805	0.971	0.332	+
TSLF loans over total assets	0.81 %	0.23 %	0.57 %	550	805	17.123	0.000	+
CEO salary in thousands	\$878.7	\$884.1	-\$5.4	278	342	-0.19	0.849	+
CEO stock compensation in thousands	\$17,061.7	\$12,459.9	\$4,601.8	274	342	5.031	0.000	+
CEO options compensation	\$3,921.7	\$2,548.9	\$1,372.8	274	342	4.057	0.000	+
Total CEO compensation	\$31,397.0	\$22,561.2	\$8,835.8	278	342	7.074	0.000	+

funds, it has less need to borrow Treasuries from the Fed. In addition, we find no increased tendency to borrow Treasuries from the TSLF if the bank received other emergency loans or tapped the Fed's discount window. In contrast, Wilson and Wu (2011a, b) find that one bailout complements another. Previous studies find that banks taking one bailout are more likely to take another bailout.

While the bailout hypotheses 3a and 3b cannot find support in Table 2, we do find support for the null hypothesis 3c. Investment banks which borrowed Treasuries from the Fed previously were significantly more likely to continue to tap the TSLF program. This is likely due to primary dealers' desire to continue to roll over their general collateral repos and obtain the necessary Treasuries from the Fed to do so. Thus, there is

a significant positive association between accepting TSLF assistance in the past and receiving TSLF support in the next round of TSLF funding.

In Table 3, we test a logistic model of TSLF participation. Some of the predictions perform well even when controlling for other factors. There is a strong positive relationship between auctions for schedule 2 collateral and TSLF participation. The interest rate spreads, log total assets, liquidity ratio, and prior TSLF participation were all positive and significant in all specifications. The common equity and TCE ratios were negative and significant in line with the financial weakness predictions.

Other predictions fared less well in the logistic regressions. Profitability ratios, ROA and ROE, and the foreign firm dummies were insignificant. Interestingly, there was a positive and significant relationship between market-to-book ratios and TSLF participation in Table 3 when we controlled for other factors. Not only does this contradict the financial weakness predictions, but it also contradicts the t-test results in Table 2, which found a negative

Table 3 Logistic regressions of Term Securities Lending Fund (TSLF) participation

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5	Pred. sign
Type 2 collateral auction dummy	0.714 ^a	0.669 ^a	0.760 ^a	0.524 ^b	0.770 ^a	+
Credit default swap spread			0.159 ^c	0.061		+
30-day implied volatility index	0.011 ^b	0.009 ^b			0.001	+
Financial commercial paper spread less lending fee			0.737 ^a		0.757 ^a	+
LIBOR spread less lending fee				0.205 ^c		+
Mortgage repo spread less lending fee	0.937 ^a	0.848 ^a				+
Log(1 + total assets in billions)	1.854 ^a	2.053 ^a	1.580 ^a	1.240 ^a	3.418 ^a	+
Liquidity ratio	0.037 ^b	0.031 ^a	0.023 ^a	0.025 ^a	0.082 ^a	+
Common equity over total assets					-0.531 ^a	-
Tangible common equity (TCE) ratio	-0.398 ^b	-0.473 ^a	-0.540 ^a	-0.560 ^a		-
Return on equity (ROE)		0.108	0.038		0.027	-
Return on assets (ROA)	-3.628			-2.373		-
Market to book ratio	1.464 ^a	1.245 ^b	1.164 ^a	1.289 ^a	0.195 ^c	-
Foreign firm dummy	0.496					-
TARP capital dummy	-0.816 ^b	-0.796 ^b	-0.558	-0.584 ^c	-1.170 ^a	+
Non-TSLF fed loans over total assets	-0.252 ^b	-0.198 ^c	-0.201 ^c	-0.311 ^a	0.198	+
TSLF loans over total assets	1.627 ^a	1.654 ^a	1.465 ^a	1.400 ^a	1.039 ^a	+
Constant	-17.945 ^a	-19.125 ^a	-14.834 ^a	-11.596 ^a	-29.526 ^a	None
Number of observations where Y=1	241	241	250	250	241	
Number of observations where Y=0	293	293	299	299	293	
Pseudo R-squared	0.247	0.246	0.254	0.218	0.298	

Dependent variable equals one if the primary dealer borrowed Treasuries from the TSLF auction and equals zero if it did not borrow from the Fed auction

^a Denotes significance with 99 % confidence

^b Denotes significance with 95 % confidence

^c Denotes significance with 90 % confidence

Table 4 Logistic regressions of Term Securities Lending Fund (TSLF) participation controlling for CEO pay

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5	Pred. sign
Type 2 collateral auction dummy	1.724 ^a	1.669 ^a	1.600 ^a	1.742 ^a	1.791 ^a	+
30-day implied volatility index	0.011 ^c	0.015 ^a	0.016 ^a	0.013 ^b	0.011 ^a	+
Mortgage repo spread less lending fee	1.276 ^a	1.425 ^a	1.284 ^a	1.240 ^a	1.323 ^a	+
Log(1+total assets in billions)	-0.157	1.433	0.081	0.156	1.377	+
Liquidity ratio	0.006	0.061 ^a	0.019	0.027	0.068	+
Tangible common equity (TCE) ratio	-0.282	-0.497 ^c	-0.306	-0.075	-0.232	-
Return on equity (ROE)	-0.226	-0.172	-0.142	-0.378 ^b	-0.393 ^b	-
Market to book ratio	1.394 ^b	1.421 ^c	2.103 ^a	2.452 ^a	1.765 ^c	-
TARP capital dummy	-0.857 ^c	-1.194 ^c	-0.637 ^b	-0.472	-0.931	+
Non-TSLF fed loans over total assets	-0.076	-0.121	-0.131	-0.090	-0.097	+
TSLF loans over total assets	0.738 ^b	1.031 ^a	1.093 ^a	0.967 ^a	0.949 ^a	+
CEO salary in \$ millions		-1.629			-1.400	+
CEO options awards in \$ millions			-0.001		-0.009	+
CEO stock awards in \$ millions				0.065 ^a	0.062 ^a	+
Total CEO compensation in \$ millions	0.049 ^a					+
Constant	-3.194	-15.363 ^a	-5.655	-8.291	-17.169	None
Number of observations where Y=1	122	124	122	122	122	
Number of observations where Y=0	171	171	170	170	169	
Pseudo R-squared	0.303	0.290	0.278	0.303	0.306	

Dependent variable equals one if the primary dealer borrowed treasuries from the TSLF auction and equals zero if it did not borrow from the Fed auction

^a Denotes significance with 99 % confidence

^b Denotes significance with 95 % confidence

^c Denotes significance with 90 % confidence

relationship between market to book ratios and TSLF participation. The bailout hypotheses 3b and 3a about taking other Fed loans and TARP capital, respectively, are negative and significant in four out of five specifications of the model. This indicates that we should reject the null hypothesis that bailouts are complements. Instead, it seems that other bailouts are substitutes for the TSLF program.

In Table 4, we have all the controls from model 2 in Table 3, but we add the CEO pay controls. Table 4 indicates that total CEO pay and stock awards are positively related to borrowing Treasuries from the Fed through the TSLF program. In general, this lends support to the null hypothesis that higher CEO pay is associated with accepting bailouts as was found in Wilson and Wu (2011b). Interestingly, firm size is no longer significant when we control for CEO pay. This indicates that CEO pay, not firm size, is a better predictor of whether a dealer taps this emergency lending program.¹² Thus, hypothesis 4 (CEO pay) seems to be stronger than hypothesis 2 (systemic risk).

¹² Wilson and Wu (2012) also found that the predictive power of total assets went away when controlling for CEO pay. That study also found that CEO pay was significant when total assets were not.

Salary and options awards, which are smaller components of total pay than stock awards, according to the summary statistics in Table 1, are not significant predictors of whether a primary dealer participates in a TSLF auction. The marginal effects for Tables 3 and 4, are reported in Appendix B, Tables 6 and 7, respectively.

Conclusion

This is the first paper to test how participation with one Federal Reserve emergency program impacts the likelihood of participating in another Fed bailout or tapping the discount window. We find that there is a negative and significant association between tapping another Fed loan program or a TARP bailout and an eligible investment bank borrowing from the \$2.3 trillion Term Securities Lending Fund (TSLF). The TSLF program was an attempt by the Fed to relieve strains in the repo markets for lower quality collateral by lending out U.S. Treasury securities for typical terms of 28 days in exchange for the dealer's posting riskier collateral. This is the first paper to analyze the characteristics of primary dealers which obtain Treasuries through the TSLF auctions. Dealers were more likely to borrow from the Fed when they faced higher interest rate spreads. We find that Wall Street banks with higher paid CEOs, with higher market to book ratios, and with TSLF liabilities outstanding were more likely to borrow Treasuries from the Fed.

Appendixes

Appendix A: List of Primary Dealers Eligible for the TSLF

Table 5 Eligible primary dealers for the Term Securities Lending Fund (TSLF)

Primary dealer name	Dates eligible to receive TSLF loans	Based inside US	Number of loans	Market value of Treasuries borrowed in billions
Citigroup Global Markets Inc.	Start to end	Yes	65	\$347.9
RBS/Greenwich Securities Inc.	Start to end	No	58	\$291.4
Deutsche Bank Securities Inc.	Start to end	No	52	\$276.9
Credit Suisse Securities (USA) LLC	Start to end	No	53	\$260.5
Goldman, Sachs & Co.	Start to end	Yes	53	\$224.9
Barclays Capital Inc.	Start to end	No	65	\$186.6
Merrill Lynch Government Securities Inc. ^a	Start to 2/10/09	Yes	39	\$175.0
UBS Securities LLC.	Start to end	No	21	\$121.8
Morgan Stanley & Co. Incorporated	Start to end	Yes	34	\$114.7
Lehman Brothers Inc.	Start to 9/30/08	Yes	18	\$99.3
Bank of America Securities LLC	Start to end	Yes	23	\$92.1
J.P. Morgan Securities LLC	Start to end	Yes	23	\$68.3
BNP Paribas Securities Corp.	Start to end	No	21	\$41.2
Countrywide Securities Corporation ^b	Start to 6/14/08	Yes	10	\$7.8

Table 5 (continued)

Primary dealer name	Dates eligible to receive TSLF loans	Based inside US	Number of loans	Market value of Treasuries borrowed in billions
HSBC Securities (USA) Inc.	Start to end	No	11	\$3.6
Cantor Fitzgerald & Co.	Start to end	Yes	9	\$3.2
Bear, Stearns & Co., Inc. ^c	Start to 9/30/08	Yes	2	\$2.4
Dresdner Kleinwort Securities LLC	Start to end	No	2	\$1.3
Daiwa Securities America Inc.	Start to end	No	0	\$0.0
Jefferies & Company, Inc.	6/29/09 to end	Yes	0	\$0.0
Mizuho Securities USA Inc.	Start to end	No	0	\$0.0
RBC Capital Markets Corporation	2/11/09 to end	No	0	\$0.0
		Total	559	\$2,318.6

Twenty-two primary dealers were eligible for TSLF loans that originated from March 28, 2008, to July 17, 2009. The last TSLF loan was originated on July 17, 2009. We only consider auctions that had at least one successful bidder. The typical loan of Treasury securities was for 28 days, but maturities ranged from 7 to 31 days. At any one time, there were approximately 20 primary dealers eligible for the TSLF. The Federal Reserve lent U.S. Treasury securities with a market value of \$2.3 trillion to 18 different brokerage firms through the TSLF program. Half, 11, of the eligible primary dealers were headquartered outside the United States. ^a Merrill Lynch and ^b Countrywide merged with Bank of America. ^c Bear Stearns merged with JP Morgan Chase in a Federal Reserve assisted transaction

Appendix B: Marginal Effects of the Logistic Regressions

The logistic model generates probabilities that an investment bank participates in the TSLF. Let x be a column vector of independent variables X_1, \dots, X_N , where N is an integer greater than 1, and b is a row vector of coefficients b_1, \dots, b_N for the independent variables. Let us assume that the estimated intercept coefficient is α . If the independent variable is denoted by the variable Y , then the probability of receiving TARP funds is $p(Y=1|x)$ below:

$$p(Y = 1|x) = \frac{1}{1 + \exp(-\alpha - bx)} \tag{1}$$

To find the marginal effects of a change in the independent variable X_j , where $N \geq j \geq 1$ we need to differentiate Eq. (1) with respect to X_j . That simplifies to the following expression:

$$\begin{aligned} \frac{dp(Y = 1|x)}{dX_j} &= b_j p(Y = 1|x) [1 - p(Y = 1|x)] \\ &= b_j \frac{\exp(-\alpha - bx)}{(1 + \exp(-\alpha - bx))^2} \end{aligned} \tag{2}$$

In Tables 6 and 7, we have reported the marginal effects for Tables 3 and 4. Since the marginal effects in the logistic model are dependent on the values of all the independent variables, we have chosen the mean values of the independent variables from the summary statistics in Table 1.

Table 6 Marginal effect of Term Securities Lending Fund (TSLF) participation

Dependent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Type 2 collateral auction dummy	0.179	0.167	0.187	0.130	0.183
Credit default swap spread			0.039	0.015	
30-day implied volatility index	0.003	0.002			
Financial commercial paper spread less lending fee			0.182		0.180
LIBOR spread less lending fee				0.051	
Mortgage repo spread less lending fee	0.234	0.212			
Log(1+total assets in billions)	0.464	0.512	0.389	0.307	0.811
Liquidity ratio	0.009	0.008	0.006	0.006	0.019
Common equity over total assets					-0.126
Tangible common equity (TCE) ratio	-0.100	-0.118	-0.133	-0.138	
Return on equity (ROE)		0.027	0.009		0.006
Return on assets (ROA)	-0.907			-0.587	
Market to book ratio	0.366	0.311	0.287	0.319	0.046
Foreign firm dummy	0.124				
TARP capital dummy	-0.204	-0.199	-0.137	-0.144	-0.278
Non-TSLF fed loans over total assets	-0.063	-0.049	-0.050	-0.077	0.047
TSLF loans over total assets	0.407	0.413	0.361	0.346	0.246

Table 7 Marginal effect of Term Securities Lending Fund (TSLF) participation controlling for CEO pay

Dependent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Type 2 collateral auction dummy	0.368	0.378	0.350	0.276	0.296
30-day implied volatility index	0.002	0.003	0.004	0.002	0.002
Mortgage repo spread less lending fee	0.273	0.323	0.281	0.196	0.219
Log(1+total assets in billions)	-0.034	0.325	0.018	0.025	0.227
Liquidity ratio	0.001	0.014	0.004	0.004	0.011
Tangible common equity (TCE) ratio	-0.060	-0.113	-0.067	-0.012	-0.038
Return on equity (ROE)	-0.048	-0.039	-0.031	-0.060	-0.065
Market to book ratio	0.298	0.322	0.460	0.388	0.292
TARP capital dummy	-0.183	-0.270	-0.139	-0.075	-0.154
Non-TSLF fed loans over total assets	-0.016	-0.027	-0.029	-0.014	-0.016
TSLF loans over total assets	0.158	0.234	0.239	0.153	0.157
CEO salary in \$ millions		-0.369			-0.231
CEO options awards in \$ million			0.000		-0.001
CEO stock awards in \$ million				0.010	0.010
Total CEO compensation in \$ million	0.010				

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