Depositor discipline and LOLR facilities

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Abstract

The paper analyses the presence of depositor discipline following the information disclosure of borrowers' name from the Federal Reserve liquidity facilities. Banks were reluctant to take funds from the Federal Reserve's Discount Window because in this way they would have been perceived as problematic banks on the market. Term Auction Facility, on the other hand, has been introduced to face this "stigma". Whether the presence of market discipline is well recognised in the literature, scarce is the evidence concerning depositor reactions following the participation in Lender Of Last Resort facilities. Using quarterly US data (FRY-9C) from 2006 to 2016 this work investigates if, following the contraction in the interbank market, these funds have been used as substitutes of wholesale deposits and whether the perception of financial instability has led to depositor discipline. Interestingly, results exhibit the presence of depositor reactions with differences among programs and type of deposits: borrowers from Discount Window exhibit a reduction in non-guaranteed deposits whilst borrowers from Term Auction Facility experienced an increase. Moreover, the analysis on market share excludes the presence of herding effects in states different from states where headquarters are located.

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1 Introduction

In August 2007,... banks were reluctant to rely on discount window credit to address their funding needs. The banks' concern was that their recourse to the discount window, if it becomes known, might lead market participants to infer weakness [the so-called stigma problem]. (Bernanke, 2009)

When the Federal Reserve was established, in 1913, there were no open market operations to conduct monetary policy. Instead, the Federal Reserve adjusted the money supply by lending directly to banks through the Discount Window (DW in what follows). Even if at the beginning the DW was used extensively and there appears to have been no mention of "stigma" attached to DW borrowing, in the long-run the access to DW has been scarce (even when banks faced acute liquidity shortages).
During the 2007-09 financial crisis, there has been a freezing in the interbank market (Figure 1), which has increased problems for banks funding with a subsequent reduction in lending and liquidity buffers (Acharya and Skeie, 2011). Whilst deposits represent for banks the "stable" source of funding (among short-term fundings), the interbank market is the most "immediate" source of bank liquidity within the banking system and thus an important indicator of the functioning of the banking market overall. Problems in the efficiency of interbank markets can lead to insufficient bank liquidity. In addition, the overnight interbank market (the fed funds market) is one of the main mechanisms by which monetary policy is implemented, and thus an important market, especially when the market rate can differ from the target. During crisis periods, however, a sudden reduction in the willingness or ability of banks to distribute reserves through interbank transactions has disrupted the short-term funding markets. In particular, banks of sound credit quality might have decided to scale back their term-lending to other banks because they were not as certain of either the creditworthiness of their counter-parties or their own ability to raise future funds (as a result, banks might have limited access to term funds even if they were willing to pay high interest rates). In the late summer of 2007, following deteriorating performance in the market for mortgage-backed securities, (perceptions of) default risk rose and banks found it hard to roll over their uninsured debts. Amounts and maturities shrank in markets involving overnight lending between large banks, like the federal funds and LIBOR markets (Heider, Hoerova, and Holthausen, 2015; Gorton and Metrick, 2012; Covitz, Liang, and Suarez, 2013).
To improve liquidity in the funding markets, the Federal Reserve made a number of changes to its Discount Window facility and, starting from August 2007, this program has been revised in order to allow banks to face the liquidity problems caused by the crisis; in particular, terms of lending were strongly favoured by reducing price of credit and allowing for longer borrowing period. With the bankruptcy of Lehman Brothers (October, the 15th 2008) the volume of borrowing requests from Discount Window increased dramatically: banks lent not directly to each other, but to the central bank and, on the other side, borrowed not directly from each other, but from the central bank. However, a growing literature is proving that even if the aim was to regenerate the asset side of banks' balance sheets and solving liquidity problems, intermediaries that asked credit from this program suffered a "stigma" in the financial markets. That is, reliance on this type of facility was a signal for troubles with negative adverse effects on the stock markets (Fleming, 2012; Berger, 2014; Armantier et al., 2015; Wall, 2016). Consequently, there was reluctance to access the DW out of concerns that, if detected, depositors, creditors, or analysts could interpret DW borrowing as a sign of financial weakness. Moreover, in December 2007, the Fed introduced a temporary liquidity program, the Term Auction Facility (TAF), specifically designed to eliminate concerns of stigma attached to the DW. Under this facility banks bid for funds with (at least) other ten banks. As a result, and in contrast to the DW, the TAF was an immediate success in terms of amounts borrowed.
Initially the Federal Reserve decided not to reveal borrower's name under the reasoning that greater transparency would allow market participants and bank counter-parties to discipline banks and lead to avoidance of borrowing from the Lender Of Last Resort. However, regulators potentially have a different objective function than an individual firm. Bloomberg News and Fox News filed several lawsuits against the Federal Reserve under the Freedom of Information Act requesting access to the DW borrowing data during the financial crisis. On March 21, 2011, the Supreme Court ruled in their favour and, on March 31, 2011, forced

the Federal Reserve to reveal which banks accessed the DW facilities, when they did so, how much they borrowed and for how long.[1]

The presence of market discipline following DW borrowing has been deeply investigated in the literature (Furfine, 2003; Armantier et al., 2015), showing a negative market reaction for banks participating in the DW. However, recent studies show that the decline in prices has happened not when the information has been released but when banks effectively borrowed from the facility (Berger, 2014; Kleymenova, 2015), meaning that the information was leaked or that market participants had been adept at understanding which banks had borrowed.

In this paper we ask whether depositors react following the access to Federal Reserve's liquidity facilities generating a temporary reduction in deposits (calling off the effect of liquidity injection) or, even worst, leading to financial instability problems (Mishkin, 1999; Goodhart, 2009). In fact, whether deposits have always be considered as a stable source of funding, the recent financial crisis has opened again the debate concerning bank-runs (Moore, 1988; Demirguc-Kunt and Detragiache, 2002; Shin, 2009; Huang and Ratnovski, 2011; Beck et al., 2013; Vazquez and Federico, 2015). We conduct the analysis along the period 2006-2016 using quarterly data from FRY-9C consolidated balance sheets for Bank Holding Companies. We differentiate among type of deposits in order to exploit the composition effect and shifting in the maturities: among others we consider demand deposits, liquid deposits, non-interest deposits, guaranteed and non-guaranteed deposits. Along the same vein, we check for depositors discipline in the quarter following the access to the facility and at the announcement date (when borrower names have been disclosed). However, the unavailability of data on DW borrowers before 2010 prevents us from a specific comparison between the two programs because there were differences in the surrounding real economy during the TAF period (2007-2010) and the DW period (2010-2014). Using 3SLS structural equations in order to take into account the demand and supply effect results show that depositors of DW banks effectively discipline their banks: in the quarter following the access to the facility the share of non-guaranteed and saving deposit diminishes and the effect is even larger when information on borrower's name is released (eight quarters later). In general, the share of deposit which suffers more DW stigma concerns time deposits. Furthermore, depositors discipline banks which take part in the Discount Window program also via interest rates: the unit-cost of deposits, increases for banks participating in the DW when the information is released and not immediately after the access to the liquidity program. Using the same methodology depositors of banks participating in the Term Auction Facility show a positive reaction following the bank access to the liquidity program. Both short-term and time deposits increase in the quarter following the participation, and the effect persists for time-deposits when the information is disclosed (in December 2010). However, even if depositors of TAF borrowers do not discipline their banks via quantities they do it via prices: unit-cost of deposits increase on average and for non-guaranteed deposits when the information is disclosed, whilst there is no reaction on guaranteed deposits.

In the second phase of the analysis, using yearly data from the US Summary of Deposits provided by the FDIC, we check whether the results of the previous analysis remain, focusing on the change in the market share (in terms of deposits), in the same state where the bank is headquartered, and in the others. Using Fixed Effect regression and Propensity Score Matching, our evidence show that Discount Window borrowers reduce their market share in the state in which they are headquartered and, although the immediate effect, the market share suffers the larger losses in the year in which the information is disclosed. Nonetheless, results on the bank's market share in other states but where the bank is headquartered, show no reduction in the year in which the BHC access the facility and an increase in the following years excluding the hypothesis of herding effect (results are confirmed from PSM when we control for selection on observables). When we conduct the market share analysis on banks which have participated in the Term Auction Facility program, results exhibit that the market share increases in the year following the access to the facility (with mild effect when the information on borrowers' name is disclosed); however, from Propensity Score Matching analysis evidence show the presence of "herding effect" with the increase happening also in the states in

[1] For the news coverage, see, for example, Torres, Craig (2011), "Fed Releases Discount-Window Loan Records During Crisis Under Court Order" Bloomberg, March 31, 2011, available at http://www.bloomberg.com/news/2011-03-31/federal-reserve-releases-discount-window-loan-records-under- court-order.html

which the bank is not headquartered.

This study contributes to the literature across several dimensions. First, it adds to the literature on the role and economic consequences of mandatory disclosure[2] investigating which are the net effects on financial stability and transparency. The unexpected nature of this disclosure allows us to exploit the exogenous variation resulting from the information shock and hence to draw causal inferences. Secondly, it opens again the debate on depositors sensitivity and the appropriateness of deposits guarantee schemes citare. Third, it adds to the literature concerning the net benefits from liquidity injections: as long as participation in Lender Of Last Resort liquidity programs generate a decline in market prices and deposit contractions, we wonder what is the net benefit in the long term from these programs.

The rest of this paper is organised as follows: Section 2 provides a brief history of the Discount Window and Term Auction Facility; Section 3 reviews the literature; Section 4 introduces the dataset and discusses the research design; Section 5 presents the empirical results and Section 6 concludes.

2 The institutional background

Bank financing in recent years has been characterised by the funding of long-term assets with short-term liabilities with the majority of short-term financing supplied by the repurchase agreement market (Adrian and Shin, 2009; Duffie, 2010; Gorton and Metrick, 2012; Van Rixtel and Gasperini, 2013; Adrian and Ashcraft, 2016). From the second quarter of 2007 to the first quarter of 2009, net repo financing provided to US banks and broker-dealers fell by about 1.3 trillion (more than half of its pre-crisis total). Importantly, as Gorton and Metrick (2012) report, a significant portion of the collateral underlying the repos was comprised of mortgage-backed securities. Lenders of funds became increasingly concerned about losing money on repos because of worries about the value of the collateral as well as the credit risk of counter-parties.

In order to respond to the financial crisis that emerged in the summer of 2007, the US Federal Reserve System and the Board of Governors used liquidity programs, credit programs and other monetary policy tools. In particular, these programs fall into three broad categories: those aimed at addressing severe liquidity strains in key financial markets, those aimed at providing credit to troubled systemically important institutions, and those aimed at fostering economic recovery by lowering longer-term interest rates. The emergency liquidity programs that the Federal Reserve set up provided secured and mostly short-term loans. As financial markets stabilised, the Federal Reserve closed most of these programs: many of the programs were intentionally priced to be unattractive to borrowers when markets are functioning normally and, as a result, wound down as market conditions improved. All Fed liquidity programs were used more heavily after the bankruptcy filing of Lehman Brothers on September 15, 2008, however borrowing remained concentrated through the crisis, and some safer banks were absent from the Fed programs even after Lehman's collapse. Previous evidence (Taylor and Williams, 2009; Sarkar, 2010; Afonso et al., 2011; Benmelech, 2012) shows that weaker banks were significantly more likely to borrow from the Fed and that loan prepayments were not generally motivated by better market conditions, but rather by a desire among weaker banks to avoid investor scrutiny. The most famous and lasting program has been the Discount Window: originally the Discount Window was an overnight temporary loan, but on August 17, 2007, the Federal Reserve extended maturities beyond overnight (from 30 to 90 days); four months later, in order to solve the "stigma" associated with the DW (under which borrowers are perceived riskier or weaker), on December 12, 2007, the Federal Reserve introduced the Term Auction Facility. Both DW and TAF were addressed toward depository institutions, and in addition, the same institutions, namely, those deemed in sound financial condition by their Federal Reserve District Bank, had access to both facilities: funding was offered against the same collateral using identical haircuts calculations.[3]

[2] In this case we can consider the event as exogenous because our analysis investigates unexpected mandatory liquidity disclosures by a regulator, at the time of disclosure. Mandatory disclosure by a regulator is an interesting setting as it provides standardised information for all companies and is less likely to be influenced by the strategic behaviour of a particular bank.

[3] No rules about executive compensation or dividend payments were applied to borrowers using Federal Reserve facilities. Executive compensation restrictions were imposed by statute on firms receiving assistance through the U.S. Treasury's Troubled Asset Relief Program (TARP). Dividend restrictions were the province of the appropriate supervisors and were imposed by the

Discount Window -DW-. In the US, the traditional way for the Federal Reserve to provide emergency credit to depository institutions is through the DW. Lending from the DW is in the form of "advances" which are loans evidenced by promissory notes of the borrowing bank and secured by adequate collateral. All depository institutions that maintain reservable transaction accounts or non-personal time deposits are entitled to borrow at the DW: these include any Federal Deposit Insurance Company (FDIC)-insured bank, savings or mutual bank, insured credit union, and US branch and agency of a foreign bank. DW enables depository institutions that are financially sound but have experienced an unexpected shortage of balances to meet their needs (Madigan and Nelson, 2002).

Prior to 2003, banks in distress could borrow from the DW at a rate below the Fed target rate. Because of the subsidised rate, the Fed was concerned about "opportunistic over-borrowing" by banks. Accordingly, before accessing the DW, a bank had to satisfy the Fed that it had exhausted private sources of funding and that it had a genuine business need for the funds. Hence, if market participants learned that a bank had accessed the DW, then they could conclude that the bank had limited sources of funding. The old DW regime therefore created a perception of "stigma" since DW borrowers revealed financial weakness to the Federal Reserve and possibly to competitors. These concerns may have deterred banks from accessing the DW even if they had an urgent need for funds. This growing reluctance to borrow has impaired the functioning of the Discount Window because depository institutions preferred borrowing from the interbank market at high rates rather than from DW: this lead to the disappearance of the sensitivity of borrowing to the interest rate paid for borrowing (i.e. the "borrowing function"). The Federal Reserve's response to this challenge was to make changes to its lending program so that it would be more appealing to depository institutions. To address concerns about DW stigma, the Fed fundamentally changed its DW policy on January 9, 2003. Under this new regulation (Regulation A) the Fed classified DW loans into: primary credit, secondary credit and seasoned credit.[4]Under primary credit, financially strong and well-capitalised banks can borrow under the primary credit program at a penalty rate (100 basis points above the Federal Open Market Committee's –FOMC– target rate). Because primary credit is available only to depository institutions in generally sound financial condition, it is generally provided with minimal administrative requirements (there are essentially no restrictions on the use of funds borrowed under primary credit -"no questions asked"-). The primary credit facility provides a backup source of funding if the market rate exceeds the primary credit rate, thereby limiting trading at rates significantly above the target rate. On the other hand, secondary credit is available to depository institutions that are not eligible for primary credit. It is extended on a very short-term basis, typically overnight, at a rate 50 basis points above the primary credit rate. There are restrictions on the uses of secondary credit extensions (it may not be used to fund an expansion of the borrower's assets): credit is available to meet backup liquidity needs when its use is consistent with a timely return by the borrower to a reliance on market sources of funding or the orderly resolution of a troubled institution. Moreover, the secondary credit program entails a higher level of administration and oversight than the primary credit program and the Federal Reserve usually applies higher haircuts on collateral pledged to secure secondary credit. Despite these changes, DW borrowing remained sparse after 2003 and perceptions of stigma resurfaced at the onset of the recent financial crisis. By the end of the summer of 2007, financial institutions were perceived to face serious liquidity shortages for term funding (Hilton and McAndrews, 2011). To encourage borrowing, the Fed reduced the DW penalty from 100 bps to 50 bps on August 17, 2007 (Khandani and Lo, 2007) and increased the term of DW financing from overnight to as long as 30 days. In addition, the Fed issued statements that DW borrowing would be viewed as a sign of strength and not a sign of weakness. An important change to its approach occurred in March 2008 after the Bear Stearns bailout, when the Fed reduced the penalty further to only 25 bp above the target FF rate.

Term Auction Facility -TAF-. In August 2007, amid widespread concerns about the condition of many

Federal Reserve on bank holding companies in that role, but not because of borrowing through these facilities.

[4]The seasonal credit program assists small depository institutions in managing significant seasonal swings in their loans and deposits. Eligible depository institutions may borrow term funds from the discount window during their periods of seasonal need, enabling them to carry fewer liquid assets during the rest of the year and, thus, allow them to make more funds available for local lending. The interest rate applied to seasonal credit is a floating rate based on market rates. Seasonal credit is available only to depository institutions that can demonstrate a clear pattern of recurring intra-yearly swings in funding needs.

financial institutions, investors became very reluctant to lend, especially at maturities beyond the very shortest terms. Unfortunately, the steps taken by the Federal Reserve by increasing the amount of liquidity through the Discount Window were not enough: many banks were reluctant to borrow at DW out of fear that their borrowing would become known and would be erroneously taken as a sign of financial weakness. To meet the demands for term funding more directly, the Federal Reserve announced the creation of the TAF on December 12, 2007. A total of 60 TAF auctions were conducted every two weeks between December 17, 2007 and March 8, 2010 when the TAF program was terminated (with credit extended under that auction maturing on April 8, 2010). The amount of credit allocated by the Fed at each auction varied from 20 billion (initially) to 150 billion at the peak of the crisis. With a few exceptions, the terms of the funds allocated were 28 days, and after August 11, 2008, 84 days. The TAF enabled the Federal Reserve to provide term funds to a broader range of counterparts and against a broader range of collateral than it could through open market operations. As a result, the TAF helped promote the distribution of liquidity when unsecured bank funding markets were under stress. All depository institutions that were eligible to borrow under the Federal Reserve's primary credit program (DW) were eligible to participate in the TAF.[5] All loans extended under the TAF were fully collateralised and the funds were allocated through an auction.[6] This emergency facility was considered temporary, for use in a crisis, and thus only the DW facility lasted beyond 2010 (the penalty on DW loans was reset to 100 bp).

The information disclosure. At the time, the Federal Reserve was reluctant to release to the public information about the specific borrowers from its emergency lending programs, releasing neither the identity nor the amount borrowed either incrementally or entirely. The motivation for withholding information from the public about the identity of the borrowers and the amount borrowed appears to have been driven by fear that the news could have caused a bank-run on the borrowing institution. As anecdotal evidence of the idea that the Federal Reserve wanted to increase transparency while carefully managing the stigma associated with participation in the Fed lending programs, Chairman Ben Bernanke testified before the U.S. Congress in February 2010: *"We are also prepared to support legislation that would require the release of the identities of the firms that participated in each special [emergency lending] facility after an appropriate delay. It is important that the release occur after a lag that is sufficiently long that investors will not view an institution's use of one of the facilities as a possible indication of ongoing financial problems, thereby undermining market confidence in the institution or discouraging use of any future facility that might become necessary to protect the U.S. economy"*. After this testimony and in response to a Freedom of Information Act (FOIA) requested by Bloomberg LLP and Fox Business Network, the Federal Reserve divulged detailed public information about the specific institutions that had participated in the emergency lending programs. This information not only identified the name of the borrowing institution and the date of the borrowing, but also included the incremental amount borrowed and the outstanding balance by date of new borrowing. This information was released to the public on December 1, 2010 and March 31, 2011 for the Term Auction Facility (TAF) and Discount Window (DW) borrowings, respectively.[7] The initial reporting period for Dis-

[5] All U.S. depository institutions and U.S. branches and agencies of foreign institutions that maintain deposits subject to reserve requirements are eligible to borrow from the Federal Reserve's discount window. Of those institutions, primary credit, and thus also the TAF, is available only to institutions that are financially sound.

[6] According to this bi-weekly auction participating depository institutions placed bids specifying an amount of funds, up to a pre-specified limit -ten percent of the auction total -, and an interest rate that they would be willing to pay for such funds. The funds were allocated beginning with the highest interest rate offered until either all funds were allocated or all bids were satisfied. All borrowing institutions paid the same interest rate -stop-out rate-, either the rate associated with the bid that would fully subscribe the auction, or in the case that total bids were less than the amount of funds offered, the lowest rate that was bid. Unlike the DW, TAF loans could not be paid back prior to maturity and whereas DW loans are credited on the same day, TAF awards were only credited three days after the auction.

[7] On July 21, 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act was signed into law. The Dodd-Frank Act included changes that were designed to promote transparency while protecting monetary policy independence and the efficacy of the Federal Reserve's liquidity programs and open market operations (OMOs). As required by the Dodd-Frank Act, on December 1, 2010, the Federal Reserve disclosed detailed information about (i) entities that received loans or other financial assistance under a Section 13(3) credit facility between December 1, 2007, and July 21, 2010; and (ii) entities that [...] borrowed through the Term Auction Facility during that time frame. This information includes: the identity of the entities provided financial assistance under the facility, the type of financial assistance provided, the value or amount of the assistance, the date on which the assistance

count Window covers loans made between July 22, 2010 and September 30, 2010. Loan data for subsequent periods are published quarterly, with an approximately two-year lag.
Even if Federal Reserve loan data was kept secret prior to the Bloomberg FOIA lawsuit in 2011, some empirical papers show negative market reaction at the time of borrowing (Berger, 2014; Kleymenova, 2015). This could have happened because, if the amounts borrowed were large enough, banks would be required to disclose them in SEC filings (in fact, to avoid disclosure, banks would prefer to prepay loans immediately prior to the end of the fiscal reporting period).[8] While more disclosure improves price efficiency and leads to market discipline in a setting without frictions, Goldstein and Sapra (2013) demonstrate analytically that this might not necessary be the case for banks. This is because banks operate in the "second-best" environment, due to their interconnected nature, the presence of externalities, and banks'exposure to informational and market frictions. Furthermore, they show that, in the second- best environment, the incentives of all market participants need to be taken into account arguing that while more disclosure might lead to better market discipline and price efficiency, it is a necessary but insufficient condition for economic efficiency because of the endogenous costs of disclosure. Similarly, Thakor (2012) analytically predicts that mandatory financial disclosure for financial institutions might be inefficient and lead to banks' fragility.

3 Literature Review

The literature related to this paper refers to depositors discipline, market reactions following information disclosure and the effects of the liquidity programs launched by the Federal Reserve (especially with reference to Term Auction Facility and the stigma associated to Discount Window).
One of the first studies related to depositor discipline is the one by Douglas and Lewis (1994) where authors provide evidence of risk pricing of insured deposits: if there is risk pricing of guaranteed deposits, investors in deposit instruments evidently price the possibility of loss from incomplete or costly deposit insurance coverage. Moreover, a lot of studies have been performed internationally studying depositors' reaction following a change in bank riskiness. Birchler and Maechler (2001), using bank-specific data on 250 Swiss banks from 1987 to 1998, test for the presence of saving depositors discipline (the uninsured share of deposits) following changes in bank's fundamentals. Authors find evidence of market discipline via quantities, in the sense that depositors are sensitive to fundamentals, institutional differences and changes in deposits guarantees schemes. Martinez-Peria and Schmukler (2001), using a sample of banks located in Argentina, Chile and Mexico from 1980 to 1990, study the interaction between market discipline and deposits insurance and the effects of banking crisis on market discipline. The first set of results show that depositors effectively discipline their banks by requiring higher interest rates and by withdrawing deposits. Interestingly, deposits insurance does not appear to diminish the extent of market discipline. Secondly, authors show that aggregate shocks affect deposits and interest rates during crisis, without distinguishing among banks' fundamentals. In the US market, Maechler and McDill (2002) test whether depositors penalise banks for poor performance by withdrawing their uninsured deposits. Their results support the existence of depositors discipline; moreover, risk-premium offered by the bank (in the form of higher interest rates) is not enough to stop a deposit drain. Goday et al. (2005) investigate depositors' reaction during the Uruguayan crisis studying the effect on the growth rate of deposits, changes in interest rates and by testing if depositors discipline banks by shortening the maturity of time deposits. Their findings show that depositors discipline riskier banks mainly by withdrawing their deposits and weaker evidence on the hypothesis that depositors require higher interest rates or reduce the maturity of time deposits as disciplining actions. For Russian banks along the period 2004-2006, Semenova (2007) investigates whether depositors react to changes in

was provided, the specific terms of any repayment expected, including the repayment time period, interest charges, collateral, limitations on executive compensation or dividends, and other material terms and the specific rationale for the facility.

[8]The Federal Reserve's policy prior to the Dodd-Frank Act was that it would not disclose the names of banks that borrowed from the discount window, but it would publish a weekly total of borrowing by Reserve District. Nevertheless, considerable anecdotal evidence suggests banks believed that other banks would be able to identify which banks borrowed from the discount window. The Richmond Fed's Renee Courtoisis and Huberto M. Ennis suggest that given knowledge of borrowing in a district, "it would not be hard to infer" which bank is doing the borrowing based on the close relationships banks establish with one another in the interbank market.

fundamentals by requiring higher interest rates, withdrawing their deposits or switching from long-term to short-term or on call deposits; moreover the author deepens the analysis testing differences among group of banks (state, private and foreign) and whether depositors discipline disappears with banks' admission to deposit insurance system. Findings show that depositors of foreign banks exert no discipline by quantity or prices, whilst state-owned banks use quantity-based discipline mechanism and private domestic banks are disciplined either by withdrawing deposits and by requiring higher interest rates. Interestingly, the deposit insurance scheme performs the predicted effect: it reduces the maturity-shift for time deposits for state-owned banks, whilst does not remove the disciplining effect for private domestic banks. Karas et al. (2010), demonstrate the presence of quantity based sanctioning of weaker banks by firm and household before the deposit insurance in Russia. Findings show that market discipline happens via quantity (instead of price), is consistent with depositors interpreting the deposit rate as a proxy for bank-level risk. Moreover, deposit supply function show that deposit attraction diminishes following an increase in interest rates, especially for poorly capitalised banks. Berger and Turk-Ariss (2014) study the unintended consequences of a reduction in market discipline following the expansion in deposit insurance schemes. The authors, address for the presence of market discipline in US and EU and how discipline changes during the crisis: evidence shows the existence of depositor discipline and that it varies between US and EU, bank size, and listed versus unlisted status. Moreover, they effectively proved that depositor discipline decreases during the crisis in the US, especially for small banks. Chesini and Giarretta (2016), using a sample of banks located in 22 OECD countries from 2005 to 2014, build up a model for testing whether depositors discipline banks based on banks' riskiness and taking into account Deposit Insurance Schemes depending on where the bank is located. Results show that depositors do not discipline banks before and during the recent financial crisis, while they do it in the post-crisis period. Interestingly, their findings prove the effectiveness of depositors discipline in smoothing moral hazard behaviour.

In what concerns the literature related to depositor discipline and safety net, Demirguc-Kunt and Detragiache (2002), based on evidence for 61 countries between 1980-1997, find that Depositors Guarantee Schemes increase the probability of banking crisis. Moreover, this effect is larger when banks are mainly financed by insured depositors, when the Deposit Guarantee Scheme is run up by the government instead of the private sector, when bank interest rates are deregulated and when the institutional environment is weak. Since TAF program was born in late 2000, literature on it is scarce but is growing rapidly, whilst most of the literature concerning Federal Reserve's liquidity programs analyses the effects of Discount Window with event study methodology. Benmelech (2012) examines the role of foreign banks played in the TAF and finds that the foreign banks used the facility to a greater extent than domestic banks. Ennis and Weinberg (2013) show analytically that in the presence of information asymmetry about the quality of banks' assets, it is rational for banks to avoid using the DW facility to prevent signalling that their need for funding might be an indicator of poor asset quality. Armantier et al. (2015) study if the "stigma" associated with the Discount Window program was effectively proved. Comparing DW (*Primary Credit*) with TAF, repo and Assed Backed Secured Commercial Paper they find that banks were willing to pay more for alternative funds in order to not use funds from DW. Moreover, they find that banks were generally willing to pay an average premium of 37 basis points for TAF funds: this premium is associated with the cost that banks have to pay in order to avoid to be declared as "weak" banks. They even investigate the determinants of DW stigma and they find that banks outside New York, foreign banks, stress in financial markets have higher incidence of DW stigma. Interestingly they do not find any evidence of herding effect; that is, when access to DW is made by banks in the same district and of the same size. Berger et al. (2015) examine the joint use of TAF and DW investigating in which characteristics users of DW and TAF differ, if Fed liquidity programs were substitutes or complements with other sources of funding and which are the use of funds obtained with these program. Using two sub-samples of small and large banks results show that smaller borrowers were weaker than their peers (while larger banks had no significant difference with their peers), that small banks increased lending at small business level and large banks enhanced large business lending. Loan quality only improved at small banks, while both left loan contract terms unchanged. Boyson, Helwege and Jindra (2015) studying the liquidity framework and the bailout framework, find that TAF (among other programs) was used by relatively few institutions and had modest effects on the liquidity of short-term

debt markets. Instead, evidence suggests that the decision to borrow and to prepay loans was related to each firm's financial health. Results suggest that healthy banks found the terms of the loans expensive relative to private market funds, while banks closer to insolvency generally did not. Their perspectives implicitly assume that markets, while not functioning as normal, continue to provide some funds to the strongest financial institutions. As a result, the weakest banks are more likely to find DW loans cheaper than private market debt. Thus, if bailouts are the primary factor in Fed lending, the use of the programs will be limited and skewed towards under-capitalized banks. Allen et al. (2016) study the effects of the modification in TAF facility starting from March 2008, like the increase in the amount of funding offered joint with the reduction in interest rates which allows this program to move from competitive auction to quantitative easing. Moreover, they study the uses of these funds from the community and non-community banks pointing out the financial crisis arises from non-community banks; non-community banks had short-term funding problems and the interbank funding was not of great importance for community banks as they rely mostly on core-deposits and non-equity funding sources. Concerning the stock market reaction following the participation to these programs, Cyree, Griffiths, and Winters (2013) investigate the stock market impact of borrowing from the lender-of-last-resort facilities (DW and TAF), from the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, the Primary Dealer Credit Facility, and the Commercial Paper Funding Facility. In this broad setting they provide evidence of negative wealth effects for banks that participated in Fed crisis lending programs, suggesting this information was valuable to market participants. They distinguish among traditional banks, investment banks, and too-big-to-fail banks in their investigation. Blau at al.(2016) investigate the market's ability to accessing relevant information in order to influence prices. They find that, although the name of the institutions were not released until the completion of the program, public bank loans had negative cumulative abnormal returns around TAF loans. Authors show that when the details of this information were finally made public by the Fed, there was no stock market reaction, contrary to the thought that this was valuable information. However, further investigation shows that stock returns for publicly traded borrowing institutions declined significantly and almost immediately after the Fed borrowing was initiated, although the information had not been made public by the Fed at the time. The underperformance of borrowing institutions was greatest for those that received the largest loans or had the largest amount of loans outstanding. This evidence is consistent with the idea that investors were able to trade on the information about the Fed's emergency loan program, although the Fed purposely tried to keep the information private. Kleymenova (2016) studies the capital market consequences of unique and unexpected mandatory disclosures of banks' liquidity and the resulting changes in banks' behaviour. Employing a hand-collected sample of the disclosures of banks' borrowing from the US Federal Reserve Discount Window (DW) during the financial crisis, the author finds that these disclosures contain positive incremental market information as they decrease banks' cost of capital (measured by the equity bid-ask spreads and the cost of debt). However, the paper also evidences endogenous costs associated with more disclosure: banks respond to the DW disclosures by increasing their liquidity holdings and decreasing risky assets. In line with the theoretical predictions of Goldstein and Sapra (2013), this finding indicates that, following the DW disclosures, banks try to avoid accessing the DW facility, despite its cost of capital benefits.

4 Identification strategy and methodology

Motivations. During the pre-crisis period banks started the reengineering of the liability side via the substitution of retail deposits by institutional investors financing (mainly in the form of repos as reported by Adrian and Shin, 2010). In other words, the traditional banking function of maturity transformer from short-term deposits to loans was still there but the share of financier shifted consistently towards wholesale depositors. Figure 3 supports this view by showing the increase in repo financing before the recent financial crisis. However, from the second quarter of 2007 to the first quarter of 2009, net repo financing provided to US banks and broker-dealers fell by about 1.3 trillion: as soon as some banks have begun to default, banks that had direct deposits or repo with the suffering banks have recorded losses immediately, and all the others started to jointly withdraw their deposits (domino effect). This suggests that runs in the tri-party

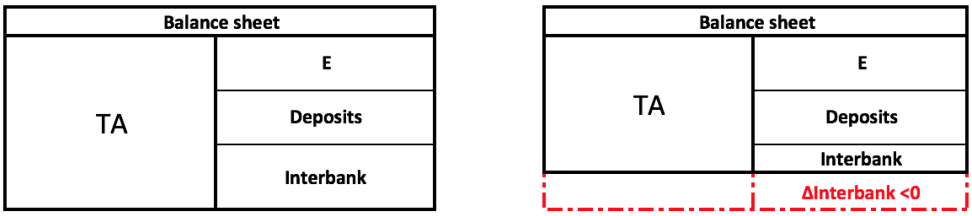

Figure 1: Stylized BS and crisis effects

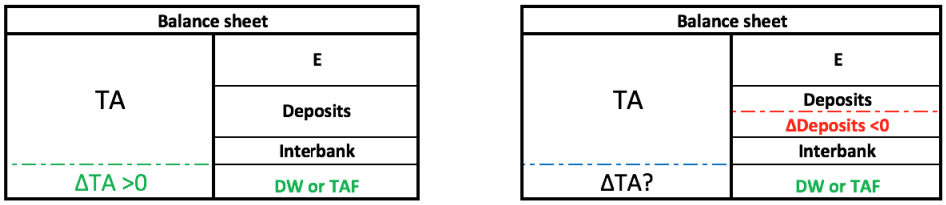

Figure 2: Depositors' reaction

repo market may occur precipitously, like traditional bank runs, rather than manifest themselves as large increases in margins. In order to face liquidity needs, banks could access the Discount Window facility and moreover, in December 2007, the Federal Reserve announced the Term Auction Facility. Despite the fact that funds provided through the DW and TAF had the same collateral and eligibility requirements, banks borrowed substantially higher amounts during the financial crisis through the more expensive TAF and thus paid substantially more because of the perceived DW stigma (Brunnermeier, 2009; and Haltom, 2011). The presence of "stigma" associated to DW financing, the ease with which liquidity difficulties come to know on the market even before the information disclosure and the fact the banks relied heavily on wholesale borrowings, lead us to investigate if there has been a depositor discipline following bank participation in Federal Reserve's liquidity emerging programs. In other words, when repos financing drained and banks had difficulties in rolling over short-term debt, one way to substitute these funds was take advantage from Federal Reserve' programs. However, as shown in Figure 1 and 2, we ask whether the negative reaction perceived by the market (following the access to DW) was perceived even by (or transferred to) depositors. That is, provided that the aim of these emergency liquidity facilities was to alleviate short-term problems, did depositors reacted when news on liquidity difficulties propagated on the market? If this prediction would be true, then the net effects on short-term financing of these programs would be controversial because bank-runs might call off benefits from liquidity injections. Following past crisis, the creation of a "safety net" in the form of deposit guarantee schemes and LOLR facilities, contribute to cushion the panic created by rumours considering deposits as a "stable" source of funding and voiding the likelihood of bank-runs. However, the recent financial crisis demonstrated that it is not always the case: the "bank-run" phenomenon effectively materialised again (especially for English banks, like Northern Rock).

In this paper, we identify depositors as an important source of market discipline. While debt-holders and shareholders can typically exert their influence on larger public banks, depositors are an important source of funding across all strata of banks, from small community banks to large, systemically important financial institutions. Uninsured depositors are particularly exposed to the risks of bank failure as they stand to lose a considerable amount of their unprotected deposit investment.[9]

Structural Equation. In the first stage of the analysis we investigate the presence of deposit discipline, that is of a market-based incentive scheme in which uninsured deposits punish banks for greater risk-taking by

[9]Large depositors have become an important source of retail funding for banks and their share of total deposits rose from around 30 percent in the mid-1990s to over 45 percent by the mid-2000s (Peristiani and Santos, 2014).

demanding higher yields on those liabilities (or even worse, by withdrawing their deposits), via a structural equation model.[10] In general, it is very difficult to estimate the underlying structural parameters of a model using reduced form equations due to endogeneity issues and non-linearities. For example, in order to estimate the borrowing function via least squares, we would need instruments for the equilibrium funds rate which is determined endogenously. Standard literature investigating the effects of bank riskiness on deposit discipline usually tackle endogeneity via dynamic panel (Arellano and Bond, 1991) using as instrument past changes in the dependent variable.[11] However, in our case the access to the Discount Window or Term Auction Facility acts as substitute of other short-term liabilities and modelling via dynamic panel could lead to infer as "deposit discipline" what truly is a "demand side effect".[12] Although the Federal Reserve was reluctant to release to the public information about the specific borrowers from its emergency lending programs, releasing neither the identity nor the amount borrowed, the level of transparency and public information provision about monetary policy decisions increased substantially following the Dodd-Frank Act. Exploiting information on borrower's name, amount borrowed and cost of funds, we estimate a structural equation system via modelling the bank's *demand* of deposits and the *supply* of funds by depositors. As standard in the literature, we model the bank's *demand* of deposits equation by regressing the change in the volume of deposits ($\Delta ln(Deposits_{i,t})$) on the interest rate on deposits ($interest^d_{i,t}$), the price of competing sources of funds and the *federal fund rate* as what in economics is defined as "the price of raw materials used to produce the product". Whilst, in the *supply* equation we include in the set of regressors the interest rate on deposits ($interest^d_{i,t}$), a proxy for macro-economic conditions, and a proxy of benefits from competing investments.

$$\begin{cases} \textbf{Demand}: \Delta ln(Deposits_{i,t}) = \alpha + \beta_1 ln(Deposits_{i,t-1}) + \beta_2 ln(interest^d_{i,t}) + \beta_3 * P_{i,t-1} + \beta_4 ln(interest^P_{i,t-1}) + \\ \qquad \beta_5 ln(amount^P_{i,t-1}) + \beta_6 \mathbf{Bank_{i,t}} + \beta_{\mathbf{7}} \mathbf{price^c_{i,t}} + \alpha_{\mathbf{i}} + \epsilon_{\mathbf{i,t}} \\ \\ \textbf{Supply}: \Delta ln(Deposits_{i,t}) = \alpha + \beta_1 ln(Deposits_{i,t-1}) + \beta_2 ln(interest^d_{i,t}) + \beta_3 * P_{i,t-1} + \beta_4 \mathbf{X_{i,t}} \\ \qquad + \beta_5 Macro_t + \alpha_i + \epsilon_{i,t} \end{cases} \tag{1}$$

with the number of banks $i = 1, ..., N$ and the quarterly number of observations per bank $t = 1, ..., T$. In Equation (1) the left-hand side variables are the first difference of the logarithm of deposits held by bank i at time t. We use growth instead of levels because, as Ioannidou and de Dreu (2006) suggest, the levels depend more on bank characteristics, than on supply and demand equality conditions, moreover, the levels may be biased to balance equality of assets and liabilities. To take into account the attrition effect we control for the log-level of deposits in the previous quarter ($Deposits_{i,t-1}$). $P_{i,t-1}$ stands for the participation in the liquidity facility for bank i in quarter t, $P_{i,t} = \{DW; TAF\}$; while $interest^P_{i,t}$ and $ln(amount^P_{i,t-1})$ represent the average interest paid and amount borrowed from the Fed's emergency credit in the quarter. Even if the treatment variable, $P_{i,t}$, could be considered as continuos (different dosage of DW or TAF funds) or dummy, in our study we consider the participation in the liquidity programs as an indicator variable (the idea behind this decision is coherent with the fact that we do not know if depositors react to "rumours" or

[10] For market discipline to be effective three conditions need to be satisfied. First, investors in bank liabilities need to consider themselves at risk of loss if the bank defaults. Second, market responses to changes in the bank's risk profile need to have cost implications for the bank. Third, the market must have adequate information to gauge the riskiness of the bank. Specifically, Rochet (1992), Blum (2002) and Cordella and Yeyati (1998) show that in the absence of corporate governance problems between bank shareholders and manager, if bank deposits are uninsured and the bank's risk choice is observable by depositors, the bank's risk choice will be efficient. The reason is that banks internalise the impact of their risk choice on depositors since these in turn will demand higher compensation if the bank incurs higher risk. In such a world there is perfect market discipline and no moral hazard. Conversely, if deposits are insured or the bank's risk choice is not observable by depositors, then the bank will choose a higher than the efficient risk profile at the expense of depositors. The reason is that depositors will not demand a higher return in response to higher risk choices by the bank. In such a world there is no market discipline and the bank's choice of its risk of default is subject to moral hazard.

[11] cite

[12] For robustness, we report results from dynamic panel regression in the Appendix.

following the information disclosure, thus if information is biased they would react when they know about banks' participation in the program independently from the amount borrowed).

In the demand equation, $\mathbf{Bank_{i,t}}$ is a vector of bank-specific variables assumed exogenous and included with a quarterly lag to account for the fact that financial reports are not instantaneously made available to the public and to reduce potential endogeneity concerns. Among them we alternatively exclude or include the changes in other funding sources, like commercial paper, repo, wholesale financing, because these are potentially endogenous. We consider that the decision of the bank depends also on the level of unused commitments on the loan side and on the level of capitalization. $\mathbf{price^c_{i,t}}$ is the vector of interest rates paid on competing sources of funding. We allow for unobserved bank heterogeneity by introducing a bank-specific, time-invariant effect α_i. While in the supply side equation we model the decision to deposit depending on macro-economic condition (which influence the banking system as a whole –i.e., growing unemployment and lower wages lead families to save less–), on the interest rates offered on deposits and on the bank's financial fragility perceived by depositors. $Macro_t$ variables do not depend on banks and bank fundamentals, but influence the depositors' decisions. These variables are included without any lag because the depositors tend to take into account the current economic situation, not the previous period one. In order to tackle *relationship banking*, depositors and borrowers (residential mortgage, family loans) are two sides of the same coin (recall Savings & Loans), we include the log-level of these loans as controls. Provided that each bank might offer different types of deposit characterised by different interest rates even for deposits of the same maturity, this might lead to different behaviours depending on the type of deposits. We conduct the analysis by distinguishing among short-term and time deposit and guaranteed and non-guaranteed deposits. The focus on categories of deposits allow us to work with an homogeneous aggregate: i.e. changes in the fraction of uninsured saving deposits are not likely to be distorted by shifts between different kind of deposits as may, e.g., be induced by changes in the level of interest rates.

Secondly, we employ a separate system of equations in which we use as a mean for depositor discipline the interest rate paid on deposits ($interest^P_{i,t}$). Whether banks faced "stigma" on the market, on the deposit side they might want to increase the rate in order to attract deposits or, on the other hand, depositors might ask higher compensation for increased risk. We directly estimate the demand-supply function employing Equation (2). Unfortunately, we have no opportunity to obtain the rates offered by the banks to each specific depositor; however, we compute the (implicit) real interest rate paid on each category of deposit by dividing interest expenses for category j to the volume of deposits j at time t. This ratio seems to be an appropriate estimation of cost interest cost per unit of deposit and has been widely used in the literature as "the implicit interest rate" (Martinez-Peria and Schmukler, 2001; Ungan and Caner, 2008). In order to tackle the fact that the increase in interest rates might be interpreted, as well, as coincident with an increase in bank-risk not reflected in other observed measures (Hellman et al., 1998, 2000), we control for bank-specific dummy and other risk measures (e.g., low capitalization).

$$\begin{cases} \textbf{Demand}: \Delta ln(Deposits_{i,t}) = \alpha + \beta_1 ln(Deposits_{i,t-1}) + \beta_2 ln(interest^d_{i,t}) \\ \qquad\qquad + \beta_3 * P_{i,t-1} + \beta_4 ln(interest^P_{i,t-1}) + \beta_5 ln(amount^P_{i,t-1}) + \beta_6 \mathbf{Bank_{i,t}} + \alpha_\mathbf{i} + \epsilon_{\mathbf{i,t}} \\ \textbf{Supply}: \Delta ln(Deposits_{i,t}) = \alpha + \beta_1 ln(Deposits_{i,t-1}) + \beta_2 ln(interest^d_{i,t}) \\ \qquad\qquad + \beta_3 * P_{i,t-1} + \beta_4 \mathbf{X_{i,t}} + \alpha_\mathbf{i} + \epsilon_{\mathbf{i,t}} \end{cases} \tag{2}$$

In both Equation (1) and (2) observing the coefficient estimates for the bank's participation in the liquidity programs β_3 provides the basis for testing market discipline. Generally speaking, we look for statistically significant associations between this variable (that measures a bank's capacity for responding to deposit withdrawals) and its subsequent net deposit flows and deposit rates. All else being equal, weaker banks are described as subject to market discipline if they experience less net growth in deposits or if they pay higher deposit rates. Depositors, that is, are presumed to react to the observed weakness by either (i) channelling money away from weaker institutions or (ii) requiring a deposit rate premium as compensation. The two dependent variables provide a more comprehensive test of market discipline than relying upon just one (Martinez-Peria and Schmukler, 2001).

Information disclosure. In equations (1) and (2) we conduct the analysis following the hypothesis that

depositors, as market participants (Furfine, 2003; Armantier et al., 2015), react following the access to the facility by the bank; that is, they are able to infer the participation in the Federal Reserve's liquidity programs in the same moment in which they borrow, nonetheless the Fed's will to keep the information private. However, given that the regulation affects all banks, the setting of the unexpected liquidity disclosure enables to construct a counterfactual scenario of the consequences of liquidity disclosure by comparing banks that were directly affected by these disclosures (banks accessing the DW or TAF) with those that were not. Thus, in order to study if liquidity disclosures provide incremental information to the capital market over and above that available in financial filings we investigate depositors' reaction at the day of the information disclosure.[13] Particularly, we repeat previous analysis investigating depositor reaction 2 years following the event for DW borrower and following December 2010 for TAF borrowers.

Market share analysis. Secondly, in order to investigate if previous findings reflect the change in the composition of banks' liability side or a change in the aggregate level of bank's deposit we perform the analysis investigating the effect on the market share.

Firstly, using the difference in difference (fixed effect) methodology, we model the effect of the decision to participate in the Discount Window and Term Auction Facility on the change in market share. As standard in the literature (cite), for both deposits and loans, two banks in the same location face the same demand for loans and the same supply of deposits. Thus, we estimate the effect of the participation in Federal Reserve's liquidity programs within the same state[14] in order to capture macro-economic condition faced by two banks in the same area.

$$\begin{aligned}\Delta ln(Mktshare_{i,t}^{I,O}) =& \alpha + \beta_1 ln(Mktshare_{i,t-1}^{I,O}) + \beta_2 ln(Offices_{i,t-1}^{I,O}) + \beta_3 * ln(Deposits_{i,t-1}^{I,O}) \\ &+ \beta_4 P_{i,t-1} + \beta_5 \mathbf{Macro_t} + \alpha_\mathbf{i} + \alpha_\mathbf{j} + \epsilon_{\mathbf{i,t}}\end{aligned} \tag{3}$$

Where, the state fixed effect α_j controls for common factors that all banks within the same state face, including local economic condition and local demand for loans. We also control for one year of lagged market share and deposit growth to allow for dynamics in the outcome variable. The identification assumption of this strategy is that the sum of market shares (within each state) has to sum 1 and that banks that are in the same state face together the same local demand ($D_{i,t} = D_{m,t}$). By taking differences, we net out these common demand factors that may influence deposits growth and β_4 represents the effects of the participation in the liquidity program $P_{i,t} = \{DW; TAF\}$ on the change in market share for bank i.

As analysed before, when uninsured depositors become concerned about the financial conditions of their banks, they have an incentive to use any available information to identify which banks are weak or in danger of failing. Thus, uninsured depositors in a bank will be looking carefully for signs a silent run has begun on their bank. In Equation (3) $\Delta Mktshare_{i,t}^{I,O}$ stands for the change in the deposit market share in the same state in which the bank is headquartered $I - Inside-$, and in the sum of the market shares in all the other states but where headquarter are located $O, -Outside-$. In this way we investigate for the presence of herding effects in states different from where the bank conduct its primary business. Provided that banks' usage of the Discount Window or Term Auction Facility was confidential information in the borrowing quarter, we ask whether other market participants were able to identify which banks were asking fund to the Fed and if the reaction among *inside* and *outside* depositors happened in the same year (if any).

Propensity Score Matching. Lastly, we use Propensity Score Matching in order to compare the effects on the change in the deposit market share on two sub-samples of banks: those participating in DW versus those which did not or those participating in the TAF program and those which did not. With this methodology, banks in the control group are those banks having ex-ante the same probability to participate in these programs. In particular, given that banks which rely on these facilities are those under liquidity distress we compare banks facing difficulties ex-ante and we select banks in the *control sample* as those banks having *ex-ante* the same probability of participating in the Federal Reserve's liquidity facilities.

That is, we estimate to what extent the treatment (participation in the facility) change the average deposit

[13] We are aware that, for this kind of research the proper methodology is represented by event-study, however data on deposits are available only on a quarterly-based frequency.

[14] As standard in the literature on commercial bank, we should control for fixed effect Metropolitan Area (MSA) instead of state, however, our analysis at Bank Holding Company level justifies the use of state FE.

market share for the BHCs who were actually treated, had they not participated in the facility. The effect of the participation in the facility on the market share of bank i, can be expressed as:

$$ATT = E\{\Delta ln(Mktshare^{P}_{i,t+1})|P_{i,t} = 1\} - E\{\Delta ln(Mktshare^{NP}_{i,t+1})|P_{i,t} = 1\} \quad (4)$$

Where Mktshare represents the *Inside or Outside* market share of deposits and P represents the participation in the Discount Window or Term Auction Facility. I.e. $DW_{i,t}$ is a dummy indicating the participation in the Discount Window facility and taking a value equal to one if bank i participates in quarter t, $\Delta ln(Mktshare^{P}_{i,t+1})$ is the change in inside/outside market share of bank i at time *t+1* following the participation in year t, and $\Delta ln(Mktshare^{NP}_{i,t+1})$ is the hypothetical performance change of the same bank i in *t+1* had it not participated the previous year. The selection problem is of great concern because there is no direct estimate of the counterfactual mean analogous to the one based on randomisation.
Matching methods are useful when no good instruments are available with non-randomized groups and using them is useful if there are many potential controls. In order to verify if the participation decision in these facilities does not affect the distribution of potential outcomes we test whether the common support condition and the conditional independence assumption are satisfied.[15] The propensity score matching is a two-stages semi-parametric procedure where in the first stage we estimate the probability of being treated (using probit regression) on the basis of pre-treatment observables X. We consider in our set of pre-treatment regressors macroeconomic variables as Federal Fund Rates -*FFR*-, average rate on commercial paper *CP rate*, the Treasury rate, the S&P500, the bond index, the Cpi index, GDP growth rate and the Vix. Among the balance sheet accounting controls we consider the logarithm of total assets in order to proxy the size, of loans commitment, interbank debt, repo and commercial paper financing and the level of capitalization. In the second stage, we match treated and untreated with the same p(X), we calculate the differences in outcome and we average it out; the untreated sample is identified by Kernel matching:

$$ATT = \frac{1}{N}\Sigma_{i\in N}\{\Delta y^{1}_{i,t+1} - \Sigma_{j\in C} w_{i,j}\Delta y^{0}_{i,t+1}\} \quad (5)$$

5 Data

We collect quarterly data from US BHCs filling the FRY-9C from January 2002 to March 2016 and we extend this dataset including information based on the participation in the Discount Window and Term Auction Facility implemented by the Federal Reserve. Initially, the dataset includes 6,104 BHCs for the years under consideration. However, we narrow it considering only consolidated balance sheets of banks with total assets greater than 500 million of dollars filling the "BHCK" fields.[16] Thus, our final dataset

[15]The common support condition needs that for every bank there is a positive probability of non-participation or, for every treated unit there is another matched untreated with similar X: $0 < Prob[P_{i,t} = 1|X] < 1$; the conditional independence assumption needs that, conditional on covariates, the outcomes are independent from the treated; that is: $F(\Delta y^{j}_{i,t+1}|X, P_{i,t} = 1) = F(\Delta y^{j}_{i,t+1}|X, P_{i,t} = 0) = F(\Delta y^{j}_{i,t+1}|X)$

[16]Beginning March 31, 2006, the FR Y-9C filing threshold was increased from $150 million to $500 million or more and FR Y-9SP filing threshold was increased from $150 million to banks with total consolidated assets of less than $500 million.

Table 1: Facilities' distribution

PRG_type	Freq.	Percent	Cum.
Primary Credit	2,411	71.19	71.19
Seasonal Credit	259	7.72	79.63
Secondary Credit	257	7.66	87.27
TAF	427	12.73	100.00
Total	3,354	100.00	

comprises observations for 1635 BHCs from January 2006 to March 2016.[17] The choice of using data on bank holding companies has been employed for two reasons. The first, when banks are subsidiaries to need liquidity, they are the largest banks and leader in providing aid (just to prevent these borrow at higher rates than the banking group). Second, since the end of analysis to investigate the effects on depositors the participation of the banks for emergency liquidity programs, we think it is reasonable that the reaction impacts the group. Or, if it is to be perceived as financially unstable banks a_i, we reasonably expect the herding effect on bank a_j in the same group. We keep Bank Holding Companies with total assets of at least $500 million. Several foreign banks borrowed heavily from the Fed during the crisis but they do not have to fill FRY-9C thus they are excluded from our final sample.Our total sample consists of 1,635 Bank Holding Companies. By construction, our sample uses data for the consolidated entity (including bank holding companies and bank subsidiaries).

Concerning data about the programs that were established in response to the crisis, the dataset has detailed information for each loan including: the borrower, the date that credit was extended, the interest rate, information about the collateral, and other relevant terms. The transaction data are provided from the Federal Reserve in compliance with the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 on a daily basis. Next, we identify banks that borrowed at least once during the crisis from at least one of the two facilities. We identify institutions accessing the DW or TAF from the 3/31/2011 FOIA production by the Federal Reserve. Since the FOIA files only report the name of the institution and no other identifying information, we match the names manually. We identify XXX banks that borrowed from at least one Fed facility.
We should point out, however, that collecting borrowing at BHC level has some limitations. First, from XXX Term Auction Facilities only 497 are in our sample and the reason is that banks participating in the Term Auction Facility are mainly foreign banks or banks which do not belong to BHCs. Moreover, from our data we can infer that banks which are borrowing from TAF are jointly borrowing from Discount Window, but the reverse is not true. By far, the most common form of DW borrowing (with a 72% share in the sample) is through the primary credit program. In the first stage of the analysis investigate the change among two quarters in the quarterly average of interest bearing deposits -*QDep*- (BHCK3517) which includes the quarterly average for all interest-bearing deposits held in domestic offices of depository institutions that are consolidated subsidiaries of the bank holding company (this field also includes all time and savings deposits in domestic offices. Then, we investigate the presence of depositor discipline analysing the log-difference in short-term and time deposits. In the first category we consider liquid deposits -*LiqDep*- (BHCB3187) defined as "now, ATS and other transaction accounts in domestic offices of commercial banks". According to the Federal Reserve Board definition it includes the total of all accounts subject to negotiable orders of withdrawal (NOW), all ATS accounts and all other transaction accounts[18], excluding demand deposits. Then, we consider demand deposits -*DemandDep*- (BHCB2210) which include all checking accounts (including those pledged as collateral for loans and excluding Now accounts), all outstanding certified, cashier's teller's and officer's checks or any other instruments drawn by the reporting institution for any purpose, traveler's checks and money orders sold (but not drawn) by the reporting institution, until the proceeds of the sale are remitted to another party, funds received or held in connection with letters of credit sold to customers, withheld taxes, withheld insurance premiums, and other funds withheld from salaries, funds received or held in escrow accounts that may be withdrawn on demand or within six days from the date of deposit, an obligation to pay on demand or within six days a check, any deposit or account

[17] We exclude from the analysis financial institutions belonging to Charter type (RSSD9048) of insurance broker or insurance companies (code 550), Employee Stock Ownership Plan (code 610), securities broker or dealer (code 700), utilities company and credit card companies without commercial bank charters (codes 710 and 720).

[18] Other transaction accounts includes: (1) accounts (other than MMDAs) that permit third party payments through automated teller machines (ATMs) or remote service units (RSUs); (2) accounts (other than MMDAs) that permit third party payments through the use of checks, drafts, negotiable instruments, debit cards; or similar items; and (3) accounts (other than MMDAs) if more than three of the following transactions per calendar month are permitted to be made by telephone or pre-authorized order or instruction: (a) payments or transfers to third parties; (b) transfers to another account of the depositor at the same institution; and (c) transfers to an account at another depository institution.

that otherwise meets the definition of a time/saving deposit but that allows withdrawals within the first six days after the date of deposit, all matured time certificates of deposits, even if interest is paid after maturity, unless the deposit agreement specifically provides for automatic renewal at maturity or that have not been redeemed. Thirdly, in this category we include also the amount of non-interest bearing deposits (BHDM6631) as *NonIntDep*. Lastly, we consider interest bearing deposit liabilities that reprices within one year or mature within one year as *ShortDep* (BHCK3296) and includes Includes all interest-bearing deposit liabilities that have a time remaining to maturity of less than one year and any other interest-bearing deposit liabilities that have a repricing frequency of less than one year (regardless of the remaining maturity), without regard to scheduled contractual payments on deposits with multiple maturities. Deposits in domestic offices classified as demand or savings accounts (including money market deposit accounts and all NOW accounts) are not reported.

Among time deposits we include the following sub-groups. First, all fixed rate and floating rate time deposits of $100,000 or more with a remaining maturity of one year or less -*ShortTimeDepNG*-(BHDMA242). Second, all outstanding time deposits of $100,000 or more, both negotiable and nonnegotiable -*TimeDepNG*-(BHCB2604). Third, all time deposits of less than $100,000. This item (BHCH6648) includes all non-transaction time deposits reported in item 2350, with balances of less than $100,000. Also includes both time certificates of deposit and open account time deposits with balances of less than $100,000, regardless of negotiability or transferability. Lastly, we consider non transaction saving deposits as *SavDep* (BHCB2389). It includes Money Market Deposit Accounts (MMDA's); savings deposits subject to telephone and pre-authorized transfers where the depositor is not permitted or authorized to make more than three withdrawals per month for purposes of transferring funds to another account or for making a payment to a third party by means of pre-authorized or telephone agreement, order, or instruction and savings deposits subject to no more than three transfers per month for purposes of covering overdrafts. With reference to geographical location we include the amount of total interest bearing deposits in foreign offices (BHDM6636) as *DomDep*, the Federal Reserve Board definition reports in this category the dollar amount (in thousands) of "Time Certificates Of Deposit Of $100,000 Or More (6645)" held in foreign offices of the reporting bank. The term "foreign office" includes all branches of the reporting bank located outside the 50 states of the U.S. and the District of Columbia, Edge Act and Agreement Corporations, and all offices of foreign subsidiaries located outside of the U.S. which are consolidated in the Foreign and Domestic Report of Condition (RCFD).
The standard deposit insurance amount is $250,000 per depositor, per insured bank, for each account ownership category. The FDIC insures deposits that a person holds in one insured bank separately from any deposits that the person owns in another separately chartered insured bank. For example, if a person has a certificate of deposit at Bank A and has a certificate of deposit at Bank B, the amounts would each be insured separately up to $250,000. Funds deposited in separate branches of the same insured bank are not separately insured. The FDIC provides separate insurance coverage for funds depositors may have in different categories of legal ownership. The FDIC refers to these different categories as "ownership categories." This means that a bank customer who has multiple accounts may qualify for more than $250,000 in insurance coverage if the customer's funds are deposited in different ownership categories and the requirements for each ownership category are met.
The temporary unlimited insurance coverage for non interest-bearing transaction accounts provided under the Dodd Frank Wall Street Reform and Consumer Protection Act expired on December 31, 2012. Therefore, after December 31, 2012, deposits held in non interest-bearing transaction accounts are aggregated with other demand accounts (e.g., ,Äútraditional,Äù non interest-bearing checking accounts) and will be insured by the FDIC only up to the $250,000 limit per custodian per insured bank. Deposits that exceed the $ 250,000 FDIC coverage must be secured in accordance with statutory requirements. When we conduct the analysis on market share we use the information provided by the US Summary of Deposits provided by the Federal Deposit Insurance Corporation (FDIC). The Deposit Market Share is the percentage of deposits an FDIC-insured institution has within a defined geographic market as of June 30 of each year. We collect data at state and bank holding company level and we match information from FRY-9C based on RSSD9001 code. We do not collect data at Metropolitan Statistical Area (MSA) level because our final aim is to investigate effects on BHCs, and the analysis at MSA would not have produced high cross-sectional

variation. Moreover, roughly 90% of FDIC-insured institutions in each state belong to a BHC. Per each Bank Holding Company we collect information on the state in which headquarters are located (*inside*) and in other US states but where the BHC is headquartered (*outside*) concerning: number of office, amount of deposits and market share. I.e. 97% of FDIC-insured depository institutions in Arizona, as of 30th of June 2015, belong to Bank Holding Companies; among them Western Alliance Bank which belongs to Western Alliance Bancorporation (RSSD9001: 2349815) has 11 offices, $ 3,543,203 th of deposits and a market share of 3.35% in Arizona, whilst 30 offices outside Arizona collecting $ 7,917,256 th of deposits. At the same time, JPMorgan Chase Bank, National Association which belongs to JPMorgan Chase & Co. Bank Holding Company (RSSD9001:1039502) has headquarter based in New York but collects $ 27,530,906 th of deposits in Arizona via 267 offices and representing 26.07% of the market.

6 Results

6.1 Summary statistic

This section provides summary statistics for BHC's market shares and kind of deposits.
Table 2 shows that banks participating in the Term Auction facility are those with greater business in states different from where they are headquartered. In particular, they show that, on average, cover 34% of the market outsides their headquarter boundaries collecting deposits via roughly 522 offices. Whilst, banks participating in the Discount Window program are less present in states different from where their headquarters are located: on average, they represents 3% of the market share outside headquarter boundaries collecting deposits via 62 offices. Concerning the presence in the same state in which they are headquartered we notice that banks participating in the Term Auction Facility program are still those with the greater market share inside the state (roughly 5%) collecting deposits via 124 offices, whilst banks participating in the Discount Window facility represent just 1.6% of the market in which they headquarter are located collecting deposits via 26 offices on average. Thus, we can infer that banks which participated in the Term Auction facility were larger banks with greater business all over US states independently from where they are headquartered. Concerning the geographical location of where deposits are collected and their timing we notice that banks participating in the Term Auction Facility have the larger share both in what concern domestic, short-term and time deposits. However, since we are interested in how depositors react following the participation in the liquidity emergency program, we concentrate our analysis on Table 3. Panel A shows depositors reaction for Discount Window borrowers and banks belonging in the control group (that is all the bank holding companies that did not participate in the DW facility between the first quarter of 2010 up to the first quarter of 2014). We notice that the growth rate of the share of deposits collected within the US boundaries is smaller for DW borrowers with respect to the control group an the same happen for the quarterly average of deposits (without distinguish among sub-categories). Concerning short-term deposits we notice that *Liquid deposits* and *Demand deposits* are increasing at an higher rate for DW borrowers with respect to the control group, whilst *Short-term deposits* are decreasing at a smaller pace with respect to the group. Interestingly, the growth rate of *Non-interest deposits* is lower for bank holding companies participating in the Discount Window program with respect to the control group. In what concerns time deposits we notice that, except from *Saving deposits* which show a positive growth rate for the period which we are considering, all kind of time-deposits are decreasing in the years from 2010 up to 2014. However, distinguishing among bank holding companies participating in the Discount Window facility and banks which did not in the same period Table 3 (Panel A) exhibits larger decreasing rate for DW borrower in *Guaranteed* and *Non Guaranteed* time deposits. Moreover, even if *Saving deposits* are showing a positive growth rate, the pace for DW borrowers is smaller than in the control group. Panel B shows results for bank holding companies participating in the Term Auction Facility program with respect to banks which did not along the same period (2007q3-2010q1). Results show that, provided that deposits are increasing in that period, for all sub-groups of deposits the growth for TAF borrowers is larger than for bank holding companies which did not participate in this facility. Interestingly, whilst *Short-term deposits* which reprice with one year are decreasing in the group they are increasing for banks participating in the Term Auction

Facility program.
Concerning market share analysis, Panel A (Table 3) shows that banks participating in the Discount Window facility are increasing the number of offices in the state in which they are headquartered however, in the same state, they are increasing at a lower pace the amount of deposits they are collecting losing at the same time their market share within the same state (with respect to the control group for the same period). Interestingly, results do not show the same evidence for deposits collected outside their headquarter boundaries: in particular, even if the growth rate of deposits is smaller than in the control group, their market share is increasing. Concerning results for Term Auction facility participants, Panel B shows that TAF borrowers are increasing the number of offices, the amount of deposits and their market share with respect to the control group in the same state in which headquarter are located (these results are opposite with respect what we found for DW borrowers). Whilst, concerning the market share outside the headquarter borders the pace at which they are collecting deposits is lower with respect to the control group but the market share is growing.
Table 4 shows the average cost of deposits for banks which participated in the Discount Window program and banks that did not between 2010 and 2014 (Panel A) and for banks which have participated in the Term Auction facility and banks that did not between 2007 and 2010 (Panel B). Evidence show that, on average, cost of deposits are higher for Discount Window banks than for banks in the control group and this evidence is validated for almost all sub-samples of deposits: cost on domestic deposits, the average cost of deposits and for Non-guaranteed deposits. Interestingly, Panel A shows that the interests paid per unit of Guaranteed deposits is higher than the interests paid per unit of Non Guaranteed deposits and this trend is not confirmed for the banks belonging in the control group in the same period. Panel B shows that banks participating in the Term Auction Facility paid, on average, higher interests on deposits with respect to the control group in the same period. However, for all sub-categories of Domestic, Non guaranteed and Guaranteed deposits banks which participated in the Term Auction Facility had a lower unit cost of deposits.

6.2 Depositor reactions

Discount Window. Table 5 (Panel A) shows the reaction of short-term depositors one quarter following the bank participation in the Discount Window program. The supply side equation shows no depositors reaction for the categories of demand deposits, average short-term deposits, non interest deposits and liquid deposits; however, column (5) shows that there is a reduction in the share of non-guaranteed deposits (that reprice within one year) in the quarter following the access to the DW program. Furthermore, Panel B shows that the effect is confirmed and larger when the information is disclosed (the Federal Reserve published information on borrower's name with two years lag) and the negative depositor reactions do not concern only Non-guaranteed short-term deposits but also liquidity deposits which effectively register a negative growth in the quarter following the disclosure of information. Table 6 shows the reaction of depositors which invested in time-deposit in the quarter following the one in which the bank participated in the Discount Window (Panel A) and when the information was released (Panel B). Looking at the supply-side equation, results show that time depositors reacted by withdrawing their Non-guaranteed and Saving deposits in the quarter following the access to the facility. However, when the information on borrowers' name is disclosed, the negative reaction is larger: Panel B shows that deposits (on average), domestic deposits and saving deposits decrease by 24 bp. when the information is disclosed and that Non-guaranteed deposits decrease by 43 bp. Interestingly, we notice that Guaranteed deposits do not react neither in the quarter following the access nor when the information is released.
Table 7 reports evidence on interest rate per unit of each category of deposits. Panel A shows that, as reported by Calomiris (2006) and Brunnermeier (2009), cost of funds reduce in the quarter following the access to the facility both from the demand-side and from the supply-side. However, 8 quarters following the access to the facility, when the information is released, we notice that banks continue to be willing to pay a lower interest rate, whilst depositors ask for higher interest rates both on guaranteed and non-guaranteed deposits (with a larger risk-premium for non-guaranteed deposits).

Term Auction Facility. For the period 2007-2010 we investigate the presence of depositor reaction following the access to the Term Auction facility; however, results in this section and those in the Discount Window section are not directly comparable because they refer to two different periods. Table 10, in Panel A, reports the growth rate of short-term deposits in the quarter following the access to the facility. Evidence shows that, in the quarter following the access to the liquidity program, banks participating in the Term Auction facility reduce their demand for non-interest deposits, liquid deposits and demand deposits; whilst on they increase their demand for short-term deposits (on average) and column (5) reports an increase in the share of non-guaranteed short-term deposits: for both categories of deposits the magnitude of the increase is almost the same. Panel B shows results for the change of short-term deposits after December 2010, that is the month in which information was disclosed under the Dodd-Frank Act. Banks which have participated in the Term Auction Facility between the fourth quarter of 2007 up to the first quarter of 2010, show in the second quarter of 2010 (or after) an increase in demand-deposits and non-guaranteed short-term deposits. Table 11 shows the results on the growth rate of time deposits in the quarter following the participation to the Term Auction Facility (Panel A) and after the information disclosure (Panel B). Panel A shows that, except from saving deposits, time-depositors react by lending more money in the quarter following the access to the facility whilst, in the quarter following the information release, banks still continue to demand more deposits, but the positive growth rate on depositors side is associated only to non-guaranteed and guaranteed deposits. In particular, although the smaller magnitude for both kind of deposits, the positive sensitivity is larger for guaranteed deposits than for non-guaranteed ones. Table 12 shows the effects on cost of deposits. Panel A, shows that banks are willing to pay higher interest rates one quarter after the participation in the Term Auction Facility program on the gross amount of deposits, on domestic deposits, guaranteed and non-guaranteed ones and, on the supply side, this evidence is confirmed by the fact that depositors are requiring higher compensation for domestic deposits and non guaranteed deposits. Interestingly, and in line with a stronger market discipline, the higher risk premium is required by non-guaranteed depositors. Results from Panel B show that depositor discipline in the form of higher interest rates is confirmed in the quarters following the information disclosure even if the effect is smaller in magnitude.

6.3 Effects on market share

Discount Window. Table 8 reports results from the fixed effect regression. Panel A shows the effect on the growth rate of the deposit market share in the same state in which the bank holding company is headquartered. Results show that banks participating in the Discount Window program show a reduction in their deposit market share in the year following the participation in the facility and the effect persists in the next three years. Moreover, our evidence shows that the worst reduction in the deposit market share happens following 2 years which is exactly the same lag with which information on borrowers' name is released. Panel B excludes the presence of depositors discipline in states different from the one in which the borrowing bank is headquartered. Actually, Panel B shows that not only we should exclude the presence of herding effect among depositors of Discount Window borrowers, but also that these banks increase their market share of deposits in the second and the third year following the participation in the emergency lending program. In Table 9 we report results from Kernel Matching estimation following PSM. Evidence shows that, selecting bank which have ex-ante the same probability to participate in the Discount Window, the deposit market share of borrowers from DW reduces in the year(s) following the participation in the emergency liquidity program, and the decrease is larger in the second year with a reduction in the market share by roughly 2%. Panel B shows that results hold when we control for the logarithm in the number of offices and log of deposits in the state in which the borrower bank is headquartered. Moreover, when we investigate for the presence of herding effects in states different from the one in which the bank has the headquarter, evidence shows that banks participating in the Discount Window increase their market share in the three years following the participation (although the mild effect).

Term Auction Facility Tables 13 and 14 report the market share analysis for banks which have participated in the Term Auction Facility between the fourth quarter of 2007 and the second quarter of 2010. Results

from columns (1), (2) and (3) of Panel A show that banks which relied on Term Auction Facility to in order to solve liquidity needs, experienced an increase in their deposits market share and the effect is larger over time. On the other hand, Panel B excludes the presence of herding effects not showing changes in the market share of deposits in the states in which the bank is not headquartered. Table 14, controlling for observable bank-specific characteristics, shows that the market share of deposits in the same state in which the borrower in headquartered and in the other states increases following the access to the facility: however the change is larger in the year following the information disclosure.

7 Conclusion

This paper analyses the problem of the liquidity crisis from different points of view. In fact, if before the financial crisis, banks have increasingly relied on the interbank market to manage liquidity in the short term, during the crisis such banks have withdrawn resources deposited with other institutions generating a crisis of liquidity (forcing banks to borrow in the markets at higher rates). In order to fill the gap of liquidity present in the market, avoiding bank-runs and avoid to transform situations of temporary liquidity shortages into insolvent banks, several regulatory proposal have been put forward with the aim to preventing negative situations. With this respect we analyze two important programs proposed by FED: DW and TAF. Initially these programs have included not to reveal the identity of the borrower but, following The Dodd Frank Act for TAF and admonition of Bloomberg for DW, the Federal Reserve released the name, quantity and rates paid by the banks for the two programs. Particularly TAF information were released all at the same time in December 2010 while for DW were made public quarterly, with two years of delay starting from 2010. Despite the Fed's attempts to hide the names of the participants in programs for fear of negative reactions in the markets, different paper (Furfine, 2003; Armantier et al, 2015) demonstrate the presence of "stigma" associated with DW: i.e., the banks participating in this program were perceived as financially not solid on the market with negative effects. Market participants cannot fully differentiate healthy from troubled borrowers and therefore view borrowing as a potential sign of weakness for any bank that visits the window. Furthermore, TAF, was born precisely to meet the weakness of DW.

Motivated by the fact that the recent crisis has shown that the perception of confidence by depositors, is no longer a case of school, but become again reality after the 1929 crisis (eg NorthernRock), this paper investigates the presence of reaction by depositors when the banks participated in the program and when information has been released. The first set of outcomes show, via structural equation model, results in two different periods for different kind of deposits: when the programs were born and when there was the disclosure of information. xxx In the second phase, using the information on market shares from the Summary of deposits, we investigate the DW and TAF effects on inside and outside market share of deposits (with respect to where headquarters are located), 1 and 2 and 3 years after having borrowed from the facility using Propensity Score Matching. Finally the analysis is carried on the cost of deposits.

8 Tables and Graphs

Figure 3: Wholesale in level

Figure 4: Change in wholesale funding

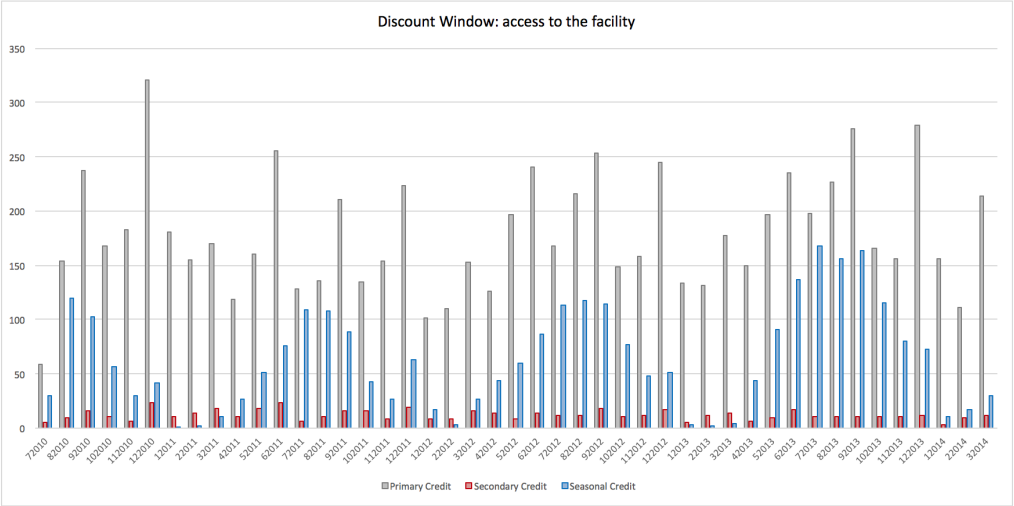

Figure 5: Access to DW

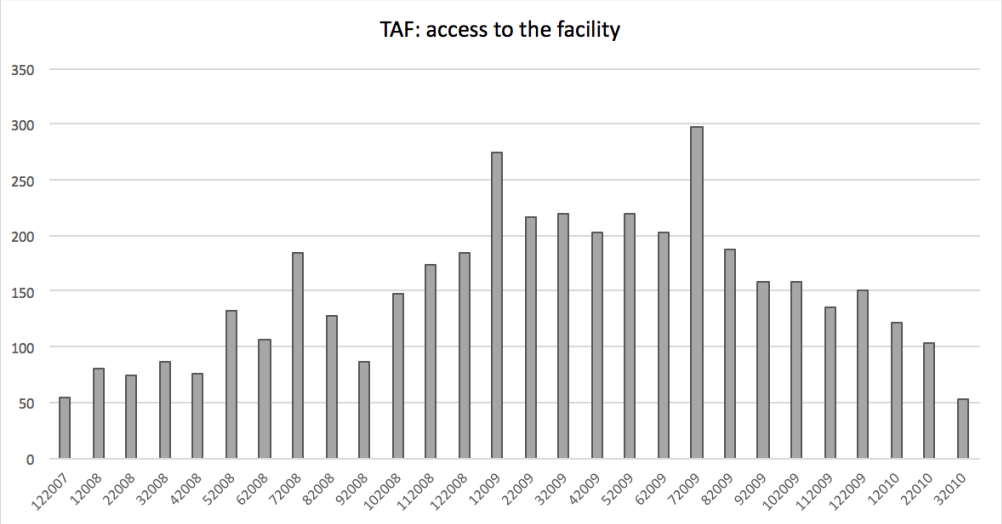

Figure 6: Access to TAF

Table 2: Summary statistics: sub-groups of deposits in level

Variable	Obs	Mean	Std. Dev.	Min	Max
Whole sample					
Domestic Dep.	74079	13.2568	1.3328	3.6636	20.4915
Quarterly dep. (avg)	74092	13.2654	1.3430	2.8904	20.4701
Demand dep.	73803	11.1234	1.4513	0.6931	19.9051
Short-term dep.	72508	12.2851	1.4099	2.1972	20.1135
Non-interest dep.	74119	11.4395	1.5339	1.3863	19.9051
Liquid dep.	72835	10.5605	1.3934	0.0000	18.7116
ST NG	73254	11.1579	1.4431	4.6052	18.8038
Time Dep. NG	73580	11.5135	1.3939	4.6052	18.8134
Time Dep. G	73500	11.7972	1.3005	2.9957	18.5368
Saving dep.	73656	12.3366	1.6341	1.7918	20.6709
Offices Out.	13775	101.8456	509.2278	1	6034
Dep. Out.	13673	12.6675	2.2582	1.3863	20.7856
Mkt Share Out.	13775	0.0639	0.3517	0	4.7469
Offices Ins.	42753	27.1909	56.8037	1	1211
Dep. Ins.	42726	13.5497	1.1172	8.2354	20.1011
Mkt Share Ins.	42753	0.0139	0.0348	0	0.4922
Discount Window					
Domestic Dep.	1537	13.7344	1.1763	10.6066	19.0617
Quarterly dep. (avg)	1537	13.7690	1.1754	10.4623	19.0586
Demand dep.	1526	11.5606	1.3990	3.6376	18.1407
Short-term dep.	1518	12.5254	1.2453	3.2189	18.7788
Non-interest dep.	1530	12.0049	1.3942	4.9345	18.2585
Liquid dep.	1511	10.9849	1.4715	4.9127	17.6468
ST NG	1529	11.4030	1.1988	5.2149	17.5906
Time Dep. NG	1524	11.8441	1.1446	5.7170	17.5911
Time Dep. G	1524	12.0001	1.1939	4.8363	16.7980
Saving dep.	1535	13.0541	1.3833	8.8619	19.0275
Offices Out.	531	62.8136	271.2914	1	3000
Dep. Out.	527	12.9781	2.0627	1.386294	19.02027
Mkt Share Out.	531	0.0324	0.1374	0	1.6195
Offices Ins.	1435	26.4641	38.8911	1	430
Dep. Ins.	1433	13.7597	1.0171	10.54897	18.37732
Mkt Share Ins.	1435	0.0163	0.0431	0	0.4092
Term Auction Facility					
Domestic Dep.	323	15.2915	2.0186	11.7723	20.3041
Quarterly dep. (avg)	323	15.2863	2.0310	10.5210	20.2854
Demand dep.	321	12.7445	2.2091	4.1431	18.4238
Short-term dep.	319	14.4486	2.1833	6.6026	20.1251
Non-interest dep.	323	13.4496	2.4483	3.8918	19.3103
Liquid dep.	321	11.9581	1.8812	8.6817	16.8693
ST NG	315	13.4045	2.0538	9.5577	18.8362
Time Dep. NG	320	13.6075	2.0130	10.1583	18.8680
Time Dep. G	323	13.8622	1.9603	9.5780	18.6065
Saving dep.	322	14.6480	2.2694	9.0285	20.0859
Offices Out.	200	522.6300	1143.6820	1	6034
Dep. Out.	200	14.7815	2.7340	8.8320	20.5292
Mkt Share Out.	200	0.3436	0.8067	0	4.2527
Offices Ins.	300	124.5867	193.0566	1	1211
Dep. Ins.	300	14.9660	1.6622	10.4719	19.4204
Mkt Share Ins.	300	0.0536	0.0707	0.0001	0.3436

Table 3: Summary statistics: changes in market shares

Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
	Discount Window					**Control sample: 2010q1-2014q1**				
Domestic Dep.	1522	0.0047	0.0585	-0.3000	0.7513	20050	0.0059	0.0813	-3.2426	3.0817
Quarterly dep. (avg)	1522	0.0060	0.0923	-0.3029	2.0393	20050	0.0079	0.1081	-1.9859	5.5962
Demand dep.	1510	0.0497	0.3815	-7.4380	2.8639	19990	0.0421	0.3273	-9.1182	9.0378
Short-term dep.	1501	-0.0180	0.1561	-1.7102	2.2689	19692	-0.0204	0.3525	-7.3717	7.3922
Non-interest dep.	1514	0.0292	0.1831	-2.5809	1.1959	20046	0.0303	0.2073	-4.3631	3.7736
Liquid dep.	1494	0.0609	0.4688	-3.1910	9.5816	19647	0.0282	0.4138	-7.3744	10.5513
ST NG	1512	-0.0233	0.2766	-3.9420	6.3699	19775	-0.0200	0.2465	-6.8171	7.1688
Time Dep. NG	1509	-0.0119	0.2050	-1.2287	6.7286	19954	-0.0103	0.1578	-4.6205	6.1269
Time Dep. G	1509	-0.0350	0.1658	-5.2311	0.6735	19944	-0.0237	0.1501	-4.5727	6.0626
Saving dep.	1520	0.0102	0.1399	-1.3149	1.6952	19983	0.0158	0.1385	-2.9504	2.7926
Offices Out.	525	0.1410	5.3620	-45	92	5998	0.0824	12.3163	-310	434
Dep. Out.	521	0.0199	0.1107	-0.4341	1.1354	5948	0.0221	0.2679	-4.7106	11.6189
Mkt Share Out.	525	0.0002	0.0036	-0.0225	0.0473	5998	0.0001	0.0133	-0.4071	0.3114
Offices Ins.	1419	0.0902	1.7244	-10	35	16961	0.0565	2.5554	-139	114
Dep. Ins.	1417	0.0056	0.0597	-0.8391	0.8620	16943	0.0102	0.0871	-2.5404	4.9041
Mkt Share Ins.	1419	-0.0001	0.0012	-0.0271	0.0130	16961	0.0001	0.0026	-0.0419	0.1971
	Term Auction Facility					**Control sample: 2007q3-2010q2**				
Domestic Dep.	320	0.0417	0.1708	-0.1448	1.9140	15429	0.0139	0.0982	-1.9737	3.3076
Quarterly dep. (avg)	320	0.0359	0.2223	-0.7804	3.6085	15431	0.0160	0.1285	-6.9040	7.0213
Demand dep.	317	0.0340	0.3103	-0.7993	3.3461	15402	0.0052	0.3239	-9.1182	6.9798
Short-term dep.	314	0.0022	0.1918	-0.5402	1.7776	15044	0.0004	0.4794	-7.3854	7.4799
Non-interest dep.	320	0.0557	0.4228	-0.8147	6.6564	15436	0.0132	0.2286	-5.8567	5.0839
Liquid dep.	317	0.0685	0.4397	-2.8161	3.7044	15204	0.0106	0.4162	-10.5191	10.5513
ST NG	309	0.0293	0.4618	-0.9754	7.2211	15321	-0.0049	0.3049	-9.7857	6.8854
Time Dep. NG	317	0.0331	0.2015	-0.4713	1.5795	15337	0.0042	0.2197	-9.7894	4.8371
Time Dep. G	320	0.0308	0.3500	-2.5670	3.2501	15334	0.0088	0.2104	-4.5727	6.3193
Saving dep.	318	0.0605	0.2681	-0.7512	3.0822	15363	0.0204	0.1436	-2.9880	3.3394
Offices Out.	197	26.2183	263.6106	-152	3214	4791	1.3565	25.8578	-195	1366
Dep. Out.	197	0.0398	0.1538	-0.2668	1.2239	4754	0.0415	0.2802	-2.8450	6.9829
Mkt Share Out.	197	0.0138	0.1529	-0.1032	2.1038	4791	0.0005	0.0198	-0.5636	0.8480
Offices Ins.	298	2.2081	19.3945	-25	203	14108	0.1875	4.5557	-242	253
Dep. Ins.	298	0.0276	0.1022	-0.1430	1.1182	14101	0.0154	0.0861	-4.0520	1.2500
Mkt Share Ins.	298	0.0009	0.0102	-0.0256	0.1503	14108	0.0001	0.0025	-0.1397	0.1020

Table 4: Average interest rate per unit of deposit

	Discount Window					**Control sample**				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Domestic	1537	0.0015	0.0013	0.0000	0.0099	20448	0.0014	0.0014	0.0000	0.0602
Average cost of dep.	1538	0.0086	0.0096	0.0003	0.0924	20495	0.0080	0.0091	0.0000	0.1012
Non guaranteed	1538	0.0109	0.0190	0.0000	0.1905	20495	0.0098	0.0169	-0.0124	0.1905
Guaranteed	1538	0.0117	0.0174	0.0000	0.1660	20495	0.0103	0.0155	-0.0240	0.1660
	Term Auction Facility					**Control sample**				
Domestic	323	0.0035	0.0031	0.0000	0.0219	15681	0.0040	0.0037	0.0000	0.0497
Average cost of dep.	323	0.0205	0.0154	0.0016	0.0735	15702	0.0206	0.0142	0.0002	0.1012
Non guaranteed	320	0.0204	0.0170	0.0016	0.1191	15702	0.0232	0.0219	0.0000	0.1905
Guaranteed	323	0.0197	0.0132	0.0012	0.1203	15702	0.0227	0.0181	0.0000	0.1660

Table 5: Discount Window: short-term deposits

	(1) Demand dep. b/se	(2) ST dep. b/se	(3) Non interest dep. b/se	(4) Liquid dep. b/se	(5) ST Non guaranteed dep. b/se
			Panel A		
			Contemporaneous effect: 1 quarter		
Demand					
$ln(Deposits_{t-1})$	.9471***	.9040***	1.0731***	.9006***	.9206***
	(.0783)	(.0428)	(.0724)	(.0520)	(.0409)
DW	.0476	-.1245**	.0114	.1612*	.0301
	(.0779)	(.0605)	(.0859)	(.0904)	(.0674)
interest rate	.0932	.3094*	2.3745***	-1.0224	.1000
	(.3166)	(.1619)	(.5240)	(1.5079)	(2.1957)
Controls	Yes	Yes	Yes	Yes	Yes
Supply					
$ln(Deposits_{t-1})$	1.0086***	1.0285***	1.0152***	.9934***	.9921***
	(.0287)	(.0163)	(.0255)	(.0379)	(.0157)
DW	.0628	-.0399	-.0619	-.0948	-.2206**
	(.1206)	(.0657)	(.1218)	(.1265)	(.1001)
interest rate	.2316	.4783***	1.8567***	3.0804***	1.7209
	(.1645)	(.0782)	(.1390)	(.9660)	(1.6482)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	971	975	974	974	964
R^2	.9454	.9859	.9306	.9224	.9659
log(likelihood)	1055.4197	1168.5369	762.4263	-151.0002	860.6070
			Panel B		
			Information disclosure: 8 quarters		
Demand					
$ln(Deposits_{t-1})$	.5087***	.7743***	1.1835***	.6352***	.6488***
	(.1381)	(.0749)	(.1819)	(.0847)	(.0966)
DW	.3451	.2139	-.2325	1.0112***	.7436***
	(.2184)	(.1424)	(.1751)	(.2439)	(.2232)
interest rate	-.2735	-.5289	.8905	-1.0788	-2.8759***
	(.6279)	(.3406)	(.5020)	(.7512)	(.5959)
Controls	Yes	Yes	Yes	Yes	Yes
Supply					
$ln(Deposits_{t-1})$	.9898***	.9714***	.9810***	1.0435***	.8486***
	(.0308)	(.0211)	(.0183)	(.0731)	(.0324)
DW	.0533	-.1642	-.0212	-.4904*	-.4469***
	(.1840)	(.1100)	(.1009)	(.2516)	(.1381)
interest rate	.1033	2.2918	-2.8783	1.8945***	.5322**
	(.3586)	(1.9564)	(2.0015)	(.4406)	(.2296)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	871	877	872	873	874
R^2	.8631	.9442	.9546	.7811	.8546
log(likelihood)	-1.25e+03	-172.7328	156.5262	-1.87e+03	-1.29e+03

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Discount Window: time deposits

	(1) Avg deposits b/se	(2) Domestic dep. b/se	(3) Time dep. NG b/se	(4) Time dep. G b/se	(5) Saving dep. b/se
			Panel A		
			Contemporaneous effect: 1 quarter		
Demand					
$ln(Deposit_{t-1})$	1.5709***	1.0418***	.9600***	1.0087***	1.0615***
	(.2701)	(.0476)	(.0253)	(.0689)	(.0720)
DW	.0896	-.0304	-.0937**	-.1453	-.0622
	(.1014)	(.0202)	(.0374)	(.1049)	(.0452)
interest rate	2.7086***	.7743***	-1.9155	.4472*	2.8829***
	(.9101)	(.1285)	(1.1947)	(.2484)	(.9527)
Supply					
$ln(Deposit_{t-1})$	1.0197***	1.0114***	.9973***	.9912***	.9959***
	(.0180)	(.0080)	(.0111)	(.0305)	(.0065)
DW	-.0636	-.0159	-.0995*	.1663	-.0856**
	(.0718)	(.0319)	(.0556)	(.1072)	(.0437)
interest rate	.8512***	.7015***	.6243	.4218***	2.6854***
	(.0920)	(.0445)	(.9011)	(.1389)	(.3652)
Observations	980	980	977	980	978
R^2	.9011	.9947	.9878	.9483	.9916
log(likelihood)	327.4554	3824.4246	1895.8043	1197.0447	2437.3887
			Panel B		
			Information disclosure: 8 quarters		
Demand					
$ln(Deposit_{t-1})$	.9558***	.8414***	.7425***	1.0950***	.7849***
	(.1382)	(.1446)	(.0707)	(.1120)	(.1255)
DW	.4002***	.3737***	.3461**	-.2466	.1873*
	(.0769)	(.0708)	(.1418)	(.2258)	(.1118)
interest rate	-1.0436***	-1.0111***	-1.8730***	-1.1612***	-.8168**
	(.2578)	(.2342)	(.4393)	(.4464)	(.3382)
Supply					
$ln(Deposit_{t-1})$	.9907***	.9967***	.9108***	.9256***	1.0069***
	(.0128)	(.0121)	(.0283)	(.0495)	(.0125)
DW	-.2367***	-.2432***	-.4063***	.2413	-.2423***
	(.0629)	(.0593)	(.1148)	(.2099)	(.0812)
interest rate	3.5253***	3.2460***	2.8145	-2.0403***	1.5551
	(1.1260)	(1.0648)	(1.8976)	(.3813)	(1.5339)
Observations	880	880	880	880	880
R^2	.9786	.9819	.9131	.8117	.9756
log(likelihood)	192.9866	317.7431	-767.0582	-672.8059	158.7148

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Discount Window: cost of deposits

	(1)	(2)	(3)	(4)
	Interest on Domestic dep.	Quarterly avg cost of dep.	Interest on NG dep.	Interest on G dep.
	b/se	b/se	b/se	b/se
		Panel A		
		Contemporaneous effect: 1 quarter		
Demand				
$ln(Interest_{t-1})$	-.2924***	.0006	-.2184**	-.0934
	(.0465)	(.0010)	(.0980)	(.0958)
$ln(Deposits_{t-1})$	-.0006**	-.0044	.0031**	.0026*
	(.0003)	(.0048)	(.0014)	(.0015)
DW	-.0018***	-.0103***	-.0144***	-.0092***
	(.0003)	(.0015)	(.0030)	(.0028)
Controls	Yes	Yes	Yes	Yes
Supply				
$ln(Interest_{t-1})$	-.4156***	.0025***	-.3198***	-.0727
	(.0574)	(.0002)	(.1152)	(.1019)
$ln(Deposits_{t-1})$	.0002**	-.0001	-.0024***	-.0008
	(.0001)	(.0007)	(.0008)	(.0007)
DW	-.0011***	-.0020	-.0053	-.0082**
	(.0004)	(.0028)	(.0035)	(.0034)
Controls	Yes	Yes	Yes	Yes
Observations	980	981	978	981
R^2	.2393	.4809	.0843	.1153
log(likelihood)	1.15e+04	7479.8594	6865.0834	7643.0062
		Panel B		
		Information disclosure: 8 quarters		
Demand				
$ln(Interest_{t-1})$	-.0043	.1715***	-.1672*	-.0630
	(.0278)	(.0289)	(.0991)	(.0812)
$ln(Deposits_{t-1})$	-.0005	-.0007	-.0000	.0018
	(.0005)	(.0035)	(.0013)	(.0015)
DW	-.0011***	-.0046***	-.0084***	-.0066**
	(.0002)	(.0014)	(.0030)	(.0029)
Controls	Yes	Yes	Yes	Yes
Supply				
$ln(Interest_{t-1})$	-.0354	.1713***	-.2870**	-.1391
	(.0333)	(.0302)	(.1154)	(.0900)
$ln(Deposits_{t-1})$	.0000	.0002	-.0007	-.0009
	(.0000)	(.0004)	(.0009)	(.0006)
DW	.0003	.0051***	.0081***	.0051*
	(.0002)	(.0019)	(.0030)	(.0030)
Controls	Yes	Yes	Yes	Yes
Observations	880	883	883	883
R^2	.1705	.2872	.0132	.0612
log(likelihood)	1.11e+04	7741.6556	6805.3522	6821.7036

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Discount Window: Market share analysis

	Panel A		
	(1)	(2)	(3)
	$\Delta MktShare^{I}_{t;t+1}$	$\Delta MktShare^{I}_{t;t+2}$	$\Delta MktShare^{I}_{t;t+3}$
	b/se	b/se	b/se
$Office^{I}_{t-1}$	.0136***	.0135***	.0130***
	(.0040)	(.0041)	(.0041)
$Deposit^{I}_{t-1}$	.7516***	.6759***	.6845***
	(.2295)	(.2195)	(.2319)
DW_{t-1}	-.0103**	-.0170***	-.0157**
	(.0042)	(.0051)	(.0070)
$BondI._t$	-.0498	-.0164	-.1362*
	(.0445)	(.0760)	(.0818)
$S\&P_t$	.0293***	-.0131	-.0297
	(.0110)	(.0353)	(.0339)
VIX_t	-.0449	.0292	.0064
	(.0302)	(.0355)	(.0359)
GDP_t	-.0023*	-.0036**	-.0017
	(.0012)	(.0015)	(.0018)
DFA	.0100***	.0131**	.0159*
	(.0034)	(.0061)	(.0090)
Constant	-.0074**	-.0004	.0053
	(.0036)	(.0042)	(.0059)
Bank FE	Yes	Yes	Yes
Observations	40662	38045	35449
No. of groups	2354	2341	2301
F-test	7.9134***	9.9473***	6.7051***
	Panel B		
	(1)	(2)	(3)
	$\Delta MktShare^{O}_{t;t+1}$	$\Delta MktShare^{O}_{t;t+2}$	$\Delta MktShare^{O}_{t;t+3}$
	b/se	b/se	b/se
$Office^{O}_{t-1}$	-.0000***	-.0000***	.0005***
	(.0000)	(.0000)	(.0001)
$Deposit^{O}_{t-1}$	.0080**	.0077**	.0078**
	(.0036)	(.0037)	(.0037)
DW_{t-1}	.0004	.0013*	.0017**
	(.0004)	(.0007)	(.0008)
$BondI._t$	.0127**	.0213**	.0291***
	(.0056)	(.0099)	(.0092)
$S\&P_t$	-.0000	-.0154	-.0138
	(.0008)	(.0138)	(.0135)
VIX_t	-.0010	-.0003	-.0003
	(.0007)	(.0013)	(.0015)
GDP_t	-.0002	-.0004	-.0006
	(.0002)	(.0005)	(.0005)
DFA	-.0004	-.0006	-.0002
	(.0004)	(.0007)	(.0011)
Constant	.0004**	.0014**	.0012**
	(.0002)	(.0006)	(.0005)
Bank FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	12616	11992	11992
No. of groups	591	586	586
F-test	84.8213***	76.2939***	11.3790***

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Discount Window: market share analysis with PSM

Market share: inside deposits

	Panel A: Bank specific controls					Panel B: Bank-specific and office-deposit controls				
	Treated	Control	ATT	s.e.	t-stat	Treated	Control	ATT	s.e.	t-stat
$MktShare^{I}_{t+1}$	1062	14208	-0.209	0.087	-2.389	1006	12736	-0.208	0.103	-2.023
$MktShare^{I}_{t+2}$	1068	14340	-0.251	0.102	-2.461	1006	12736	-0.252	0.121	-2.086
$MktShare^{I}_{t+3}$	1068	14340	-0.299	0.129	-2.31	1006	12736	-0.299	0.101	-2.963
$\Delta MktShare^{I}_{t;t+1}$	1068	14340	-0.017	0.004	-4.278	1006	12736	-0.014	0.005	-3.127
$\Delta MktShare^{I}_{t;t+2}$	1068	14340	-0.027	0.008	-3.234	1006	12736	-0.024	0.005	-4.81
$\Delta MktShare^{I}_{t;t+3}$	1068	14340	-0.024	0.007	-3.592	1006	12736	-0.022	0.010	-2.197

Market share: outside deposits

	Panel A: Bank specific controls					Panel B: Bank-specific and office-deposit controls				
	Treated	Control	ATT	s.e.	t-stat	Treated	Control	ATT	s.e.	t-stat
$MktShare^{O}_{t+1}$	1068	14340	0.051	0.010	4.889	384	4854	0.057	0.008	6.806
$MktShare^{O}_{t+2}$	1068	14340	0.051	0.010	5.108	384	4854	0.058	0.014	4.31
$MktShare^{O}_{t+3}$	1068	14340	0.052	0.010	5.436	384	4854	0.060	0.012	4.823
$\Delta MktShare^{O}_{t;t+1}$	1068	14340	0.000	0.000	1.067	384	4854	0.000	0.000	1.271
$\Delta MktShare^{O}_{t;t+2}$	1068	14340	0.001	0.001	1.054	384	4854	0.001	0.000	1.777
$\Delta MktShare^{O}_{t;t+3}$	1068	14340	0.001	0.001	2.031	384	4854	0.001	0.001	1.427

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Term Auction Facility: short-term deposits

	(1) Demand dep. b/se	(2) ST dep. b/se	(3) Non interest dep. b/se	(4) Liquid dep. b/se	(5) ST Non guaranteed dep. b/se
			Panel A		
			Contemporaneous effect: 1 quarter		
Demand					
$ln(Deposits_{t-1})$	-.0831***	-.1556***	.0295	-.0338**	-.2522***
	(.0296)	(.0398)	(.0266)	(.0131)	(.0247)
TAF	-2.2223***	1.4971***	-.4675**	-.4662**	2.9845***
	(.3828)	(.4261)	(.1821)	(.2191)	(.3545)
interest rate	-2.0535**	-.0117	1.0721	-.0092	-.0012**
	(.9879)	(.0100)	(.6569)	(.0071)	(.0006)
Controls	Yes	Yes	Yes	Yes	Yes
Supply					
$ln(Deposits_{t-1})$	-.0027	-.0351***	.0040	.0267***	-.0423***
	(.0055)	(.0082)	(.0036)	(.0090)	(.0073)
TAF	.3395	1.6598***	-.0921	-.6283*	2.3271***
	(.4051)	(.5128)	(.2625)	(.3698)	(.4377)
interest rate	-.0001	.0128	.5447***	-.0064	.0003
	(.2786)	(.0083)	(.1609)	(.0056)	(.0004)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	971	971	971	971	971
R^2	.4115	.0175	.0747	.0140	.8570
log(likelihood)	-1.52e+04	1675.5863	2.97e+04	1.16e+04	-3.82e+03
			Panel B		
			Information disclosure: after December 2010		
Demand					
$ln(Deposits_{t-1})$	.0001	-.0872**	.0987***	.0468	-.1185***
	(.0512)	(.0393)	(.0353)	(.0503)	(.0297)
TAF banks	1.5843***	.5790**	.6833***	1.7961***	.7766***
	(.4133)	(.2847)	(.2196)	(.5286)	(.2399)
interest	-3.7453**	-.7253	-.9152	2.6385	.0647
	(1.8049)	(1.3284)	(.7603)	(1.6462)	(1.0875)
Controls	Yes	Yes	Yes	Yes	Yes
Supply					
$ln(Deposits_{t-1})$	-.0108	-.0187	-.0040	-.0054	-.0176**
	(.0093)	(.0124)	(.0051)	(.0181)	(.0085)
TAF banks	.1426*	.0732	.0454	-.0280	.1152*
	(.0859)	(.0830)	(.0451)	(.1061)	(.0596)
interest	2.0769***	-1.4830	.9694***	1.6287**	2.2770
	(.5404)	(2.9039)	(.2622)	(.6647)	(2.9888)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	235	235	235	235	235
R^2	.3648	.1571	.1660	.2070	.6754
log(likelihood)	-1.09e+04	-440.2466	1617.1239	-1.46e+04	-245.6900

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Term Auction facility: time deposits

	(1) Avg deposits b/se	(2) Domestic dep. b/se	(3) Time dep. NG b/se	(4) Time dep. G b/se	(5) Saving dep. b/se
			Panel A		
			Contemporaneous effect: 1 quarter		
Demand					
$ln(Deposit_{t-1})$	-.0492***	-.0284*	-.2080***	-.0744***	-.0149
	(.0149)	(.0155)	(.0257)	(.0160)	(.0144)
TAF	.2824***	.1981***	1.7830***	.6628***	.5591***
	(.0546)	(.0518)	(.2223)	(.1854)	(.1003)
interest rate	.0001	.0001***	-.0003**	.0073***	-.4925*
	(.0030)	(.0000)	(.0001)	(.0024)	(.2624)
Supply					
$ln(Deposit_{t-1})$	.0013	.0020	-.0370***	-.0257***	.0059**
	(.0025)	(.0023)	(.0059)	(.0082)	(.0023)
TAF	.5830***	.4584***	2.0454***	2.3269***	-.0040
	(.1381)	(.1261)	(.3487)	(.4449)	(.1924)
interest rate	.0001*	.0001***	.0002*	-.0025	-.8746***
	(.0000)	(.0000)	(.0001)	(.0025)	(.1645)
Observations	978	978	978	978	978
R^2	.0089	.0567	.7250	.0823	.0900
log(likelihood)	5.11e+04	5.48e+04	5803.9075	4807.0122	3.08e+04
			Panel B		
			Information disclosure: after December 2010		
Demand					
$ln(Deposit_{t-1})$	-.1055	-.0682	-.1168***	-.0633***	.0037
	(.0721)	(.0868)	(.0279)	(.0145)	(.0559)
TAF banks	.3504***	.4801***	.4973***	.1529	.3626*
	(.1193)	(.1320)	(.1810)	(.1357)	(.1877)
interest rate	-1.9988	.6655	-2.5482	-2.9554**	1.4640
	(1.4457)	(1.8521)	(2.1047)	(1.3057)	(1.5193)
Controls	Yes	Yes	Yes	Yes	Yes
Supply					
$ln(Deposit_{t-1})$	.0034	.0059**	-.0208***	-.0249***	-.0066
	(.0029)	(.0027)	(.0067)	(.0082)	(.0042)
TAF banks	-.0290	-.0290	.0899**	.1061**	.0397
	(.0213)	(.0197)	(.0459)	(.0525)	(.0345)
interest rate	-.5369	-.4861	.4224	-.4622	.5227
	(.3439)	(.3270)	(.7999)	(.6293)	(.5239)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	743	743	743	743	743
R^2	.0421	.3258	.6165	.0578	.4136
log(likelihood)	1.46e+04	1.27e+04	6378.4552	1.98e+04	1.14e+04

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Term Auction Facility: cost of deposits

	(1) Interest on Domestic dep. b/se	(2) Quarterly avg cost of dep. b/se	(3) Interest on NG dep. b/se	(4) Interest on G dep. b/se
		Panel A		
		Contemporaneous effect: 1 quarter		
Demand				
$ln(Interest_{t-1})$	-1.2924***	.0073***	-1.2184***	-.9807***
	(.0465)	(.0021)	(.0980)	(.1029)
$ln(Deposits_{t-1})$	-.0006**	.0338***	.0031**	.0025
	(.0003)	(.0100)	(.0014)	(.0016)
TAF	.0018***	.0094**	.0144***	.0070**
	(.0003)	(.0037)	(.0030)	(.0030)
Supply				
$ln(Interest_{t-1})$	-1.4156***	-.0001	-1.3198***	-.9650***
	(.0574)	(.0003)	(.1152)	(.1077)
$ln(Deposits_{t-1})$	.0002**	.0004	-.0024***	-.0002
	(.0001)	(.0008)	(.0008)	(.0008)
TAF	.0011***	-.0008	.0073**	.0053
	(.0004)	(.0035)	(.0036)	(.0035)
Observations	980	981	978	981
R^2	.6743	.7875	.4408	.3671
log(likelihood)	1.15e+04	5920.1202	6865.0834	7828.0356
		Panel B		
		Information disclosure: after December 2010		
Demand				
$ln(Interest_{t-1})$	-.3730*	.1304	-.0470	-.0601
	(.2011)	(.1292)	(.1422)	(.1167)
$ln(Deposits_{t-1})$	-.0024**	.0004	-.0018*	.0002
	(.0011)	(.0050)	(.0011)	(.0021)
TAF banks	.0036***	.0087***	.0142***	.0144**
	(.0009)	(.0032)	(.0049)	(.0057)
Supply				
$ln(Interest_{t-1})$	-.7902***	-.3161***	-.7909***	-.3728***
	(.1210)	(.0769)	(.1578)	(.1293)
$ln(Deposits_{t-1})$	.0001*	.0011**	-.0004	.0014
	(.0001)	(.0005)	(.0008)	(.0010)
TAF banks	.0002	.0045*	.0048*	.0061
	(.0004)	(.0024)	(.0029)	(.0040)
Observations	743	744	744	744
R^2	.8919	.1449	.3203	.1427
log(likelihood)	7879.3906	5841.6675	5302.4434	5172.6537

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Term Auction Facility: Market share analysis

	(1) $\Delta MktShare^{I}_{t;t+1}$ b/se	(2) $\Delta MktShare^{I}_{t;t+2}$ b/se	(3) $\Delta MktShare^{I}_{t;t+3}$ b/se
		Panel A	
$Office^{I}_{t-1}$	.0178	-.0016	.5175***
	(.0136)	(.0149)	(.1292)
$Deposit^{I}_{t-1}$	.9876***	.9034***	.8744***
	(.2660)	(.2576)	(.2523)
TAF_{t-1}	.0868*	.2062**	.2730***
	(.0498)	(.1016)	(.1019)
$BondI._t$	-.0413	.0005	-.0155
	(.0468)	(.0776)	(.0798)
$S\&P_t$	.0271**	-.0233	-.0376
	(.0116)	(.0374)	(.0365)
VIX_t	-.0597*	.0184	.0112
	(.0330)	(.0379)	(.0358)
GDP_t	-.0023*	-.0031**	-.0014
	(.0012)	(.0014)	(.0016)
DFA	.0112**	.0162**	.0237**
	(.0045)	(.0081)	(.0105)
Constant	-.0105**	-.0054	-.0066
	(.0051)	(.0063)	(.0079)
Bank FE	Yes	Yes	Yes
Observations	38047	35449	35449
No. of groups	2341	2301	2301
F-test	7.3017***	9.9120***	6.1824***
		Panel B	
	(1) $\Delta MktShare^{O}_{t;t+1}$ b/se	(2) $\Delta MktShare^{O}_{t;t+2}$ b/se	(3) $\Delta MktShare^{O}_{t;t+3}$ b/se
$Office^{O}_{t-1}$	.0002	-.0000	.0132**
	(.0002)	(.0002)	(.0062)
$Deposit^{O}_{t-1}$	.0080**	.0077**	.0077**
	(.0036)	(.0036)	(.0036)
TAF_{t-1}	.0162	.0326	.0498
	(.0103)	(.0213)	(.0331)
$BondI._t$	.0160**	.0279***	.0148
	(.0074)	(.0102)	(.0111)
$S\&P_t$	-.0001	-.0149	-.0119
	(.0012)	(.0127)	(.0107)
VIX_t	-.0009	.0001	.0002
	(.0007)	(.0014)	(.0014)
GDP_t	-.0001	-.0002	-.0005
	(.0002)	(.0003)	(.0006)
DFA	-.0002	-.0003	-.0005
	(.0001)	(.0002)	(.0011)
Constant	-.0001	.0004	.0008***
	(.0003)	(.0003)	(.0003)
Bank FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	12616	11992	11992
No. of groups	591	586	586
F-test	12.1392***	24.2921***	22.4683***

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Term Auction facility: market share PSM

Market share: inside deposits										
	Panel A: Bank specific controls					Panel B: Bank-specific and office-deposit controls				
	Treated	Control	ATT	s.e.	t-stat	Treated	Control	ATT	s.e.	t-stat
$MktShare_{t+1}$	289	19949	1.251	0.463	2.700	264	17516	0.635	0.575	1.104
$MktShare_{t+2}$	289	19949	1.342	0.323	4.157	264	17516	0.724	0.483	1.497
$MktShare_{t+3}$	289	19949	1.187	0.725	1.637	264	17516	0.627	0.57	1.121
$\Delta MktShare_{t+1}$	289	19949	0.010	0.007	1.259	264	17516	0.089	0.012	6.875
$\Delta MktShare_{t+2}$	289	19949	0.044	0.013	3.323	264	17516	0.064	0.008	7.493
$\Delta MktShare_{t+3}$	289	19949	0.043	0.015	2.772	264	17516	0.077	0.014	7.415
Info disclosure:	effect on June 2011									
$MktShare_{t+1}$	1153	9570	0.256	0.213	1.203	1078	8338	0.035	0.018	1.929
$\Delta MktShare_{t+1}$	1153	9570	0.02	0.003	6.752	1078	8338	0.017	0.003	4.331
Market share: outside deposits										
	Panel A: Bank specific controls					Panel B: Bank-specific and office-deposit controls				
	Treated	Control	ATT	s.e.	t-stat	Treated	Control	ATT	s.e.	t-stat
$MktShare_{t+1}$	289	19949	0.079	0.058	1.359	181	5454	0.098	0.046	2.133
$MktShare_{t+2}$	289	19949	0.093	0.077	1.2	181	5454	0.12	0.069	1.727
$MktShare_{t+3}$	289	19949	0.107	0.046	2.314	181	5454	0.135	0.043	3.115
$\Delta MktShare_{t+1}$	289	19949	0.013	0.012	1.053	181	5454	0.003	0.012	0.27
$\Delta MktShare_{t+2}$	289	19949	0.03	0.015	2.062	181	5454	0.019	0.019	1.038
$\Delta MktShare_{t+3}$	289	19949	0.039	0.022	1.748	181	5454	0.029	0.02	1.462
Info disclosure:	effect on June 2011									
$MktShare_{t+1}$	1153	9570	0.18	0.021	8.384	720	2878	0.124	0.033	3.763
$\Delta MktShare_{t+1}$	1153	9570	0.003	0.001	1.932	720	2878	0.003	0.001	2.575