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Emergency Collateral Upgrades

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Abstract

During the 2008-09 financial crisis, the Federal Reserve established two emergency facilities for broker-dealers. One provided collateralized loans. The other lent securities against a pledge of other securities, effectively providing collateral upgrades, an operation similar to activities traditionally undertaken by broker-dealers. We find that these facilities alleviated dealers' funding pressures when access to repos backed by illiquid collateral deteriorated. We also find that dealers used the facilities, especially the ability to upgrade collateral, to continue funding their own illiquid inventories (avoiding potential fire-sales), and to extend funding to their clients. Exogenous variation in collateral policies at one facility allows a causal interpretation of these stabilizing effects.

JEL classification: G01, G24, E58.
Keywords: Financial crisis, Lender of last resort, Repo, Collateral, Dealers.

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1 Introduction

Traditionally in the U.S., thinking about lender of last resort has focused on providing funding to commercial banks and other depository institutions. During the financial crisis of 2008, however, the Federal Reserve (Fed) created new emergency lending facilites targeted at broker-dealers (dealers). These are institutions that provide intermediation and market making services in the capital markets–especially in markets for government, mortgage-backed, and corporate debt securities–and depend importantly on short-term funding which is vulnerable to runs.[1] Moreover, a number of these institutions, like Bear Stearns and Lehman Brothers, were also in the business of originating mortgages, securitizing them, and distributing private-label mortgage-backed securities and CDOs to investors. Partly because of their involvement in mortgage-related securities, the dealers found themselves at the epicenter of the crisis.

Dealers are not eligible for the Fed's traditional discount window lending facilities and, in order for liquidity support to be provided to them, new emergency facilities were needed. The intent in providing lender of last resort facilites to dealers was to keep them from having to liquidate their portfolios of assets into illiquid markets at fire-sale prices, to prevent illiquidity at dealers from spilling over to their clients, and to enable the dealers to continue to provide market making services (Bernanke (2008) and Madigan (2009)). In this paper, we investigate whether these new lending facilites were successful in supporting the ability of the primary dealers to make markets and to survive runs on their liabilities. We do so using a new data set that matches public data on each dealers' usage of the Fed facilities with confidential weekly data on selected activities of each dealer (including repos, reverse repos, and inventories). Our results show that the Fed's emergency lending facilities allowed dealers

[1]The Fed focused on the broker-dealers with which it had the closest relationships, the primary dealers, which serve as the trading counterparties for the Federal Reserve's open market operations and which play a key role in providing liquidity in the market for U.S. Treasury securities.

to offset losses of private repo funding by borrowing from the Fed, potentially avoiding fire-sales of the underlying illiquid collateral. More importantly, we find that these facilities successfully supported dealers' intermediation activities. For example, our results indicate that the Fed's provision of term financing for illiquid collateral allowed the dealers, in turn, to provide more term financing to their clients, which tends to be especially valuable in the crisis when funding maturities are typically shortening drastically (Krishnamurthy (2010)).

The dealers were vulnerable to liquidity shocks and lender runs because of their reliance on short-term funding instruments. Instead of funding themselves with desposits like traditional commercial banks, dealers obtain a considerable amount of funding by borrowing cash and collateralizing those borrowings with the securities in which they make markets. These transactions involve the sale of securities under agreement to repurchase. For sake of simplicity, we refer to all transactions where cash is obtained against a security as *repos*.[2] A large share of dealer borrowing consists of overnight repos that are rolled over on a daily basis, although some repos are at longer maturities. In a repo, if the cash borrower is unable to return the cash that they borrowed and defaults, then the cash lenders can repossess and liquidate the collateral (Garbade (2006)). While, in theory, the possibility of repossessing the collateral substantially reduces the exposure of the cash lender to risk, most cash lenders would prefer not to have to go through the process of liquidating the collateral.[3] Consequently, they may simply decline to roll over these contracts as they mature. As a result, the dealers are exposed to the risk of runs (Copeland et al. (2014) and Gorton and Metrick (2012)).

[2]Dealers also borrow cash in exchange for securities via securities lending transactions, which are economically similar to a bilateral repo. In a sec lending transaction, interest is in delivering a specific security against cash collateral, while a tri-party repo is used to raise cash against a broad pool of collateral. Finally, bilateral repos lie between the two, and are used to both raise cash and deliver specific securities.

[3]Some repo lenders, in particular Money Market Mutual Funds (MMMFs), cannot technically hold the collateral underlying most repo contracts either because its maturity exceeds the maximum allowed residual maturity or MMMFs are not allowed to invest in such asset class directly. In addition, MMMFs were also worried about being caught in the headline of a news story, in which it would be revealed that such MMMF was lending to a failing dealer (Ball (2016)).

A significant portion of the assets of dealers consist of reverse repos in which the dealers lend cash and receive securities as collateral. For ease of notation, we refer to transactions where cash is delivered in exchange for securities as *reverse repos*.[4] To fund their reverses, dealers often enter a repo to borrow cash against the same securities received as collateral in the reverse repo transaction, and so operate a "matched book". Dealers also finance part of their inventories directly in the repo market by repoing out the security just purchased. In either case, the ability of dealers to raise funding in the repo market will be key to the amount of credit they extend to clients and their ability to hold inventories. Consequently, when the dealers are unable to finance their collateral they will either reduce the credit they extend or sell the underlying collateral they are now unable to finance, or both (Iyer and Macchiavelli (2017a)).

During the financial crisis, there was a deterioration in the functioning of the repo markets in which dealers borrowed. Partly, this was because the financial health of the dealers themselves declined and lenders became more reluctant to provide them credit. It also reflected heightened concerns about the quality of some of the collateral being used in the repo market. To support the primary dealers, the Fed created two lending facilities, the Primary Dealer Credit Facility (PDCF) and the Term Securities Lending Facility (TSLF).[5]

The PDCF was structured similarly to the regular discount window for banks: dealers could pledge a wide variety of collateral and receive an overnight cash loan. The TSLF was an auction-based facility where the dealers could borrow Treasury securities from the Fed's System Open Market Account (SOMA) portfolio while pledging either other Treasury and Agency securities or high grade private securities as collateral; dealers could then use

[4]Dealers also deliver cash in exchange for securities via securities borrowing transactions, which are economically similar to a reverse repo. In a sec borrowing transaction, interest is in obtaining a specific security against cash collateral, while a reverse repo is used mainly to provide cash against a broad pool of collateral.

[5]See Fleming (2012) for an overview of all the emergency liquidity facilities established by the Fed during the financial crisis. Carlson and Wheelock (2015) put the Fed's response to the 2008 crisis in historical context.

the acquired Treasury securities to borrow against in the repo market. This last facility was effectively providing collateral upgrades for primary dealers. During some periods, there were TSLF auction cycles where the dealers could only pledge Treasury and Agency securities as collateral one week but pledge the broader range of collateral the next week. In some of the analysis below, we take advantage of this auction cycle to indentify how dealers' behavior changes in response to the ability to pledge a broader set of collateral at the Fed.

We analyze whether these facilities helped the dealers respond to runs or other withdrawals of financing and whether the facilities better enabled the dealers to continue to provide intermediation services. To do so, we match the borrowing of individual dealers at the two facilities, and the types of collateral they pledged, with confidential data on dealers' secured financing (repos and reverse repos) and inventories of securities. With this data, we can see whether apparent decreases in the ability of the dealers to fund certain assets in the private market were quickly offset either by borrowing from the Fed against the assets formerly pledged in private markets (PDCF), or by pledging those same securities in exchange for easier-to-finance Treasuries or Agency debt (TSLF).

Our results suggest that dealers offset substantial portions of the declines in their ability to finance corporate securities in the repo market by borrowing from the Fed. It was not atypical for dealers facing a decrease in repo funding against corporate collateral to experience a decrease on the order of $600 million;[6] our estimates suggest that this would have led to additional borrowing from the PDCF against corporate collateral of about $77 million (with some additional borrowing against non-corporate collateral) and additional borrowing at the TSLF of about $184 million, again mostly against corporate collateral. By contrast, we do not find evidence that dealers turned to the Fed when there were sharp declines in financing of higher quality securities (Treasuries and Agencies). This difference by collateral is in line with Gorton et al. (2017) who also find that the Fed's facilities were especially im-

[6]From Table 1, the 25^{th} percentile of weekly changes in corporate repos is about -$600 million.

portant for lower quality collateral. The difference in use of the Fed's facilities for different types of collateral is consistent with the idea that most of the dealers' Treasury and Agency repos were used for matched book purposes, providing dealers with the flexibility to stop rolling the reverse repo in the event that the associated repo did not roll. On the other hand, a significant portion of corporate repos were used to finance the underlying collateral, namely corporate securities, which were less liquid and of lower credit quality than Treasuries and agencies (see Figure 1). Thus a loss in the ability to use corporate securities as collateral in the repo market had the potential to cause significant fire-sale losses for the dealers. Our finding that dealers appear to turn to the Fed's facilities when they were unable to pledge corporate securities in the market suggests that these facilites did help the dealers cope with a loss of funding.

More than just helping the dealers cope with decreased access to their own sources of funding, we look at whether the ability to use these facilities supported the dealers' provision of intermediation services. We find evidence that this was indeed the case. In particular, we find that when dealers borrowed more from the Fed, they also tended to lend more to their own customers in the form of reverse repos; for instance, our estimates suggest that half of the average weekly increase in reverse repos provided by dealers against corporate collateral was funded using the TSLF. In addition, dealers used the emergency liquidity to sustain the financing of their own illiquid inventories of corporate securities, which very likely attenuated fire-sales of these assets that dealers would have been otherwise unable to finance in the private repo market.

Importantly, these effects on both credit provision to clients and inventory financing involving corporate securities were stronger during weeks in which the TSLF auction accepted corporate collateral than in weeks in which it did not. We find that, in the summer of 2008, typically 31 percent of any increase in dealer's inventories of corporate securities was funded through transactions that used these securities as collateral; in weeks in which there were

TSLF auctions that accepted such collateral, that percentage doubled. In other words, these findings bolster the case that the Fed's facilities were having a causal effect on dealers' financing of illiquid securities, likely attenuating fire-sales. We also find evidence that use of the Fed's facilities is associated with an increase in term financing provided by dealers. Since financial crises are typically periods when lenders are rapidly shortening the maturity of their lending, an increased willingness to lend at term is consistent with an improved resilience in market funding.

There have been previous studies on the impact of these emergency lending facilities on market conditions; these have tended to focus on the impact on interest rate spreads or measures of market functioning. For example, Fleming et al. (2010) find that TSLF auctions improve conditions in the repo market. Other work has analyzed who borrowed from the facilities: Acharya et al. (2017) find that more troubled institutions tended to borrow more, and Gorton et al. (2017) show that equity returns of broker-dealers increased on TSLF announcement and implementation dates.[7] Our analysis complements these studies by looking at how the use of these facilities actually affected the behavior of the borrowers, in terms of substituting for the reduced supply of private repo funding, and supporting dealers' credit to clients and their ability to finance illiquid inventories.

2 Data and background

In this section, we discuss the data that we use in our analysis. We also provide a description of the Federal Reserve's emergency lending facilities and the dealers' use of these facilities.

[7] Gorton et al. (2017) also provide some time series results showing that higher market-wide interdealer haircuts predict higher usage of emergency liquidity. The higher collateral-level interdealer haircuts proxy for the general reluctance of large dealers to extend repo financing against lower quality collateral to smaller dealers and hedge funds.

2.1 Data on dealers' activities

The information that we use on dealers' activites comes from the Primary Government Securities Dealers Reports (FR2004), forms A and C from March 01, 2008 to November 01, 2009. These reports collect weekly positions, financing, and settlement fails data of U.S. primary dealers (reporting data as of each Wednesday at close of business). Data is reported for the "legal entity that functions as the primary dealer, including any subsidiaries that it consolidates in its regulatory reports", and thus does not include data from unconsolidated subsidiaries of the same holding company. Form A reports positions, long and short, at fair (market) value. Long and short positions "in the same issue should be reported net by CUSIP", while long and short positions "in different issues should be reported gross". Reportable positions include outright transactions, new positions taken at auction or as part of an underwriting syndicate, forward contracts, when-issued positions and dollar rolls involving TBA securities; other derivatives are not included. Positions are broken down by asset class (U.S. Treasuries, Agency debt, Agency MBS and corporate securities). Corporate securities are defined as dollar-denominated debt securities issued by corporations, including bonds, notes, debentures, private-label MBS, commercial paper and privately placed securities. Throughout the paper, we refer to net positions (long minus short) in a given collateral type as inventories.

Form C reports dealers' secured financing, which refers to the actual funds delivered or received against collateral, and covers both "securities in" (funds are delivered) and "securities out" (funds are received). Securities in refers to agreements in which the dealer receives securities from a counterparty; these include reverse repos (dealer lends cash and receives a security as collateral), securities borrowed (the forms report the cash that is lent or the fair value of the securities if securities are exchanged or pledged as collateral), and other secured financing transactions. As previously noted, for simplicity we broadly refer to these transactions as *reverse repos*. Securities out similarly refers to agreements where the dealer

delivers securities to counterparties, including repos (dealer borrows cash and delivers securities as collateral), securities lent (reports the cash that is borrowed or the fair value of the securities if securities are exchanged or pledged as collateral), and other secured financing transactions. As previously noted, for simplicity we broadly refer to these transactions as *repos*. Securities in and out are broken down by asset class (Treasuries, Agency debt, Agency MBS, and corporate securities) and maturity (overnight and term).

It should be noted that all these transactions and arrangements are from the point of view of the U.S. dealer's legal entity and so transactions with customers can include transactions with other legal entities within the firm. For example, if the firm also has a broker-dealer in London, some reverse repos recorded by the New York primary dealer may consist of internal repos whereby the New York office provides cash to the London office against collateral. The FR2004 data does not allow to quantify these internal transactions.

Data is publicly available on aggregates for all the dealers.[8] These aggregates provide a basic picture of dealer's activities and the impact of the crisis. Weekly levels of securities in, securities out, and net positions for all securities, Treasury securities, Agency securities–debentures and mortgage-backed securties (MBS)–and corporate securities, are shown in Figure 1. Prior to the crisis, dealers were clearly engaging in substantial amounts of intermediation activity involving Treasury, Agency, and corporate securities. The near-zero aggregate net positions for Agency and Treasury suggests that, despite large gross positions, repos using these securities are for the most part used to finance reverse repos, and only marginally to finance dealers' own positions. (When a dealer reverses in a security and finances it by repoing it out, we refer to such trade as a "matched book" trade.[9]) This is not the case for corporate collateral, where repos seem to be used in more equal proportions to finance both net positions and reverse repos.

[8]See the New York Fed website, https://www.newyorkfed.org/markets/gsds/search.html.

[9]The exact definition of a matched book trade also requires the tenor of both repo and reverse repo to be the same, so that the dealer is not only hedged against collateral risk, but also rollover risk.

The drop in activity during the crisis is also apparent from Figure 1. During an average week in early 2007, the primary dealers typically borrowed against roughly $4.4 trillion of collateral. During 2008, the amount of borrowing and lending against all collateral types covered in the survey plunged. By 2013, borrowing against US Treasuries and corporate securities had stabilized at levels well below the levels seen prior to the crisis. Borrowing against Agency debt fell and contracted during the year 2013. Borrowing against Agency MBS recovered after 2009, but dropped off again at the end of 2013, likely following the quantitative easing patterns.[10]

While these aggregates tell a useful overall story, they do not allow us to see how individual dealers responded to different shocks. Thus, for our analysis, we use confidential dealer-level data on the financing and inventories of securities that we link to dealer-level data on use of the Fed's facilities.

2.2 The emergency lending programs for dealers

There were two emergency lending programs targeted at the dealers, the Primary Dealer Credit Facility and the Term Securities Lending Facility; both facilities were created under the authority granted by Section 13(3) of the Federal Reserve Act (Sastry (2018)). In short, Section 13(3) used to grant Federal Reserve Banks the authority to lend to any individual, partnership, or corporation in unusual and exigent circumstances, as long as the loan was secured to the satisfaction of the Federal Reserve Bank. In addition to these Section 13(3) emergency lending facilities, the Fed set up a facility that conducted repo transactions with primary dealers against Open Market Operations (OMO) eligible collateral (namely Treasuries and Agencies); this facility was named Single-Tranche Term Repo (STTR) facility,

[10] Krishnamurthy et al. (2014) find that most terms on repo contracts through which money market funds extended funds to dealers changed only modestly: the average maturity of such contracts shortened slightly, haircuts imposed by money funds on private securities serving as collateral widened a bit, but those on Treasury and Agency securities were not much changed.

and resembled the way in which the Fed used to conduct standard open market operations.[11] However, instead of repos of various maturities tailored to the specific day-to-day circumstances used in open market operations, the STTR always offered 28-day repos. In addition, this facility followed a weekly auction format, contrary to standard daily open market operations. By virtue of accepting only OMO eligible collateral from primary dealers, this facility did not need Section 13(3) authority.

Given the focus of the paper on the ability of dealers to pledge illiquid securities at the Fed, we relegate the empirical analysis of the Single-Tranche Term Repo facility to the Appendix. Next, we review each of the emergency facilities established under Section 13(3).

2.2.1 Primary Dealer Credit Facility

The Primary Dealer Credit Facility (PDCF) was an emergency lending facility announced on March 16, 2008 to respond to increasingly severe strains in funding markets, especially the triparty repo market, following the collapse of Bear Stearns.[12] Liquidity troubles at the dealers and disfunctions in the repo market had significant potential to disrupt the functioning of other financial markets via reduced dealers intermediation and market making activities. The PDCF was established to serve as a source of liquidity to the primary dealers and, by supporting these institutions, sustain the orderly functioning of the repo market and other financial markets.

The PDCF operated similarly to the Fed's primary credit facility, the main discount window facility for commercial banks, but with a different set of eligible institutions. PDCF loans were made on an overnight basis, but could be rolled over. The interest rate charged on these loans was set equal to the rate charged on discount window loans to banks made through the primary credit. In addition, use of funding was subject to an escalating usage fee

[11] For more details on open market operations, see the Federal Reserve website.

[12] The triparty repo market is the portion of the repo market where the dealers obtain financing against a general pool of collateral.

that was imposed on borrowers that drew on the facility for more than 45 business days. The amount of credit extended under the PDCF depended on the demand by the dealers, with the Fed standing ready to provide credit so long as the borrowing institution was solvent and had sufficient eligible collateral. Initially, eligible collateral was restricted to government, agency and investment-grade private securities but, in September 2008, was expanded to closely match the types of securities that could be pledged in the triparty repo market.[13] The Fed imposed a haircut on the collateral when lending albeit one that was narrower than the one the dealers could obtain in the market (which is consistent with Bagehot (1873)).

2.2.2 Term Securities Lending Facility

The Term Securities Lending Facility (TSLF) was also introduced in March 2008 to address strains in the repo market and liquidity issues at the primary dealers. Rather than lending cash, as was the case with the other Fed lending facilities, the TSLF allowed the dealers to borrow Treasury securities from the System Open Market Account portfolio against a pledge of other securities.[14] The strains in the repo market were particularly evident for non-Treasury and non-Agency collateral. The TSLF allowed the dealers to swap such securities for Treasury securities. Dealers could then use these Treasury securities as collateral to borrow against in the repo market (rehypothecation).

Loans under the TSLF were allocated through an auction mechanism instead of having institutions request loans of particular size, as was the case with the PDCF. As such, it was the Fed that determined the maximum amount of TSLF credit that could be provided at any point. The auction mechanism also established the fee at which the Fed would lend securities, subject to a minimum fee. TSLF loans had a maturity of four weeks.

[13] See Adrian et al. (2009) for additional detail on the operation of the PDCF.

[14] The Fed regularly lends Treasury securities from its portfolio to facilitate the smooth functioning of the Treasury market. The TSLF differed from this regular lending by allowing loans for a longer maturity, and allowing a broader range of securities to be pledged as collateral. In addition, usual lending is for specific Treasury securities whereas TSLF lending was for general Treasury securities. See Fleming et al. (2009) for additional detail on the TSLF auction process.

Collateral that the Fed would accept when lending Treasury collateral was classified as one of two types. "Schedule 1" collateral consisted of Treasury securities, Agency debt, and Agency mortgage-backed securities, all of which eligible for the Fed's normal open market operations. "Schedule 2" collateral consisted of selected highly rated securities as well as Schedule 1 collateral. Initially, these selected highly-rated securities consisted only of AAA-rated mortgage-backed and asset-backed securities, but the list was expanded in September 2008 to include all investment-grade debt securities. TSLF auctions would alternate between accepting Schedule 1 collateral one week and accepting Schedule 2 collateral the following week.

2.2.3 Data on usage of the emergency facilities

Total credit extended under the PDCF and the TSLF is available from the H.4.1 statistical release[15] and is shown in Figure 2. There was sizable usage of the facilities after they were introduced following the collapse of Bear Stearns in March 2008. Over the next few months, usage of the TSLF declined a bit while usage of the PDCF dropped to zero. After the bankruptcy of Lehman Brothers in September 2008 usage of the facilities soared and only gradually declined over the next few months. Overall, considerably more credit was extended through the TSLF than the PDCF.

As with the data on dealer activities, we need data on the use of these facilities by individual institutions. Here information at the dealer level is publicly available.[16] For the PDCF, since these were overnight loans, we have information at a daily frequency on each dealers' borrowing and the value of the securities pledged by each dealer to secure the loans. To match the frequency of the other data sets, we convert this data to a weekly Wednesday frequency. As most of the analysis is conducted using weekly changes, we calculate the Wednesday to Wednesday change in PDCF credit outstanding.

[15]The H.4.1 releases are available online at https://www.federalreserve.gov/releases/h41/.
[16]See the website https://www.federalreserve.gov/regreform/reform-transaction.htm.

For the TSLF, we observe the dealer's draws and securities currently pledged each time the dealer conducted a new draw on the facility. As noted above, draws made under the TSLF had a four-week maturity. We track each draw so that we know when it ran off, was replaced, or was added to. We then calculate the Wednesday to Wednesday change in TSLF credit outstanding by type of collateral pledged.

We match the newly constructed weekly data on each dealer's use of Fed credit that was secured using different types of collateral to the data on each dealer's activities–engaging in repos, reverse repos, and holding inventories–in those same collateral types. We have 23 dealers and 83 weeks. Taking into account that a few dealers drop out of the sample, in general we have at most 1468 observations to work with.

2.3 Summary Statistics

Table 1 provides summary statistics of the main variables used in the paper. Since the publicly available data on PDCF and TSLF usage groups together Treasuries and Agency debt in a single collateral type, for consistency we do the same on the side of dealers' repos, reverse repos and inventories. In the regressions, the union of Treasuries and Agency debt collateral is denoted by Treas/Agy, while Agency MBS collateral is denoted by Agy MBS; finally, corporate debt securities are referred to as Corp Debt. Both Figure 1 and Table 1 tell a similar story. For both Treasury and Agency securities, repo and reverse repo books are orders of magnitude larger than the respective inventories of securities (net positions). On the other hand, for corporate debt securities, reverse repos and inventories are of similar magnitude, which suggests that repos involving corporate securities are used by dealers to finance inventories and reverse repos in more or less equal proportions. In addition, Table 1 shows the usage of emergency liquidity relative to the size of repo books. For both Treasury and Agency securities, the amount of securities pledged as collateral at the emergency facilities is fairly minimal relative to the amount of those securities pledged

as part of the repo books. By contrast, the amount of corporate debt pledged as collateral to the Fed was much larger relative to dealers' corporate repo books; in some cases the amount was comparable to the amount of collateral pledged through repo transactions.

3 Use of the emergency facilities

We start by considering why the facilities were used by dealers: to extend collateralized credit to clients, to offset declines in the availability of private repo funding, or to sustain the financing of their own inventories of securities. We do so by looking at whether use of the facilities is related to changes in Securities In, private Securities Out, which reflects repo funding obtained from the private market (excluding PDCF and TSLF), and changes in Net Positions. We thus estimate the following equation:

$$\Delta Usage_{i,c,t} = \beta_3 \Delta SecIn_{i,c,t} + \beta_4 \Delta SecOutPriv_{i,c,t} + \beta_5 \Delta NetPos_{i,c,t} + \mu_{c,t} + \varepsilon_{i,c,t} \qquad (1)$$

where $\Delta Usage_{i,c,t}$ is the weekly change in the dollar amount borrowed at the PDCF or exchanged at the TSLF by individual dealer i secured by a particular class c of securities (US Treasury and Agency debt, Agency MBS, or corporate debt securities); $\Delta SecIn_{i,c,t}$ is the weekly change in the amount of securities in (funding being provided to clients) of the same type of securities c for dealer i; $\Delta SecOutPriv_{i,c,t}$ is the weekly change in funding (securities out) obtained in the private market, thus excluding the securities pledged at either PDCF or TSLF; $\Delta NetPos_{i,c,t}$ is the weekly change in dealer i's net positions (or inventories) in the same type of securities c, and $\mu_{c,t}$ is a set of week fixed effects. In some specifications, we also look to see whether use of the facilities was related to changes in funding provided to clients (securities in) on an overnight or a term basis. Standard errors are two-way-clustered at the dealer and week level. These regressions provide a broad sense of the value of the

Fed's emergency lending facilities for financing dealers' activities and offsetting declines in private repo funding.

The results of these regressions, shown in Table 2, suggest that the emergency facilities were important for addressing changes in funding available in the private repo market for corporate securities. In particular, a given decline in funding from the private corporate repo market is associated, on average, with an increase in dealer PDCF take-up by 13% of the original decline and an increase in TSLF take-up by 31% of the original decline.[17] To put this in dollar terms, weekly declines in repo funding against corporate collateral were not uncommonly of the order of $600 million.[18] Our estimates suggest that such a decline would result in an increase in borrowing from the PDCF against corporate collateral by $77 million and borrowing from the TSLF by $184 million.

We find that the TSLF was also used to finance about 50% of the additional corporate collateral reversed in (which we think of as funding provided to clients) either overnight or at term. Moreover, the TSLF was also used to finance on average 24% of dealers' inventories of corporate securities. Altogether, our results suggest that the emergency credit facilities may have been vital in helping dealers avoid fire-sale losses in corporate securities, both directly and indirectly: directly by funding dealers' inventories, and indirectly by sustaining credit to their clients, who most likely used it to finance long positions in the underlying collateral. Aside from sustaining the intermediation and financing of corporate debt collateral, we do not find any significant relationship regarding the use of either PDCF or TSLF for the financing of safer collateral (Treasuries and Agencies).[19] In the Appendix, we document the usefulness of a different Fed facility (Single-TrancheTerm Repo) that provided term repos

[17] Our finding that the PDCF and TSLF were important for financing corporate securities is consistent with Krishnamurthy et al. (2014) who find that dealers that borrowed more through repo transactions secured by corporate securities tended to make greater use of both the PDCF and the TSLF. Our results that the TSLF was broadly used to upgrade illiquid collateral are also consistent with Gorton et al. (2017).

[18] From Table 1, the 25^{th} percetile of weekly changes in corporate securities out is about -$600 million.

[19] In general, the higher the quality of the collateral, the better the repo market for that collateral worked in the financial crisis. Thus, it is not too surprising that we find smaller effects for higher quality collateral.

only against Treasury and Agency collateral. Dealers appear to have used this latter facility to partially offset losses of Treasury and Agency repo funding, and to sustain the financing of Treasury and Agency reverse repos (see the Appendix).

It is worth noting that, while we argue in this section that declines in funding were importantly the result of dealers being less able to obtain funding in the market, we cannot be certain that causality runs from losing access to the private repo market to usage of the Fed facilities. Indeed, it is possible that a dealer with full access to the private repo market could nevertheless shift from financing its securities in the private market to relying on the Fed's facilities; this may have happened either because the Fed was offering competitive rates, or because it was perceived as being a more stable source of funding. However, there are several reasons to think that a substantial portion of the borrowing from the emergency facilities was to replace funding that became unavailable to the dealers. First, much of the borrowing that occurred happened amid the massive drop in interdealer activity following the collapse of Lehman Brothers; it seems unlikely that all this decline was by the choice of the dealers. Second, to the extent that the dealers were quite concerned that the private market funding was considerably less stable, then such actions would still be consistent with the emergency lending facilities playing a Lender of Last Resort role. Third, the rates charged on loans from the PDCF and the TSLF were set to be unattractive if markets were functioning normally, so if dealers found these rates to be cheaper than those in the market, then that would again be consistent with the facilities serving as lender of last resort facilities. Finally, the Fed has often found that there is stigma associated with its lending facilities, particularly the discount window (Armantier et al. (2015) and Anbil (2016)); any stigma attached to the PDCF and TSLF should have pushed the dealers to finance as much as possible on the private market and use the Fed facilities as a last resort.

We conduct a variety of additional tests to shed further light on the role of the emergency facilities in providing backstop funding for dealers that experience a loss in funding

and to confirm the robustness of these results. We start by looking at "cross-collateral" relationships, namely whether changes in borrowing from the emergency facilities against one type of collateral is associated with changes in securities in or securities out of different collateral types. Under US laws, broker-dealers cannot repledge (or rehypothecate) clients' securities in excess of 140% of their debts to the dealer (Huertas (2009) and Scott (2016)).[20] Therefore, facing worse funding conditions, a dealer may pledge additional clients' securities (within the 140% limit) to raise cash. It is then possible that a dealer may offset a decline in corporate repo funding by pledging some high quality clients' securities (Treasuries and Agencies) in the repo market or at the PDCF to raise cash. We indeed find the latter to be the case.

The results of the regressions that allow for cross-collateral relations are displayed in Table 3. As shown in line 6, we find that declines private funding backed by corporate bonds were associated with increases in borrowing at the PDCF against both Treasury securities and Agency MBS securities; the size of borrowing is admittedly modest–the same decline of $600 million in repo funding against corporate collateral noted above would result in additional borrowing at the PDCF against other securities of $14 million–but is not inconsequential. These results are consistent with our earlier results regarding the value of the emergency credit facility in helping the dealers cope with disruptions in their ability to finance their activities in corporate debt securities. It is notable that we find this relationship for the PDCF and not the TSLF. The dealers could access the PDCF on an as-needed basis rather than waiting for an auction. Thus, borrowing in response to an abrupt disruption in the availability of funding is more likely to be from the PDCF than from the TSLF.

Next, we look to see whether there is a different response in borrowing behavior at

[20] On the other hand, UK laws allowed unlimited rehypothecation of clients' assets. Some hedge funds entering into a prime brokerage agreement with Lehman Brothers in New York were actually signing a contract with Lehman's London subsidiary which, subject to UK laws, was constrained by rehypothecation limits (Huertas (2009)).

the emergency facilities depending on whether the dealer is faced with positive or negative changes in private repo funding. We expect that use of the emergency facilities will increase when private funding declines, but it is not obvious how use will evolve when funding increases. Dealers may reduce their use of the Fed's facilities when private funding increases or, having already started to borrow, they may continue to do so.

The results are shown in Table 4. We continue to find strong support for the idea that the emergency liquidity facilities were important for helping dealers finance their corporate securities, especially in the face of declines in their ability to fund themselves in the private market. As shown in line 6, we find that declines in corporate securities out (the baseline effect) correspond to an increase in the use of the PDCF against all types of collateral, and an increase in the use of the TSLF against corporate securities. This result is as expected. Adding the coefficients in lines 6 and 9, we find little change in PDCF use when funding backed by corporate securities increased. This suggests that dealers did not necessarily take advantage of increased funds available to pay back PDCF loans. On the other hand, an increase in private corporate repos is associated with a decrease in TSLF use.

3.1 Robustness of the Results

We check the robustness of the results in Tables 5 and 6. Work by Acharya et al. (2017) finds that the equity valuation and other financial conditions of the dealer affected their use of the emergency facilities. To account for this, we add the change in the dealers' 5-year senior CDS spread and/or equity price to the analysis. Doing so excludes the smallest dealers for whom such security prices or CDS spreads are not available, additionally confirming the robustness of the results to the exclusion of the smallest primary dealers. Gorton et al. (2017) argue that increases in failures by the dealers to receive Treasury securities that they were supposed to receive prompted use of the facilities, especially the TSLF, as a way to obtain Treasuries. To this regard, we also include measures of failure to receive Treasury

securities in Table 5; note that since we include week fixed effects, we are only looking at whether differences across dealers in fails to receive are linked to use of the facilities, not whether changes in aggregate fails over time affected facility use. When measuring failures to receive at the dealer level, we look at both gross fails to receive Treasuries and the net fails to receive (namely fails to receive net of fails to deliver).[21] Then, in Table 6 we check to see whether our results vary before and after the bankruptcy of Lehman Brothers.

As shown in Table 5, our results are robust to controlling for changes in equity valuations, perceived default risk, excluding the smallest dealers, and including measures of failures to receive Treasuries. These additional controls tend to have the expected signs, although their significance in this setting varies. We also find, as shown in in Table 6, that the relationships between dealers' funding conditions and usage of the TSLF for corporate collateral apply both before and after the Lehman bankruptcy, although the magnitudes increase markedly in the aftermath of Lehman's demise. For instance, while a decrease in repo funding of $600 million against corporate collateral resulted in an increase in use of the TSLF by $67 million before the Lehman bankruptcy, the same decrease in repo funding resulted in increased use of the TSLF by $196 million in the period following the Lehman bankruptcy. Consistent with the pattern of use of the PDCF shown in Figure 2, we find that our results regarding the use of the PDCF when repo funding declined is entirely driven by the post-Lehman period.

4 Stabilizing effects on intermediation

In this section, we examine in more detail whether the TSLF was important in supporting the ability of the primary dealers to provide financial intermediation services. Some of the previous results (from Tables 2 and 3) suggest that this was the case. To further investigate the impact of the TSLF on dealer behavior, we exploit a particular aspect of the TSLF

[21] Especially during the crisis, fails to receive were passed almost 1-to-1 into fails to deliver (Iyer and Macchiavelli (2017b)).

auction cycle.

Up until Lehman's bankruptcy, TSLF auctions would be held against Schedule 1 collateral (US Treasury and Agency collateral) in one week and against Schedule 2 collateral (other highly-rated securities, such as investment-grade corporate bonds) in the next week. If the TSLF was important in enabling the dealers to finance their positions, then we would expect that there would be differences in the behavior of the dealers during weeks in which the TSLF auctions accepted corporate collateral and weeks in which they did not.

To see whether this was indeed the case, we regress the change in securities out (both private repo financing obtained by dealers and borrowing from the TSLF) on changes in securities in (secured financing provided by dealers), changes in net positions, and interactions of the variables of interest with an indicator for the week being one in which their was a TSLF auction that accepted Schedule 2 collateral. Because the auction cycle changes after Lehman declared bankruptcy, we use several sample periods that include different amounts of time following Lehman's failure to check the robustness of the results. To this purpose, we run a set of panel regressions focusing on corporate collateral:

$$\begin{aligned}\Delta SecOut_{i,t} = \beta_6 \Delta SecIn_{i,t} + \beta_7 \Delta NetPos_{i,t} + \beta_8 Sched2 \cdot \Delta SecIn_{i,t} + \\ + \beta_9 Sched2 \cdot \Delta NetPos_{i,t} + \mu_t + \varepsilon_{i,t} \qquad (2)\end{aligned}$$

where, in addition to the variables previously defined, $Sched2$ equals one only in the weeks when the Schedule 2 auction is available. As shown in Table 7, we find that dealers' reliance on funding secured by corporate collateral to finance inventories of corporate securities is more than twice as large during Schedule 2 auction weeks than otherwise: specifically, on a regular crisis week dealers finance around 30% of additional corporate inventories using secured funding, whereas on a Schedule 2 week they rely on secured funding to finance around 70% of their additional corporate debt inventories. Together with the results of Table 2, our

findings suggest that the TSLF significantly sustained dealers' financing of illiquid securities, potentially avoiding costly fire-sales.[22]

In addition to sustaining the financing of illiquid inventories, the availability of the TSLF may have enabled dealers to provide better financing terms to their customers, such as by providing longer maturity financing, because the dealers knew they had a dependable source of term funding. Our results in Table 2, Panel B, are suggestive of this idea. We further test this hypothesis by exploring whether dealers that pledged more corporate securities at TSLF auctions also increase in the provision of term financing on corporate collateral. We create an indicator variable that equals one if a dealer pledges more corporate debt securities as collateral during the current Schedule 2 auction than it did in the previous Schedule 2 auction and is zero otherwise; we label this indicator variable as "Higher Usage".

We then regress several variables related to the dealers' provision of financing secured by corporate securities on an indicator for it being a week of a Schedule 2 auction and an interaction of that indicator with the "Higher Usage" indicator. Doing so tells us how closely increased pledges of corporate collateral during Schedule 2 auctions were associated with changes in term funding. The particular dependent variables that we use are changes in securities in, changes in the dealer's provision of overnight financing, changes in the dealer's provision of term financing, the share of financing provided at term, and the change in the dealer's inventories (net positions). All the dependent variables refer to corporate debt collateral. We consider the period from the launch of the TSLF to September 10, 2008, just prior to the switch to weekly Schedule 2 auctions.

As shown in Table 8, we find a strong relationship between an increase in the provision of term financing to clients and increased dealer pledges of corporate securities to obtain

[22]We also looked at there was a change in the use of funding for inventories from private sources in weeks in which there was a TSLF auction. Interestingly, we find that, during weeks in which there was a schedule 2 auction, there is a stronger positive association between a change inventories and use of private funding secured by corporate collateral. That results indicates that the resuts in Table 7 are not driven just by TSLF borrowing and are consistent with the idea that the TSLF generally improved market functioning.

financing at the TSLF. The amount of term financing associated with higher use of the TSLF increased and caused the share of all financing provided at term to increase by 1.4 percentage points, relative to a base of 35 percent. These results again suggest that the TSLF supported the ability of dealers to extend term financing to their clients against illiquid collateral; the provision of stable funding to hedge funds by dealers may have, in turn, reduced the hedge funds' need to liquidate the underlying corporate debt collateral.[23] The last column of the Table shows that the availability of the Schedule 2 auction is not driving dealers to take significantly more leveraged positions in corporate securities. This result seems to suggest that the availability of a Lender of Last Resort did not lead to more risk-taking by dealers, but simply to more stability in their funding and intermediation of illiquid securities.

5 Conclusion

In trying to directly support broker-dealers and the functioning of repo markets right after the near-default of Bear Stearns, the Federal Reserve established two emergency facilities targeted to broker-dealers. In this paper, we analyze the effectiveness of these measures by using a mix of publicly available and confidential data on broker-dealers. We find strong support for the idea that the Fed supported the dealers' ability to fund both their own illiquid inventories and the illiquid collateral of their own clients. This likely avoided a more pronounced deleveraging and a more severe sale of illiquid assets at fire-sale prices. Also, the Fed's provision of term financing for corporate debt collateral allowed dealers, in turn, to extend more term financing backed by those same assets to their clients. In addition, dealers appear to have used both facilities to cope with the impaired ability to raise private repo funding against lower-quality and illiquid collateral. We do not find evidence of moral

[23] This result is consistent with other findings regarding the impact of the emergency lending programs on the behavior of loan recipients. For instance, Berger et al. (2017) find that commercial banks that used the Fed's emergency facilities, such as the Term Auction Facilities, increased lending.

hazard: dealers do not use the facilities to purchase additional risky and illiquid assets.

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6 Appendix: the Single-Tranche Repo Facility

Between March 2008 and December 2008, the Fed conducted repo transactions with its regular counterparties for open market operations (the Primary Dealers) against collateral regularly used for open market operations (Treasury and Agency securities); these repo transactions were larger and for a longer maturity than usual. In particular, these transactions had a term of 28 days. Use of this Single-Tranche Term Repo (STTR) facility peaked at about $80 billion in April 2008, shortly after the collapse of Bear Stearns. Since these transactions were against regular open market collateral, they were done under the Fed's regular open market authority rather than through the authority to create lending facilities that was used for the PDCF and the TSLF (Section 13(3) of the Federal Reserve Act).

Data on use of the single-tranche repo is available at the transaction level, similar to the other facilities. Thus we can construct a measure of the amount of credit each dealer has outstanding from this facility on a daily basis and calculate weekly changes in use to align with the data on dealer balance sheets from the FR 2004. However, the data for the single-tranche repo facility do not disclose the particular type of collateral being used. Thus, we aggregate FR 2004 data on Treasury and Agency securities.

We analyze how the use of the single-tranche repo aligned with other developments on dealer balance sheets using the same framework as in Section 3. In some specifications, we include controls for indicators of dealer's financial condition. The results of this analysis are in Table 9. Use of the single-tranche repo appears to have been strongly related to developments in other parts of the dealer's balance sheets involving open market operation eligible collateral. (It is worth noting that corporate securities, where the PDCF and the TSLF matter most, are not eligible for open market operations or the single-tranche repo.) We find that changes in reserve repos where dealers were providing funding to clients, both overnight and at term, are associated with increased use of the single-tranche repo. For

instance, a rise of $5 billion in reverse repos to clients is estimated to lead to about a $250 million in single-tranche repo use. We also find that a decline in private funding through repo against Treasury and agency collateral would also lead to an increase in use of single-tranche repo funding. The regression coefficient sugguests that a decrease in private repo funding of $5 billion is associated with an increases in use of the single-tranche facility by $250 million.[24] Change in Treasury and Agency inventories do not appear to be associated with use of the single-tranche repo.

[24]From Table 1, the 25^{th} percetile of weekly changes in Treasury and Agency debt securities out is about -$4.5 billion, and -$2 billion for Agency MBS collateral.

7 Figures and Tables

Figure 1: Net Positions, Securities In and Securities Out by Collateral Type.

Net positions is long minus short positions in a class of securities. Securities Out mostly includes repos and economically equivalent contracts; similarly, Securities In mostly consists of reverse repos and economically equivalent contracts. Source: aggregate data from the New York Fed website.

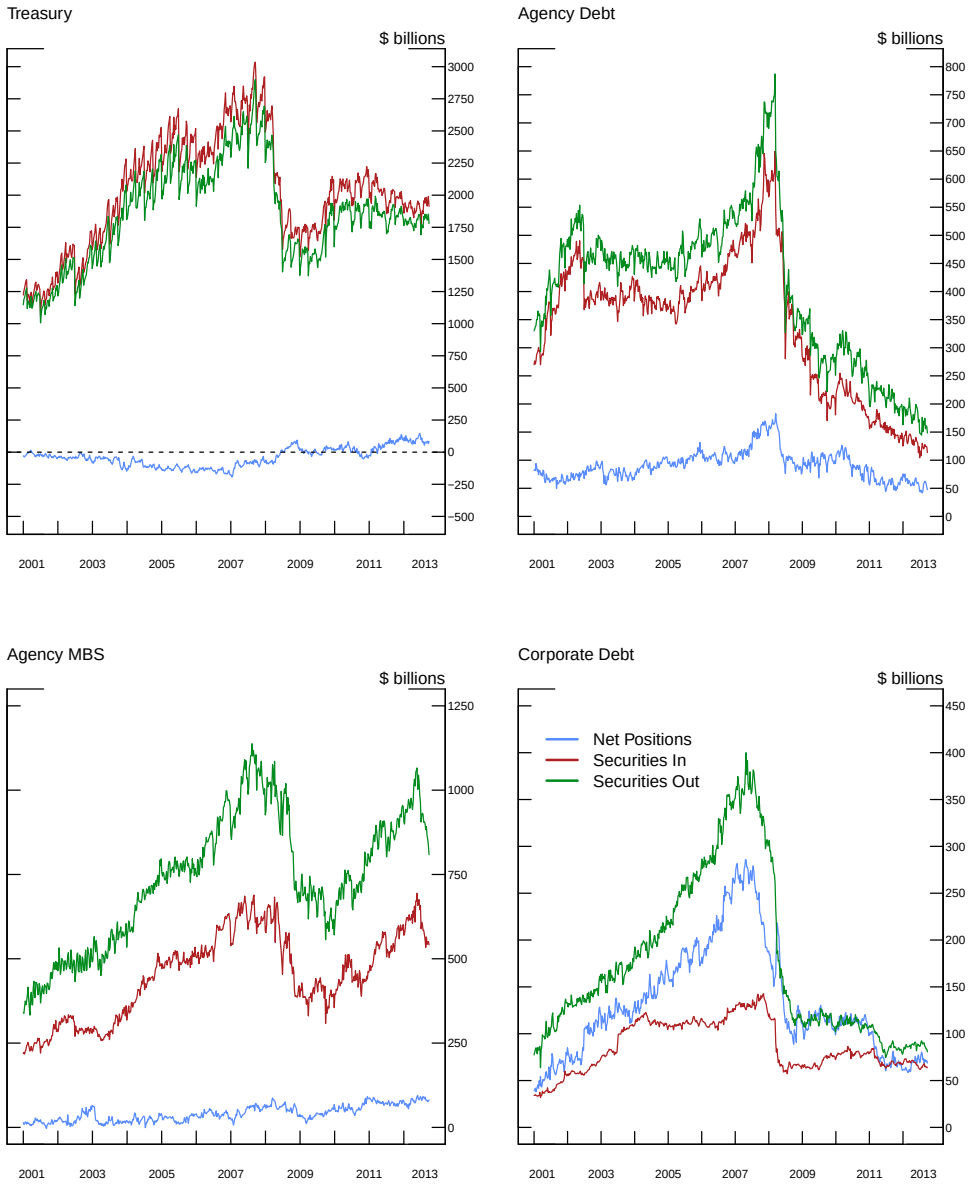

Figure 2: Take-up at the PDCF and TSLF by Collateral Type.

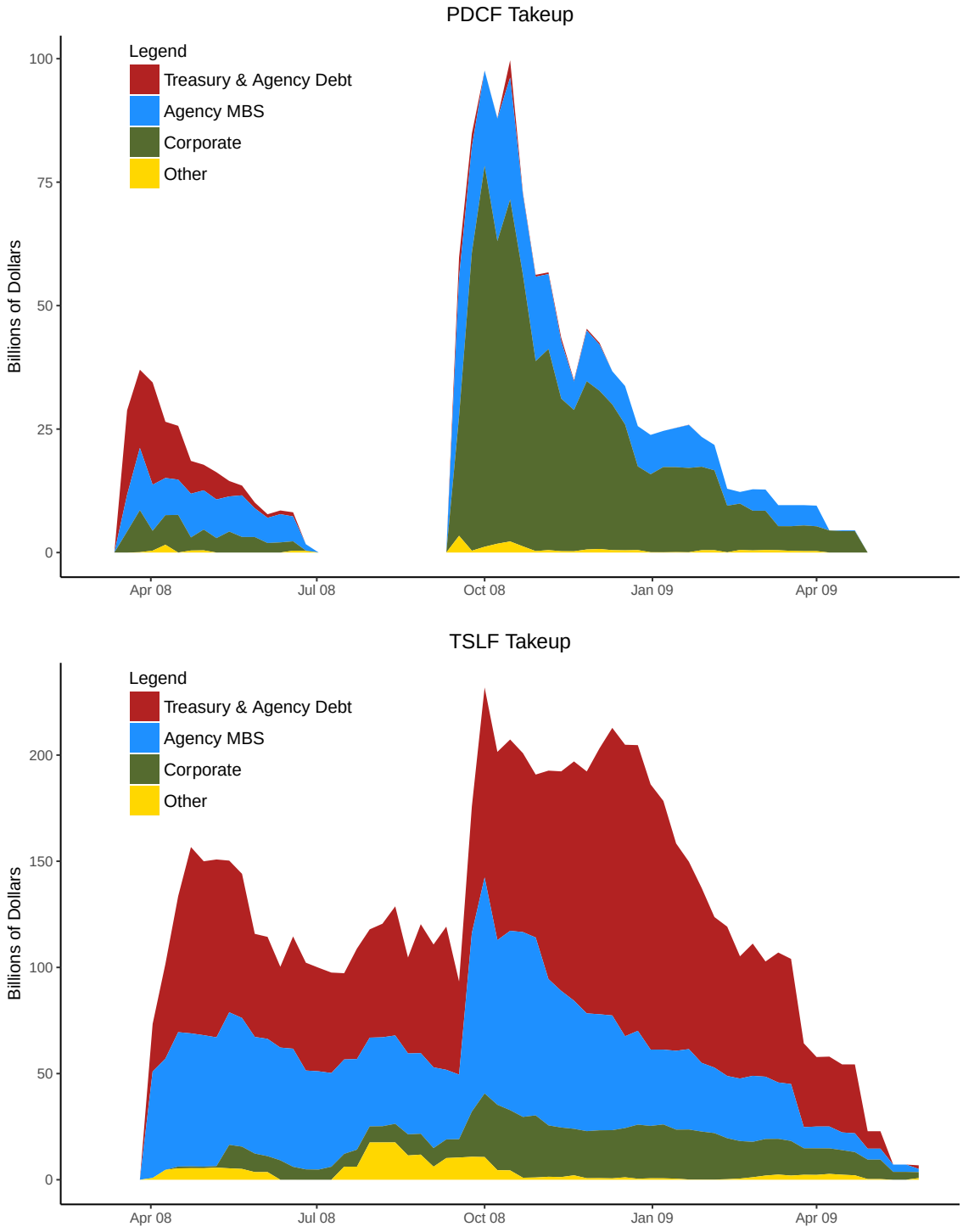

Table 1: Summary Statistics – variables in level and first difference

All variables are expressed in $ millions.

	Panel A: Treasury and Agency Debt Collateral						
	mean	st.dev	p(10)	p(25)	p(50)	p(75)	p(90)
PDCF	19	141	0	0	0	0	0
TSLF	207	1,110	0	0	0	0	110
Securities In	148,829	100,758	17,369	57,082	156,332	228,629	295,815
Securities Out	142,502	99,474	17,865	59,191	124,822	211,899	297,021
Net Positions	6,085	10,843	-1,811	602	3,148	8,130	22,224
Δ PDCF	2	135	0	0	0	0	0
Δ TSLF	-1	505	0	0	0	0	0
Δ Securities In	-886	14,030	-12,258	-4,391	-216	4,745	12,020
Δ Securities Out	-929	14,126	-12,876	-4,509	-62	4,870	11,686
Δ Net Positions	32	2,767	-2,931	-1,201	16	1,371	3,032
	Panel B: Agency MBS Collateral						
	mean	st.dev	p(10)	p(25)	p(50)	p(75)	p(90)
PDCF	70	813	0	0	0	0	0
TSLF	4,430	6,950	0	0	441	6,447	13,068
Securities In	31,481	25,069	2,400	6,896	33,733	50,890	61,613
Securities Out	52,880	43,394	3,081	10,093	50,405	79,672	105,473
Net Positions	3,348	3,747	0	12	2,582	5,146	8,337
Δ PDCF	-15	352	0	0	0	0	0
Δ TSLF	-6	2,177	-1,281	0	0	0	1,160
Δ Securities In	-114	7,283	-6,094	-1,344	0	1,727	5,674
Δ Securities Out	-228	10,678	-7,425	-2,091	-4	1,466	6,502
Δ Net Positions	-6	1,375	-1,115	-302	0	272	1,069
	Panel C: Corporate Debt Collateral						
	mean	st.dev	p(10)	p(25)	p(50)	p(75)	p(90)
PDCF	490	1,530	0	0	0	0	1,468
TSLF	3,688	5,039	0	0	1,345	5,879	11,058
Securities In	7,303	7,325	195	1,020	5,262	10,728	17,302
Securities Out	15,070	14,164	98	2,409	11,627	24,178	33,081
Net Positions	8,551	10,261	0	223	4,618	13,449	23,976
Δ PDCF	-1	960	0	0	0	0	0
Δ TSLF	-31	1,427	-537	0	0	0	364
Δ Securities In	-84	949	-662	-194	0	108	442
Δ Securities Out	-215	2,455	-1,864	-596	-7	197	994
Δ Net Positions	-95	1,916	-1,258	-347	0	116	796

Table 2: Usage of Emergency Liquidity in the face of Runs

All variables are expressed in $ millions. The dependent variables are weekly changes in PDCF (TSLF) take-up by collateral types, namely Treasury and Agency Debt, Agency MBS and Corporate Debt securities. The regressors are weekly changes in either Securities In, Securities Out financed in the private market, or Net Positions, matching the collateral types of the respective dependent variables. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF
	Treas/Agy		Agy MBS		Corp Debt	
			Panel A			
Δ Sec In	-0.000	0.008	-0.002	0.019	0.059	0.502***
	(0.001)	(0.006)	(0.002)	(0.017)	(0.096)	(0.111)
Δ Sec Out Priv	-0.002	-0.009	-0.001	-0.005	-0.128**	-0.307***
	(0.002)	(0.006)	(0.001)	(0.026)	(0.055)	(0.069)
Δ Net Pos	0.006	-0.001	-0.002	-0.009	0.030	0.239***
	(0.006)	(0.004)	(0.007)	(0.044)	(0.051)	(0.070)
			Panel B			
Δ Sec In (ON)	-0.001	0.008	-0.001	0.012	0.060	0.517***
	(0.001)	(0.006)	(0.002)	(0.016)	(0.120)	(0.109)
Δ Sec In (Term)	0.001	0.010	-0.006	0.055*	0.057	0.471***
	(0.001)	(0.007)	(0.007)	(0.031)	(0.084)	(0.152)
Δ Sec Out Priv	-0.002	-0.009	-0.001	-0.008	-0.128**	-0.307***
	(0.002)	(0.007)	(0.001)	(0.027)	(0.055)	(0.068)
Δ Net Pos	0.006	-0.000	-0.001	-0.012	0.030	0.239***
	(0.006)	(0.004)	(0.006)	(0.045)	(0.054)	(0.070)
N	1147	1214	1147	1214	1147	1214
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer Clusters	21	22	21	22	21	22
Week Clusters	65	69	65	69	65	69

Table 3: Usage of Emergency Liquidity: Cross-Collateral Effects

All variables are expressed in $ millions. The dependent variables are weekly changes in PDCF (TSLF) take-up by collateral types, namely Treasury and Agency Debt, Agency MBS and Corporate Debt securities. The regressors are weekly changes in either Securities In, Securities Out financed in the private market and backed by the specified collateral or Net Positions matching the collateral type of the respective dependent variables. We drop the observations where the dealer does not intermediate corporate debt collateral. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF
	Treas/Agy		Agy MBS		Corp Debt	
Δ Sec In Treas/Agy	0.001	0.004	-0.002	0.031	-0.006	0.022***
	(0.001)	(0.003)	(0.002)	(0.022)	(0.013)	(0.005)
Δ Sec In Agy MBS	-0.002	0.001	-0.001	-0.003	-0.020	0.008
	(0.001)	(0.001)	(0.001)	(0.012)	(0.013)	(0.010)
Δ Sec In Corp Debt	-0.051	0.026	-0.034	-0.123	0.078	0.469***
	(0.032)	(0.029)	(0.025)	(0.123)	(0.073)	(0.119)
Δ Sec Out Priv Treas/Agy	-0.002*	-0.005	0.002	-0.016	0.005	-0.020**
	(0.001)	(0.004)	(0.003)	(0.018)	(0.011)	(0.007)
Δ Sec Out Priv Agy MBS	-0.001*	0.000	-0.001	0.002	0.011	-0.002
	(0.001)	(0.000)	(0.001)	(0.024)	(0.012)	(0.008)
Δ Sec Out Priv Corp Debt	-0.010**	-0.012	-0.013**	0.085	-0.129**	-0.290***
	(0.005)	(0.010)	(0.006)	(0.055)	(0.052)	(0.080)
Δ Net Pos	0.003	0.001	-0.003	-0.022	0.032	0.226***
	(0.003)	(0.002)	(0.009)	(0.049)	(0.056)	(0.079)
N	960	1023	960	1023	960	1023
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer Clusters	21	22	21	22	21	22
Week Clusters	65	69	65	69	65	69

Table 4: Usage of Emergency Liquidity: Directionality of Cross-Collateral Effects

All variables are expressed in $ millions. *Positive* is a dummy equal to one when the weekly change in private securities out is positive.The other variables are described in Table 3. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF
	Treas/Agy		Agy MBS		Corp Debt	
Δ Sec In Treas/Agy	0.001	0.004	-0.002	0.032	-0.007	0.022***
	(0.001)	(0.003)	(0.002)	(0.022)	(0.011)	(0.006)
Δ Sec In Agy MBS	-0.001	0.001	-0.001	-0.000	-0.018*	0.007
	(0.001)	(0.002)	(0.001)	(0.015)	(0.010)	(0.013)
Δ Sec In Corp Debt	-0.039	0.024	-0.020	-0.113	0.157*	0.452***
	(0.025)	(0.027)	(0.019)	(0.118)	(0.079)	(0.124)
Δ Sec Out Priv Treas/Agy	-0.003	-0.008	0.000	-0.023	0.007	-0.021**
	(0.002)	(0.007)	(0.004)	(0.023)	(0.016)	(0.009)
Δ Sec Out Priv Agy MBS	-0.000	-0.001	0.002	-0.012	0.020	0.001
	(0.001)	(0.002)	(0.002)	(0.033)	(0.015)	(0.013)
Δ Sec Out Priv Corp Debt	-0.024***	0.003	-0.030***	0.102	-0.266**	-0.260**
	(0.005)	(0.006)	(0.006)	(0.072)	(0.103)	(0.096)
Positive · Δ Sec Out Priv Treas/Agy	0.003	0.007	0.004	0.016	0.005	0.000
	(0.002)	(0.006)	(0.004)	(0.027)	(0.011)	(0.012)
Positive · Δ Sec Out Priv Agy MBS	-0.001	0.001	-0.005	0.021	-0.014	-0.006
	(0.001)	(0.003)	(0.003)	(0.021)	(0.014)	(0.009)
Positive · Δ Sec Out Priv Corp Debt	0.024***	-0.026	0.030***	-0.029	0.282**	-0.060
	(0.004)	(0.026)	(0.004)	(0.096)	(0.134)	(0.107)
Δ Net Pos	0.002	0.001	-0.005	-0.025	-0.019	0.236***
	(0.003)	(0.003)	(0.008)	(0.049)	(0.057)	(0.078)
N	960	1023	960	1023	960	1023
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer Clusters	21	22	21	22	21	22
Week Clusters	65	69	65	69	65	69

Table 5: Usage of Emergency Liquidity – Additional Controls

Positive is a dummy equal to one when the weekly change in private securities out is positive. Δ CDS is the weekly change in 5-year USD senior CDS spreads, and Δ Equity is the weekly percentage change in the dealer's equity valuation. Δ FTR Tsy is the weekly change in the dealer's fails to receive Treasuries (in $ millions), while Δ Net FTR Tsy is the weekly change in fails to receive minus fails to deliver Treasuries (in $ millions). The other variables are described in Table 2. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Δ PDCF		Δ TSLF		Δ PDCF		Δ TSLF		Δ PDCF		Δ TSLF	
	Treas/Agy				Agy MBS				Corp Debt			
Δ Sec In (ON)	0.000	0.000	0.006	0.006	-0.001	-0.001	0.013	0.014	0.031	0.030	0.472***	0.471***
	(0.001)	(0.001)	(0.006)	(0.006)	(0.002)	(0.002)	(0.015)	(0.015)	(0.111)	(0.113)	(0.103)	(0.102)
Δ Sec In (Term)	0.001	0.001	0.008	0.008	-0.008	-0.007	0.059*	0.059*	0.047	0.041	0.462***	0.452**
	(0.001)	(0.001)	(0.007)	(0.007)	(0.008)	(0.008)	(0.033)	(0.033)	(0.084)	(0.080)	(0.147)	(0.155)
Δ Sec Out Priv	-0.003	-0.003	-0.007	-0.007	0.000	0.000	-0.005	-0.005	-0.116*	-0.115*	-0.270***	-0.266***
	(0.002)	(0.002)	(0.006)	(0.006)	(0.000)	(0.001)	(0.026)	(0.027)	(0.063)	(0.062)	(0.075)	(0.076)
Δ Net Pos	0.006	0.006	-0.001	-0.000	-0.004	-0.004	-0.005	-0.006	0.014	0.016	0.203***	0.207***
	(0.006)	(0.006)	(0.003)	(0.003)	(0.007)	(0.008)	(0.044)	(0.043)	(0.067)	(0.069)	(0.054)	(0.060)
L. Δ CDS	0.822*	0.824*	0.263**	0.261**	1.059	1.096	1.299	1.582	-2.306	-2.353	2.091	2.105
	(0.420)	(0.418)	(0.117)	(0.117)	(0.775)	(0.772)	(2.935)	(3.063)	(3.089)	(3.163)	(1.791)	(1.740)
L. Δ Equity	-1.477	-1.405*	0.326	0.312	-0.784	-0.589	-8.928	-8.154	-9.718	-9.683	1.551	2.080
	(0.860)	(0.794)	(0.572)	(0.633)	(0.496)	(0.432)	(13.947)	(13.982)	(6.514)	(6.830)	(4.596)	(4.244)
Δ FTR Tsy	0.001*		-0.000		0.001		-0.007		0.004		0.009	
	(0.001)		(0.001)		(0.001)		(0.008)		(0.007)		(0.011)	
Δ Net FTR Tsy		-0.001		0.000		-0.003		-0.015		0.000		-0.007
		(0.001)		(0.002)		(0.002)		(0.011)		(0.009)		(0.022)
N	907	907	959	959	907	907	959	959	907	907	959	959
Week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dealer Clusters	15	15	15	15	15	15	15	15	15	15	15	15
Week Clusters	65	65	69	69	65	65	69	69	65	65	69	69

Table 6: Usage of Emergency Liquidity Before and After Lehman

All variables are expressed in $ millions. Post LEH is a dummy equal to one after Lehman files for bankruptcy. The other variables are described in Table 5. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF	Δ PDCF	Δ TSLF
	Treas/Agy		Agy MBS		Corp Debt	
Δ Sec In (ON)	0.001	0.018	0.000	0.049	0.080	0.176**
	(0.001)	(0.017)	(0.000)	(0.032)	(0.083)	(0.081)
Δ Sec In (Term)	0.001	0.020	0.000	0.102**	0.063	0.192
	(0.000)	(0.019)	(0.000)	(0.041)	(0.061)	(0.191)
Δ Sec Out Priv	0.000	-0.019	0.000	-0.050**	-0.008	-0.111*
	(0.000)	(0.018)	(0.000)	(0.020)	(0.007)	(0.062)
Δ Net Pos	-0.001	-0.005	-0.001	-0.192***	0.008	0.055
	(0.001)	(0.009)	(0.001)	(0.017)	(0.006)	(0.061)
Post LEH · Δ Sec In (ON)	-0.000	-0.017	-0.002	-0.041	-0.027	0.396**
	(0.001)	(0.017)	(0.002)	(0.036)	(0.129)	(0.152)
Post LEH · Δ Sec In (Term)	0.002	-0.019	-0.011	-0.063	-0.042	0.339
	(0.002)	(0.019)	(0.010)	(0.057)	(0.121)	(0.247)
Post LEH · Δ Sec Out Priv	-0.004	0.018	0.000	0.055	-0.144*	-0.216**
	(0.003)	(0.018)	(0.000)	(0.033)	(0.075)	(0.095)
Post LEH · Δ Net Pos	0.011	0.006	-0.003	0.224***	0.035	0.209**
	(0.008)	(0.009)	(0.008)	(0.041)	(0.090)	(0.096)
L. Δ CDS	0.830*	0.116	1.032	1.460	-2.689	1.652
	(0.408)	(0.184)	(0.756)	(2.858)	(2.937)	(2.031)
L. Δ Equity	-1.370*	0.369	-0.751	-8.520	-8.502	2.906
	(0.778)	(0.534)	(0.502)	(12.649)	(5.593)	(4.898)
N	907	959	907	959	907	959
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer Clusters	15	15	15	15	15	15
Week Clusters	65	69	65	69	65	69

Table 7: Effect of Emergency Collateral Upgrades – Asynchronicity of Schedule 2

All variables are expressed in $ millions. The dependent variables are weekly changes in Corporate Debt Securities Out . The regressors are weekly changes in either Corporate Debt Securities In or Net Positions in Corporate Debt securities. Sched2 refers to the weeks when a Schedule 2 auction is taking place; the last auction matures on July 15, 2009. Between April and mid-September 2008, Schedule 1 and Schedule 2 auctions alternate each week; however, both of them have two weeks maturity, so that securities could be rolled into the next auction. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
		Δ Sec Out		
		Corp Debt		
Δ Sec In	0.947***	0.913***	0.917***	0.873***
	(0.113)	(0.107)	(0.098)	(0.103)
Δ Net Pos	0.312***	0.356***	0.330**	0.256**
	(0.027)	(0.085)	(0.136)	(0.113)
Sched2 XΔ Sec In	0.080	0.299	0.257	0.301
	(0.473)	(0.193)	(0.194)	(0.191)
Sched2 XΔ Net Pos	0.375**	0.458***	0.415***	0.489***
	(0.166)	(0.062)	(0.063)	(0.087)
N	471	777	1200	1468
Week FE	Yes	Yes	Yes	Yes
Dealer Clusters	20	20	22	23
Week Clusters	24	48	68	83
Sample begins	04/02/08	04/02/08	04/02/08	04/02/08
Sample ends	09/10/08	03/01/09	07/15/09	11/01/09

Table 8: Additional Effects of Emergency Collateral Upgrades Linked to Usage

The dependent variables are weekly changes in Corporate Debt Securities In (total, overnight, or term), the weekly change in the percentage of Corporate Debt Securities In at term, and the weekly change in corporate net positions. Sched2 refers to the weeks when a Schedule 2 auction is taking place; Higher Usage equals one if a dealer pledges more corporate debt securities as collateral during the current Schedule 2 auction relative to the previous Schedule 2 auction, and zero otherwise. The sample runs from April to mid-September 2008, Schedule 1 and Schedule 2 auctions alternate each week; however, both of them have two weeks maturity, so that securities could be rolled into the next auction. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)
	Δ Sec In Total	Δ Sec In Overnight	Δ Sec In Term Corp Debt	Δ % Term Sec In	Δ Net Pos
Sched2	0.006	0.017	-0.002	0.189	0.001
	(0.016)	(0.020)	(0.022)	(0.524)	(0.035)
Sched2 X Higher Usage	0.143	0.129	0.054***	1.354***	0.108
	(0.140)	(0.131)	(0.013)	(0.449)	(0.108)
N	449	424	392	444	422
Dealer FE	Yes	Yes	Yes	Yes	Yes
Week FE	No	No	No	No	No
Dealer Clusters	20	20	20	20	20
Week Clusters	24	24	24	24	24
Sample begins	04/02/08	04/02/08	04/02/08	04/02/08	04/02/08
Sample ends	09/10/08	09/10/08	09/10/08	09/10/08	09/10/08

Table 9: Appendix Table – Usage of the Single-Tranche Term Repo Facility

The dependent variables are weekly changes in take-up at the Single Tranche Term Repo facility (STTR); this facility provided 28-day cash loans against OMO eligible collateral (Treasuries, Agency Debt and Agency MBS). The regressors are weekly changes in either Securities In, Securities Out financed in the private market, or Net Positions, all regarding total OMO eligible collateral. The former variables are all expressed in $ millions. Δ CDS is the weekly change in 5-year USD senior CDS spreads, and Δ Equity is the weekly percentage change in the dealer's equity valuation. Standard errors are two–way clustered at the dealers and week level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Δ STTR			
Δ Sec In (ON)	0.048**	0.049**	0.049**	0.050**
	(0.018)	(0.018)	(0.019)	(0.019)
Δ Sec In (Term)	0.058**	0.047*	0.058**	0.047*
	(0.023)	(0.023)	(0.023)	(0.024)
Δ Sec Out Priv	-0.049**	-0.044**	-0.049**	-0.044**
	(0.018)	(0.019)	(0.018)	(0.019)
Δ Net Pos	0.033	0.030	0.032	0.029
	(0.030)	(0.034)	(0.031)	(0.034)
L. Δ Equity		4.093		5.613
		(4.240)		(4.461)
L. Δ CDS			0.264	1.005
			(1.741)	(1.899)
N	854	669	744	669
Week FE	Yes	Yes	Yes	Yes
Dealer Clusters	20	16	18	16
Week Clusters	46	46	46	46