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Did the Federal Reserve help European banks to overcome the financial crisis?

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RESEARCH

Did the Federal Reserve help European banks to overcome the financial crisis?

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Abstract

The aim of the paper is to analyze the stock market reaction and the CDS market reaction to the usage of the FED liquidity programs by European banks. We analyze whether the usage of the liquidity programs was perceived as an opportunity for the banks to overcome the liquidity crisis or as a signal of a harmful illiquidity position. We show that the financial markets first perceived the TAF program as positive, but that a very early usage – in the two first weeks – as a late usage generates a stigma effect. Conversely, the CPFF, the PDCF and the TSLF programs announcements are negatively perceived; the first usage of CPFF and TSLF were somehow stigmatizing, whereas, at last, the usage of these three programs is perceived as useful for European banks to overcome the liquidity crisis. We also show that financial markets react positively to discount window loans and to the implementation of Bank Central Swap Lines.

Key words: Financial crisis, Federal Reserve lending facilities, European banks

JEL classification: E58, G21, G28

The opinions expressed in this paper are those of the authors and do not necessarily reflect the view of the Federal Reserve Banks of Atlanta or the Federal Reserve System.

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Did the Federal Reserve help European banks to overcome the financial crisis?

1. Introduction

The purpose of this paper is to document the extent and impact of the Federal Reserve's provision of liquidity to European banking groups during the 2007-2010 phase of the financial crisis. Part of this support came in the form of swap lines with European Central Banks, including most notably the Bank of England (BoE), the European Central Bank (ECB) and Swiss National Bank (SNB). However, a substantial component of this support came in the form of the Federal Reserve's discount window lending and access to other lending facilities provided to European groups with qualifying branches or subsidiaries in the United States (e.g. Term Auction Facility – TAF – Primary Dealer Credit Facility – PDCF or Asset back commercial paper Money Market Mutual Funds program – AMLF).

European financial institutions and markets played an important role throughout the crisis.[1] Indeed, many observers date the start of the first phase of the crisis to August 9, 2007 when BNP Paribas announced that it was suspending convertibility of two of its hedge funds which in turn started problems in interbank funding markets and in the commercial paper markets.[2] This suspension and the run on at Northern Rock in the United Kingdom were important factors leading to a big jump in the spread between the three month London Interbank Offer Rate (LIBOR) and the overnight indexed swap (OIS)[3]. This spread climbed from what had been a relatively constant 10 basis points prior to August 2007 climbed to 85 basis points on September 14, 2007 when the Bank of England announced emergency support for Northern Rock.[4] Although LIBOR is the rate at which banks borrow unsecured funds from other banks in London, it is also the reference rate used in the pricing of many U.S. domestic bank loans. Thus, not only were European banking groups important due to their direct participation in U.S. domestic markets but their U.S. dollar based activities outside the U.S. were also impacting U.S. markets[5].

The Federal Reserve's first effort to "promote orderly market functioning" was to reduce the spread between the primary credit rate at the discount window by 50 basis points and

[1] The origin and propagation of the crisis that began with U.S. residential mortgage finance is discussed by many articles, including Sarkar and Shrader (2010) or Johnson (2011).
[2] http://www.newyorkfed.org/research/economists/vickery/LiborKSV_staff_webpage.pdf.
[3] See for instance Syrstad (2014) or Tamakoshi and Hamori (2014).
[4] https://research.stlouisfed.org/publications/es/08/ES0825.pdf. Fender and Mc Guire (2011) explains the important need for USD funding from European banks.
[5] Cyree et al. (2003) already found a link between US banks, FED monetary policy and US Libor.

allow the provision of primary credit for up to 30 days.[6] The Federal Reserve's responded to stress in financial markets later that year with the creation of the Term Auction Facility on December 12, 2007 and the opening of temporary reciprocal currency arrangements (swap lines)[7] with the European Central Bank (ECB) and the Swiss National Bank (SNB). Additional facilities to support banks, primary dealers and key credit markets were created around the time of Bear Stearns collapse and again shortly after the failure of Lehman Brothers. Stability was eventually restored to financial markets (or at least to the U.S. dollar part of financial markets) through a combination of the Federal Reserve liquidity facilities (as TAF, PDCF or AMLF) and several other measures including the Federal Deposit Insurance Corporation's (FDIC's) Temporary Liquidity Guarantee Program (TLGP), the U.S. Treasury's Troubled Asset Relief Program (TARP), and the Federal Reserve's Supervisory Capital Assessment Program (SCAP).[8]

The usage of discount window and liquidity programs created a stigmatization of the banks by revealing the seriousness of their financial situation. Armantier et al. (2011) show a stigma effect of discount window loans; the effect explains the – costly – recourse to TAF program by banks. This idea is consistent with Ashcraft et al. (2010) analysis. In order to protect banks against the stigmatization, the FED did not disclose the names the banks borrowing from the liquidity program. However, Blau et al. (2013) find negative abnormal returns on the stock markets. Their results have two implications. First, in spite of the lack of disclosure from the Fed the markets participants held information about the Federal Reserve emergency loans. Second, the US stock market perceived as negative these loans.

The liquidity programs aim was to help banks to overcome their liquidity problems and to reestablish their financial situation. Therefore, a positive reaction from the financial market could have been expected. Actually, Cyree et al. (2013) find a positive reaction on stock market when commercial banks borrowed from the CPFF program. They also find a positive reaction when a Too Big To Fail bank first uses TAF program. Our paper complements previous literature by focusing on European banks. European banks benefit from a large part of FED emergency loans, but no study analyzes the European stock markets reaction to their

[6] http://www.federalreserve.gov/newsevents/press/monetary/20070817a.htm.
[7] See for instance Goldberg et al. (2011).
[8] A description of the FDIC's TLGP is available at http://www.fdic.gov/regulations/resources/TLGP/index.html. The home page for the various programs initiated under TARP is http://www.treasury.gov/initiatives/financial-stability/TARP-Programs/Pages/default.aspx. Tarullo (2010) provides an overview and analysis of the SCAP. Ashcraft et al. (2010) or Felkerson (2011) give a detailed description of the FED facilities.

usage. Buch et al. (2011) find a positive influence of FED loans on German banks, but they analyze the consequences for granted loans. The aim of the paper is to analyze the stock market reaction and the CDS market reaction to the usage of the FED liquidity programs by European banks. We analyze whether the usage of the liquidity programs was perceived as an opportunity for the banks or as a signal of a harmful illiquidity position. We also study whether the market reacted when the FED announced its programs or when a peculiar bank used a program, in order to find out if the market perceived the lack of liquidity as a systematic component of the risk or as an idiosyncratic component. At last, we want to know whether the stock market reaction was different over time (especially before vs. after Lehman Brothers collapse), in other word whether this collapse changed the perception by the stock market of the liquidity crisis. Our paper offers an over time analyze (from December 2007 to July 2010) of the market perception. Our paper also complements previous literature by considering the four main liquidity programs: TAF, TSLF, CPDF and CPFF, and the discount window loans. Our last contribution is to investigate the reaction of two different kinds of financial markets: the stock market and the CDS market, in order to collect more information about the investors' perception of the FED programs.

Among the 50 banks involved in these programs, we focus on the 43 main banks. The seven other are subsidiaries of the former or stated-own banks. We examine the evolution from December, 2007 to July, 2010 of the daily returns on European stock market for the 34 listed banks of the sample, and the evolution of the daily relative variation of the CDS spreads for the 36 banks for which CDS were issued. We use data provided by the Federal Reserve, by EUROFIDAI, by Bankscope and by Markit. Our main results are the following. First, we show that the first reaction to TAF program was positive: investors on financial markets anticipate that the facilities granted by the Fed may help banks in overcoming their liquidity issues; the general usage may prevent banks from a stigma effect. However, a late usage of the program creates a negative reaction. Second, we show that the markets reaction toward the three other programs (PDCF, TSLF and CPFF) was negative. The first usage of these programs generated a stigma effect. The markets still react negatively when a bank borrows from the PDCF or TSLF programs, implemented in March 2008, about the Bear Stearns collapse. However, the financial markets reaction is positive when a bank borrows from the PDCF program, in particular after the Lehman Brothers collapse. At last, the usage of these three programs by a European bank (measured by the outstanding loans) is perceived as positive and useful for European banks to overcome the liquidity crisis. Then, we show that the usage of discount window loans by European banks generates a positive reaction, except for a

few numbers of banks – the ones which borrowed the more from the FED – and only during the very beginning of the crisis (before the Bear Stearns collapse). At last, we find that the implementation of Bank Central swap lines was perceived as helpful for European banks during the liquidity crisis.

The paper is organized as follows. Section 2 describes the economic context of the 2007-2010 period, and provides an analysis of the FED liquidity programs. Section 3 presents in detail the different programs and their usage by European banks. Section 4 presents the data and the empirical model. Section 5 analyses the results and section 6 concludes.

2. Federal Reserve liquidity programs

The growing problems with U.S. residential mortgages had largely been confined to markets and institutions trading in these obligations until August 2007. However, that changed when BNP Paribas suspended redemptions from three investment funds on August 9 arguing that the "evaporation of liquidity … made it impossible to value certain assets." The spread between Libor and the overnight indexed swap (OIS) increased sharply and Paul McCulley, managing director at PIMCO later said of the commercial paper market that "buyers went on strike."[9]

The Federal Reserve took various actions after the BNP Paribas announcement and the subsequent changes in financial markets. However, the initial responses relied on the Federal Reserve's conventional tools. On August 10, 2007 the Federal Reserve issued a press release noting the dislocations in money markets and providing the reminder that "As always, the discount window is available as a source of funding."[10] The discount window not only provided credit to domestically chartered banks but also to foreign banks with branches and agencies in the United States that were subject to reserve requirements at the Federal Reserve. On August 17, 2007 the Federal Reserve cut the spread between its primary credit rate (discount window rate) and its federal funds target from 100 basis points to 50 basis points and extended the maximum term for primary credit to 30 days. The Federal Reserve then cut

[9] Financial Crisis Inquiry Commission Report p. 252. OIS is a fixed for floating-rate swap where the floating rate is an overnight rate. The floating rate used in U.S. OIS at that time was the federal funds rate, which meant that changes in the OIS could be interpreted as largely due to changes in the expected federal funds rate. Most importantly, as only the net difference in interest payments is exchanged, these swaps have considerably less credit risk than bank deposits. Hence the Libor – OIS spread was a commonly used measure market concerns about the credit riskiness of banks.

[10] The Federal Reserve Board Press Release dated August 10, 2007 is roughly comparable to the press release in October 1987 that helped calm markets after the stock market crash. It merely stated that: "The Federal Reserve, consistent with its responsibilities as the Nation's central bank, affirmed today its readiness to serve as a source of liquidity to support the economic and financial system" (see Carlson, 2007).
Available http://www.federalreserve.gov/newsevents/press/monetary/20070810a.htm.

both its federal funds target rate and the primary credit rate in a series of moves in September, October and November 2007.

Despite the Federal Reserve's actions, the Libor – OIS spread remained high and the anticipated increase in discount window lending did not materialize according to Cecchetti (2009). A major reason why discount window lending remained subdued according to Ashcraft, Bech and Frame (2010) is that U.S. chartered banks that were members of the Federal Home Loan Bank System could obtain funds at a lower all-in cost from the FHLBS than from the Federal Reserve until the early summer of 2008. However, many observers at that time were puzzled by the lack of borrowing and speculated about banks being reluctant to borrow from the discount window due to "stigma." According to the stigma story, other market participants would interpret the knowledge that a bank was borrowing from the Federal Reserve as a sign the bank was in financial distress. The result would be that other banks would (further) decrease their exposure to the borrowing bank, making it difficult for the borrowing bank to operate normally. The stigma concern existed even though the Federal Reserve did not disclose the identity of discount window borrowers at that time because it disclosed the total amount borrowed broken down by Reserve Bank. That disclosure combined with some knowledge of the conditions of the potential borrowers in each district would allow market participants to make an educated guess as to who was borrowing from the discount window.

In an effort to expand lending and perhaps reduce the effect of stigma, on December 12, 2007 the Federal Reserve announced plans to auction 28 days loans through the Term Auction Facility (TAF). This announcement was coordinated with announcements that the Federal Reserve would provide U.S. dollars to the European Central Bank and Swiss National Bank via a temporary swap line.[11] Simultaneously, the Bank of England also announced an expansion of the collateral it would accept for its planned long-term repo open market operations.[12]

The creation of the TAF helped reduce market concerns, bring the Libor – OIS spread down, albeit not all of the way back to the rates that prevailed in early 2007. However, mortgage market conditions continued to deteriorate. Thus, on March 11, 2008 the Federal Reserve announced the Term Securities Lending Facility (TSLF) in which primary dealers

[11] The Federal Reserve Board Press Release dated December 12, 2007 is available at http://www.federalreserve.gov/newsevents/press/monetary/20071212a.htm

[12] The Bank of England discusses its actions in a December 12, 2007 News Release titled "Central Bank Measures to Address Elevated Pressures in Short-term Funding Markets". The News Release is available at http://webarchive.nationalarchives.gov.uk/20080108114842/http://www.bankofengland.co.uk/publications/news/2007/158.htm

could exchange certain mortgage backed securities (MBS) for Treasury securities which could be more easily financed in repo markets and which supplied additional high quality collateral to the repo markets.[13] The date of the first auction was set for March 27, 2008. This announcement was accompanied by an expansion of the swap lines and an increase in the size of the TAF.

Bear Stearns collapsed before the first TSLF auction. On March 14, 2008 JP Morgan Chase agreed to acquire Bear Stearns with the help of a special Federal Reserve facility.[14] In the wake of this near failure, the Federal Reserve created the Primary Dealer Credit Facility (PDCF) on March 16, 2008 which provided primary dealers with loans at the primary credit rate on a "broad range of investment-grade debt securities."[15] The Federal Reserve Board also approved a cut in the primary credit rate, so that the rate on discount window borrowing was now only 25 basis points above the Federal Reserve's target for the federal funds rate. The Federal Reserve sought to make the TSLF more effective around key financing dates by announcing the creation of the TSLF Options Program (TOP) on July 30, 2008.[16] Once again, market conditions on the surface stabilized for a period of time as evidenced by a relatively stable but high Libor – OIS spread. However, conditions continued to deteriorate in the mortgage markets and for many major participants in that market. On September 6, 2008 Fannie Mae and Freddie Mac, the giant government sponsored enterprises specializing in residential real estate finance, were put into conservatorship by their regulator and Treasury agreed to provide support as needed to keep their capital from becoming negative.[17]

The following week saw continued deterioration in market conditions with growing liquidity strains at many financial firms. Lehman Brothers Holding Incorporated liquidity problems reached the point where it was forced to seek out a merger partner who could help in obtaining liquidity. When those efforts failed, Lehman filed for bankruptcy on September 15, 2008. That failure caused shares in Reserve Primary Fund, a money market fund, to fall below their stated redemption value of $1 per share on September 16 resulting in a large scale run by institutions on prime money funds (see Kacperczyk and Schnabl, 2010). The run on

[13] The Federal Reserve Board Press Release dated march 11, 2008 is available at http://www.federalreserve.gov/newsevents/press/monetary/20080311a.htm

[14] The Federal Reserve Bank of New York explained the transaction in a March 24, 2008 Press Release titled "Summary of Terms and Conditions Regarding the JP Morgan Chase Facility." The press release is available at http://www.newyorkfed.org/newsevents/news/markets/2008/rp080324b.html.

[15] The Federal Reserve Board Press Release dated March 16, 2008 is available at http://www.federalreserve.gov/newsevents/press/monetary/20080316a.htm

[16] The Federal Reserve Board Press Release dated July 30, 2008 is available at http://www.federalreserve.gov/newsevents/press/monetary/20080730a.htm

[17] Statement of FHFA Director James B. Lockhart at News Conference Announcing the Conservatorship of Fannie Mae and Freddie Mac. (September 7). Available http://www.fhfa.gov/Media/PublicAffairs/Pages/Statement-of-FHFA-Director-James-B--Lockhart-at-News-Conference-Annnouncing-Conservatorship-of-Fannie-Mae-and-Freddie-Mac.aspx.

the prime money funds in turn forced them to dramatically scale back their holdings of commercial paper.

The Federal Reserve took a number of steps in the aftermath of Lehman's failure and the run on money funds. On September 19, 2008 the Federal Reserve Board announced the creation of the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF). On September 24, the Federal Reserve established new swap lines with the Sveriges Riksbank (Central Bank of Sweden), Danmarks Nationalbank (Central Bank of Denmark) and the Norges Bank (Central Bank of Norway). Two days later, the Federal Reserve announced an expansion of the swap lines with Bank of England, Danmarks Nationalbank, ECB, Norges Bank, Sveriges Riksbank, and Swiss National Bank. Also during this time period the Federal Reserve agreed to provide support to AIG to prevent its collapse, and approved the conversion of Morgan Stanley and Goldman Sachs to bank holding company status in a move that gave them improved access to funding.

The continuing turmoil in financial markets led to a variety of other policy responses in the United States, most notably the signing into law of the Emergency Economic Stabilization Act of 2008, which establishes the $700 billion Troubled Asset Relief Program (TARP) on October 3, 2008. Pursuant to authority provided by the Emergency Economic Stabilization Act, the Federal Reserve authorized the payment of interest on reserves on October 6. The next day, the Federal Reserve actions announced the Commercial Paper Funding Facility (CPFF), which provided a liquidity backstop to U.S. issuers of unsecured and asset-backed commercial paper from eligible issuers.

A common feature of the Federal Reserve's liquidity programs is that their pricing was structured in such a way to make them attractive to illiquid banks but also to incent banks to switch to market based funding sources as those became available. As a result, the usage of the various programs declined in the later part of 2009 as market conditions improved and most programs were terminated in 2010.

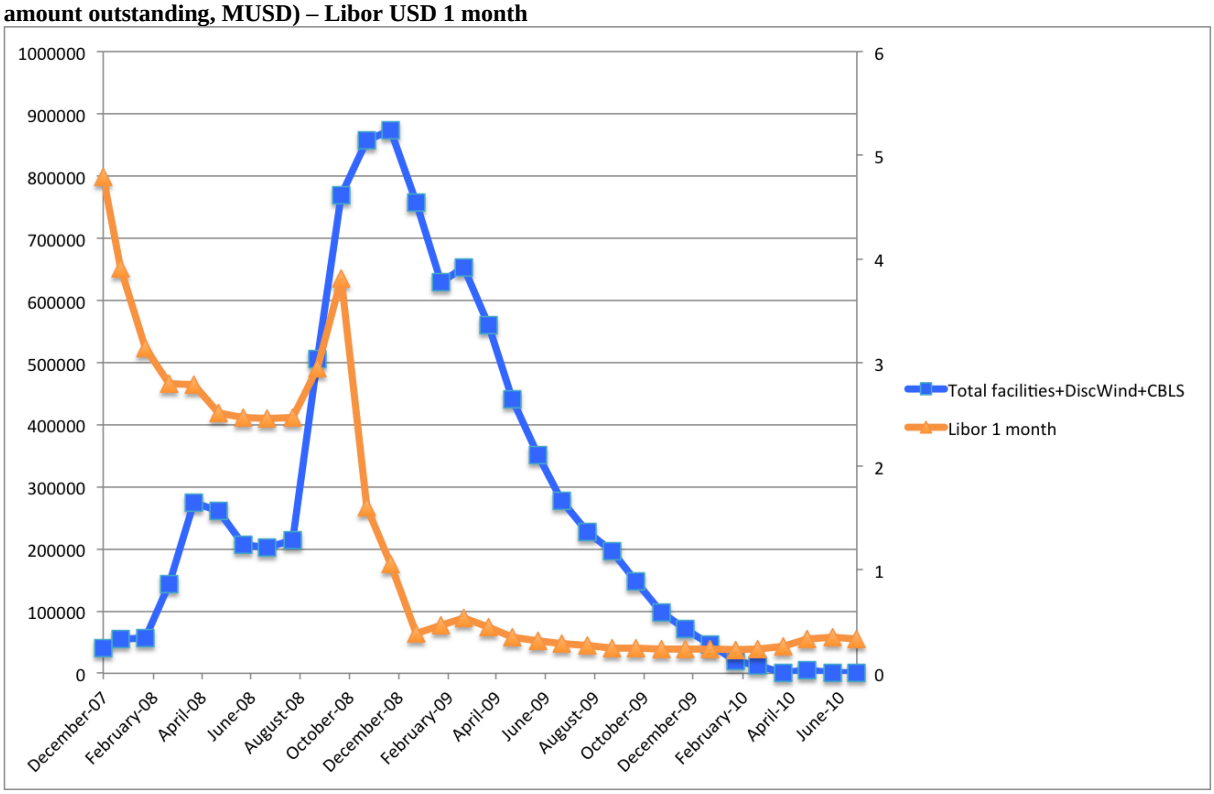
3. Federal Reserve programs and European banks

Loans to European banks were a major part of the liquidity programs, especially in the early stages. 50 European banks benefited from the FED facilities from December 2007 to March 2010 (see Table 1). This section describes the Federal Reserve facilities that were used by European banks in greater detail and discusses their usage.

Table 1. Operations lead by the Federal Reserve for each liquidity program

Program	Period	Total Amount worldwide (MUSD)	Total Amount to European Banks (MUSD) (% of total amount worldwide)	Number of operations to European Banks	Number of European Banks involved
TAF	12/2007 to 03/2010	3,818,411	1,944,419 (50.9%)	929	45
TSLF	03/2008 to 07/2009	2,005,697	1,183,079 (59.0%)	283	8
TOP	08/2008 to 06/2009	196,995	97,904 (49.7%)	16	5
PDCF	03/2008 to 10/2008	8,950,992	514,305 (5.7%)	129	6
AMLF	10/2008 to 11/2008	217,350	238 (0.1%)	2	1
CPFF	10/2008 to 10/2009	738,263	318,325 (43.1%)	531	26
Total	12/2007 to 03/2010	15,927,708	4,058,271 (25.5%)	1890	50

Figure 1. European usage of facilities, discount window and swap lines from 2007 to 2010 (monthly average, amount outstanding, MUSD) – Libor USD 1 month



Source: Federal Reserve

Figure 1 shows that the amounts borrowed by European banks (including all facilities programs, Central Banks swap lines and discount window loans) increased until April 2008 when started to decrease. Then, the borrowings resumed their climb after the failure of Lehman, reaching a peak of almost $900,000 billion in December 2008. Thereafter, the amounts dropped rapidly, reaching zero in early 2010. Meanwhile, we can observe that the Libor 1 month started to increase in September 2008 with a peak in October 2008.

3.1. Swap lines and the Term Auction Facility – TAF

The Federal Reserve's first two liquidity programs provided two different ways in which many European banks with branches in the U.S. could obtain funding.[18] The banks could borrow from the Federal Reserve through the TAF program or through the central bank of their home country which obtained dollars through its swap line with the Federal Reserve. The extent to which European banks with U.S. branches obtained dollars from their home country central bank is not publicly available. However, the Federal Reserve has released detailed information on the usage of its domestic facilities by banks which show that European banks were some of the largest users of the TAF.

3.1.1. TAF

The TAF was an extension of the Federal Reserve's traditional discount window lending through its primary credit program.[19] The key differences were: (a) that the loans initially had a fixed maturity of 28 days (with later auctions including fixed maturities up to 84 days) whereas the borrowing through the primary credit facility discount window lending was normally overnight (but the maximum was extended to 30 days as discussed above), (b) the total amount issued in any one auction was limited whereas the total amount discount window lending throughout the Federal Reserve System was not subject to such a quantitative cap, and (c) the rate paid by the borrower was set by auction whereas the rate paid on primary credit was fixed. One important similarity of the TAF and other discount window lending is that the Federal Reserve would consider lending on any sound asset subject to haircut based on the liquidity, and credit and interest rate risk of the asset.

The date, aggregate amount and maturity of each TAF auction were announced in advance. Additionally, the amount available to any one borrower was also subject to a preannounced. The minimum bid rate was set at the overnight indexed swap (OIS) rate until January 12, 2009 and thereafter was set at the rate the Federal Reserve paid on excess reserves (which was a constant 25 basis points during the operation of the TAF).[20] The rate actually paid by all banks was the stop-out rate, which is the rate at which the aggregate amount being auctioned was sold out. All bids in excess of the stop-out rate were fully

[18] See http://www.federalreserve.gov/newsevents/reform_taf.htm

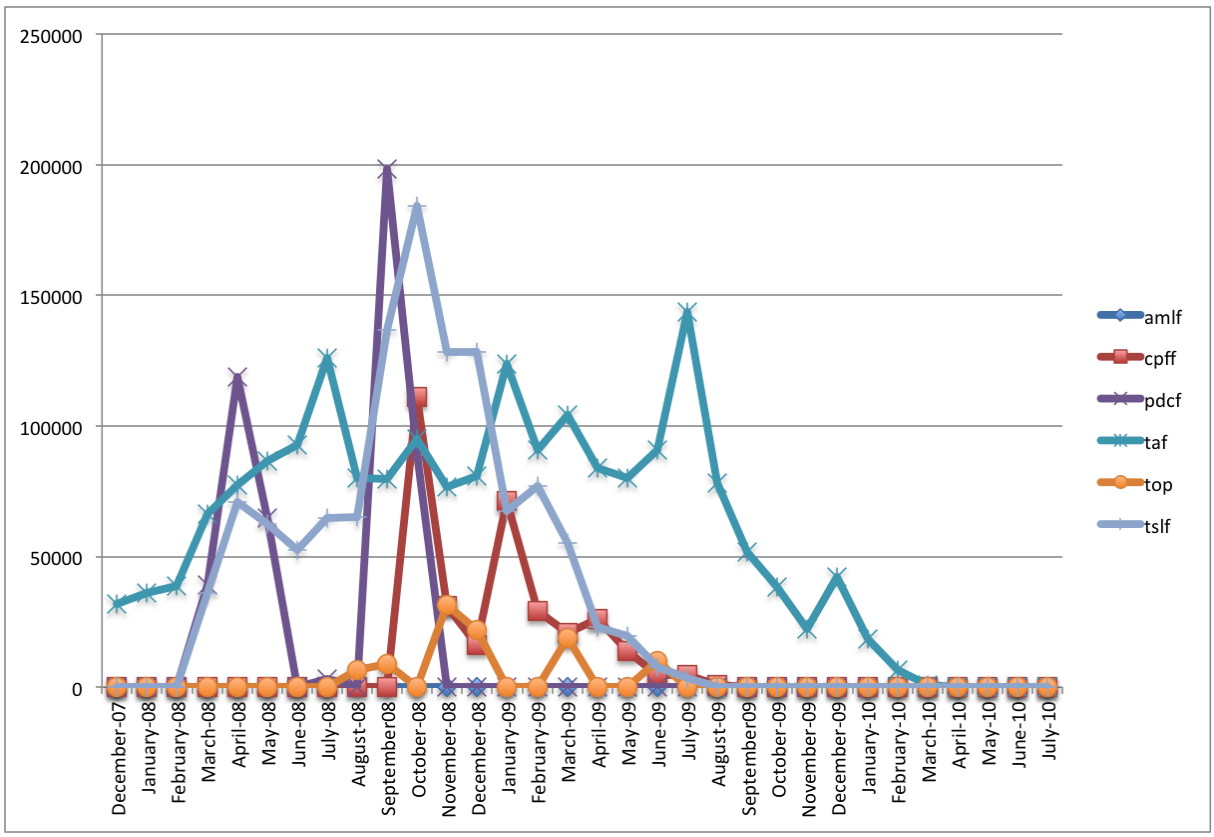
[19] The Board of Governors announced the TAF in a Press Release dated December 12, 2007, available at http://www.federalreserve.gov/newsevents/press/monetary/20071212a.htm. The Board of Governors web page on the Term Auction Facility provides a high level discussion of the facility and links to the data on its usage, see http://www.federalreserve.gov/newsevents/reform_taf.htm. Armantier, Krieger and McAndrews (2008) discuss the development and provide data on the operation of the TAF through May 2008.

[20] The terms of the TAF as of January 12, 2009 are discussed by the Federal Reserve Board in "Term Auction Facility Questions and Answers" available http://www.federalreserve.gov/monetarypolicy/taffaq.htm.

allocated (up to the single borrower limit). Bids at the stop-out rate were filled on a pro-rata basis. The final TAF auction was held on March 8, 2010 and the last loans matured on April 8, 2010. All loans issued under the TAF were repaid in full with interest. The auction details were announced in advance. The auction was typically held on a Monday, the results announced to the winning banks on Tuesday and the loans were settled on Thursday.

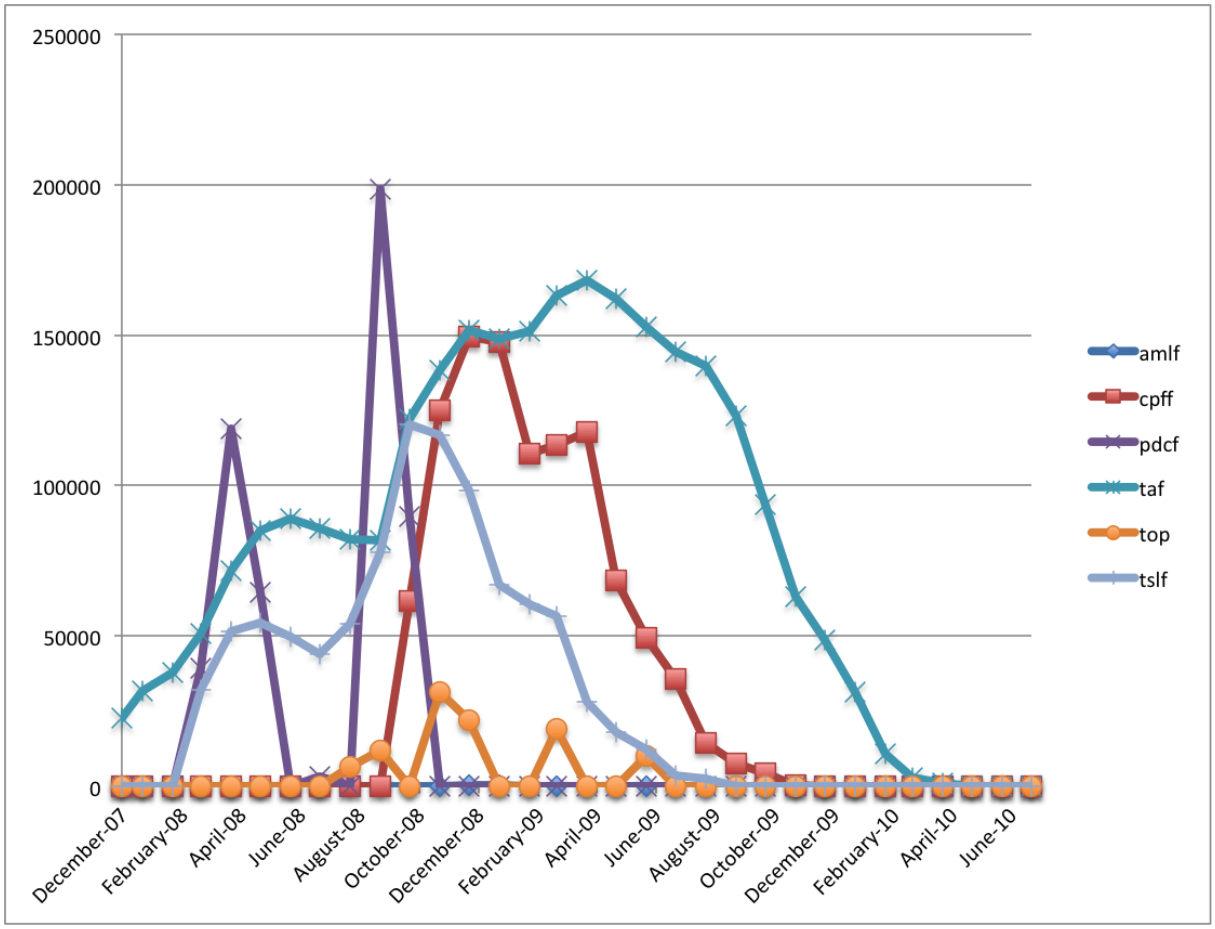
Figure 1 and Table 1 show the usage of different programs by European banks. European banks took a large fraction of the initial TAF auctions, borrowing over $30 billion on a monthly average basis when the auctions were initiated in December 2007.[21] From December 2007 to July 2010, European banks borrowed $1,944,419 million (over 60 billion on a monthly average basis). The loans borrowed by Europeans banks represent 50.9% of the total Term Auction Facilities granted by the Fed ($3,818,411MUSD). 45 banks were involved (see Appendix A2). Figures 2a and 2b show that the amounts borrowed by European banks increased until July 2008 when started to decrease. The borrowings resumed their climb after the failure of Lehman, reaching a peak of over $150 billion in July 2009 (Figure 2a). Thereafter, the amounts dropped rapidly, reaching zero in early 2010. The outstanding facilities (Figure 2b) followed quite the same trend, reaching a peak over $160 billion in April 2009.

Figure 2a. FED lending facilities granted to European banks (MUSD) – Gross total amounts per month



[21] See also Benmelech (2012) for a discussion of the TAF that focuses on European bank participation.

Figure 2b. Lending facilities extended to European banks (MUSD) – Average outstanding amounts per month



3.1.2. Central Bank Swap Lines

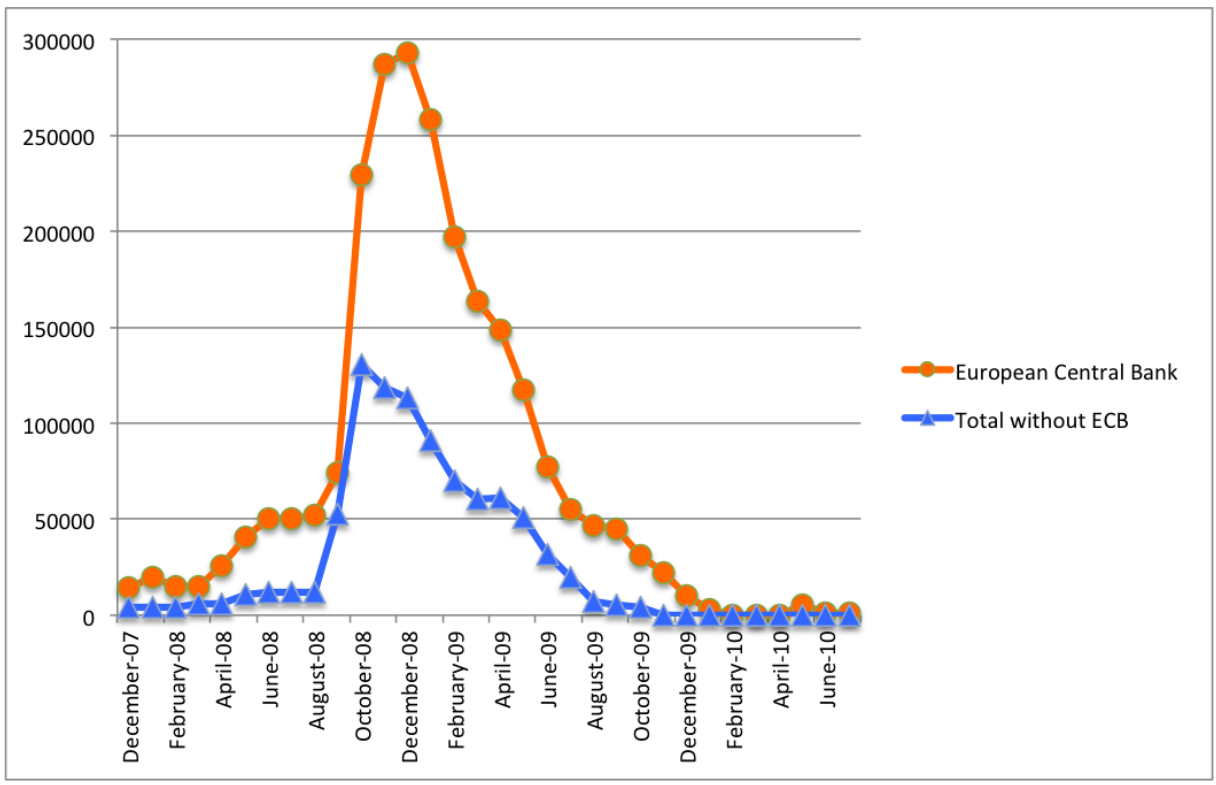
Central bank swap lines have long been used for a variety of purposes according to Hooyman (1993). Swap lines were used to supply dollars which foreign central banks could lend to their banks during the crisis. In return for supplying dollars to a foreign central bank, this one would give an equivalent value of its currency to the Federal Reserve. The transaction was reversed at a specified future date. Both transactions took place at the prevailing exchange rate in the market at the start of the transaction. The foreign central bank retained all of the credit risk associated lending to its commercial banks.

Goldberg, Kennedy and Miu (2011) provide an excellent overview of the usage of the swap lines during the crisis. The Federal Reserve opened swap lines with the European Central Bank and Swiss National Bank at the same time at the first TAF auction in December 2007. Lines were later opened with the Bank of England, Danmarks Bank, Norges Bank and Sveriges Riksbank. The lines were initially for a fixed amount, but the caps on the lines for the Bank of England, European Central Bank and Swiss National Bank were removed in October 2008.

Goldberg, Kennedy and Miu (2011) discuss the various procedures that foreign central banks then used to lend the money to banks need U.S. dollars. The funds were sold to the banks for terms similar to those used in the TAF auctions. Some central banks relied exclusively on auctions to distribute the dollars. Where the funds were sold in a competitive auction, the minimum bid rate by foreign banks equaled or exceeded the minimum bid rate for funds obtained through the TAF. The Bank of England, European Central Bank and Swiss National Bank switched from a bidding process to a non-competitive, full allotment auction at a fixed price when caps on the swap lines were removed. The fixed price for these allotments was U.S. dollar OIS + 100 basis points, this price exceeded the stop-out rate for the TAF auctions. The auctions conducted by the Bank of England, ECB and Swiss National Bank tended to coincide with the dates of TAF auctions of amounts of similar maturities.

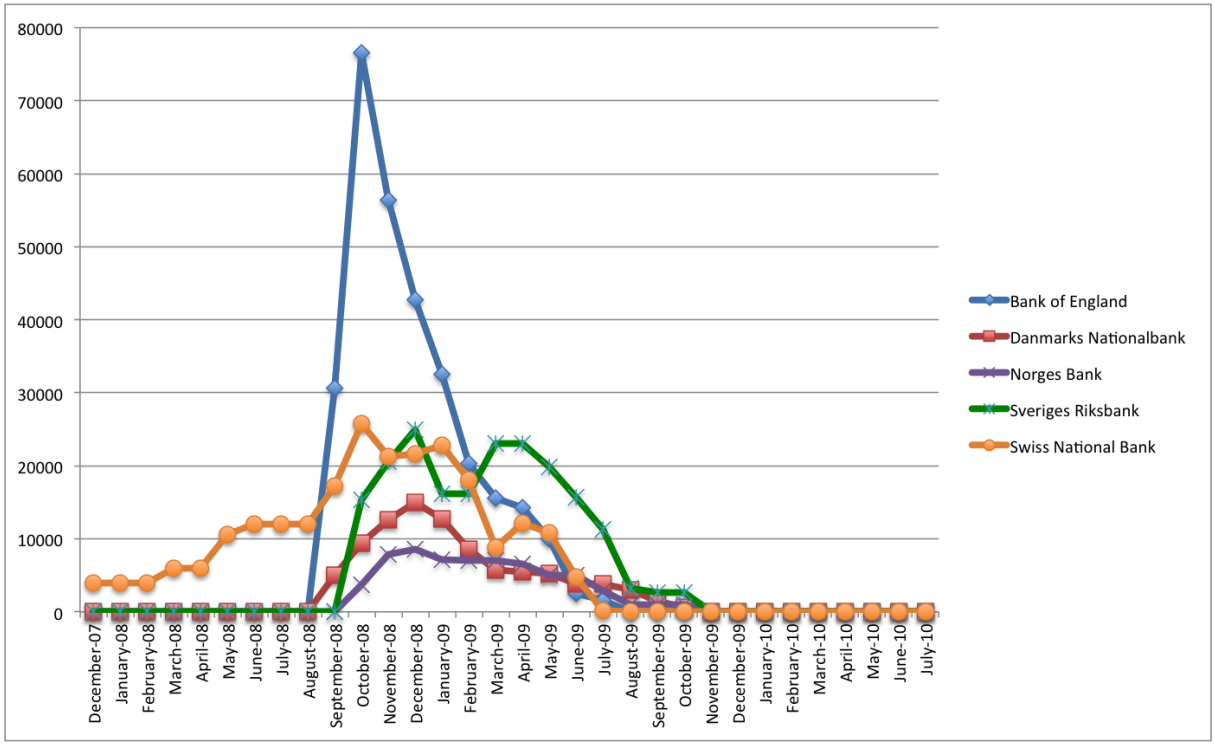
502 operations were implemented to 6 central banks in Europe, from December 2007 to May 2010. The global amount over the period is equal to 8,011,366.4 MUSD for ECB, 918,830 MUSD for Bank of England, 465,812.5 for Swiss National Bank, 72.788 MUSD for Danmarks Nationalbank, 67.200 MUSD for Sveriges Riksbank and 29.700 MUSD for Norges Bank (see Appendix A2).

Figure 3a. Liquidity swaps extended to the European Central Banks (MUSD monthly average, amounts outstanding per Central Bank)



Source: Federal Reserve

Figure 3b. Liquidity swaps extended to the European Central Banks (MUSD), except ECB (monthly average, amounts outstanding per Central Bank)



Source: Federal Reserve

Figures 3 shows the Liquidity swaps outstanding by central bank from December 2007 to July 2010. Figure 3a focuses on ECB and Figure 3b shows the usage of the swap lines by European central banks expect ECB. As would be expected, the ECB drew by far the largest amount. Total worldwide usage of the dollar swap lines peaked in early 2008 at over $600 billion with a peak of over $400 billion due to European central banks.

3.2. Term Securities Lending Facility – TSLF - and TSLF Options Program – TOP

The TSLF was intended to help primary dealers obtain financing for their securities portfolio by allowing them to pledge investment grade securities temporarily as collateral for obtaining U.S. Treasury securities according to Fleming, Hrung and Keane (2009). The U.S. Treasury securities could then be used as collateral for obtaining funds in the private market on better terms than they could have using their original securities holdings. For example, a primary dealer could pledge highly, non-agency mortgage backed securities with U.S. Treasury securities which were more readily acceptable to private lenders.

The TSLF was different from the TAF in that the TSLF was only open to primary dealers whereas the TAF was open to all U.S. banks, U.S. branches and agencies of foreign banks that maintain deposits subject to reserve requirements. The primary dealers "serve first and

foremost, as trading counterparties of the Federal Reserve Bank of New York."[22] The primary dealers play an important, ongoing role in the U.S. Treasury securities market, but they need not be headquartered in the U.S. nor need they be a commercial bank. Although not a requirement, primary dealers also tended to be important dealers in a wide variety of fixed income markets.

Access to the TSLF was sold via an auction with dealers bidding to pay a fixed fee in return for access to a given amount a given dollar amount of securities U.S. Treasury securities for one month with the dealer posting securities that were (presumably) less acceptable to private lenders. Winning bidders paid a single rate, the lowest bid rate accepted in the auction. Minimum fee levels were set to encourage primary dealers to reduce their usage as markets improved. Some financial markets become more volatile around certain key dates, especially quarter end. The TOP facility was created to give primary dealers the right, but not the responsibility to draw on the TSLF around such dates. These options for 7 days usage of the TSLF were auctioned subject to a minimum fee for winning the auction and a fixed rate fee if the option is exercised.

European banks took a large fraction of the TSLF, borrowing $1,183,079 million from March 2008 to July 2009 (over 69 billion on a monthly average basis). The loans borrowed by Europeans banks represent 59.0% of the total TSLF granted by the Fed ($2,005,967 MUSD). The TSLF Option Program also largely implied European Banks, with 49.7% of the total amounts (97,904 MUSD for European banks among 196,995 MUSD). However, only 5 banks were involved: Barclays, Deutsche Bank, Royal Bank of Scotland, Crédit Suisse and BNP-Paribas (see Appendix A2). Figures 2a and 2b show the usage of the TSLF and TOP by primary dealers headquartered in Europe. European usage of the TSLF peaked in October 2008 at over 180 billion U.S. dollars of loans and over 120 billion U.S. dollars of outstanding loans, and European usage of the TOP peaked in November 2008 at over 30 billion U.S. dollars of loans and of outstanding loans.

3.3. Primary Dealer Credit Facility – PDCF

The PDCF was like the TSLF in that both facilities were intended to ease financing conditions for primary dealers. The principal difference was that under the PDCF the primary dealers were borrowing overnight funds from the Federal Reserve as needed rather than

[22] A discussion of the primary dealers from the Federal Reserve Bank of New York may be found at http://www.ny.frb.org/markets/pridealers_policies.html. The current list of primary dealers with links to historical changes is also available from the Federal Reserve Bank of New York at http://www.ny.frb.org/markets/pridealers_current.html#tabs-1.

bidding in an auction to be able to obtain Treasury securities for 28 days. Adrian, Burke and McAndrews (2009) describe the PDCF as in many ways similar to the Federal Reserve's discount window for lending to banks. The price of the PDCF was the discount rate, but this rate increased after 45 days of usage to encourage primary dealers to rely on market based funding. Primary dealers were also required to post collateral subject to a haircut, as was the case with the TSLF and the discount window. The set of acceptable collateral for the TSLF and PDCF varied through time. After Lehman's failure the range of acceptable collateral for the PDCF included some non-investment grade securities and equities, neither of which was acceptable for the TSLF.

European banks played a minor role in this program: they borrowed 514,305 MSUD that is to say 5.7% of the total amount granted by the Federal Reserve. Only 6 European banks were involved (see Appendix A2). Figures 2a and 2b show that European banks usage of PDCF was important in April 2008 and in September 2008, peaking at levels above their usage of the TAF in September 2008 (almost $ 200 billion). However, European bank usage also fell rather rapidly in 2009.

3.4. Asset-backed commercial paper money market mutual fund liquidity facility – AMLF

The AMLF was intended to increase the liquidity of the asset-backed commercial paper (ABCP) market and provide a means for money market mutual funds to obtain liquidity for their holdings of ABCP according to Duygan- Bump, Parkinson, Rosengren, Suarez, and Willen (2013). Under this program the Federal Reserve issued non-recourse loans to commercial banks to buy commercial paper from money market funds.[23] The usage of this program by European banks was minimal, with only Crédit Suisse using the facility to buy assets from money market mutual funds managed by Crédit Suisse.[24] The amount borrowed by Crédit Suisse was comparatively small, less than 250 million U.S dollars (0.1% of the total amount granted by the Federal Reserve).

[23] When the Federal Reserve makes a loan, it ordinarily requires that the borrower post collateral. However, should the borrower default and the collateral prove insufficient to cover the loan, the Federal Reserve had recourse to the borrower's other assets. Under the AMFL, however, the Federal Reserve would not have recourse to the bank's other assets should the bank default.

[24] In theory Crédit Suisse was not directly exposed to losses from its money market funds. However, many mutual fund managers voluntarily supported their money market funds with the expectation that doing so would allow them to remain competitive in the money market mutual fund business after the crisis.

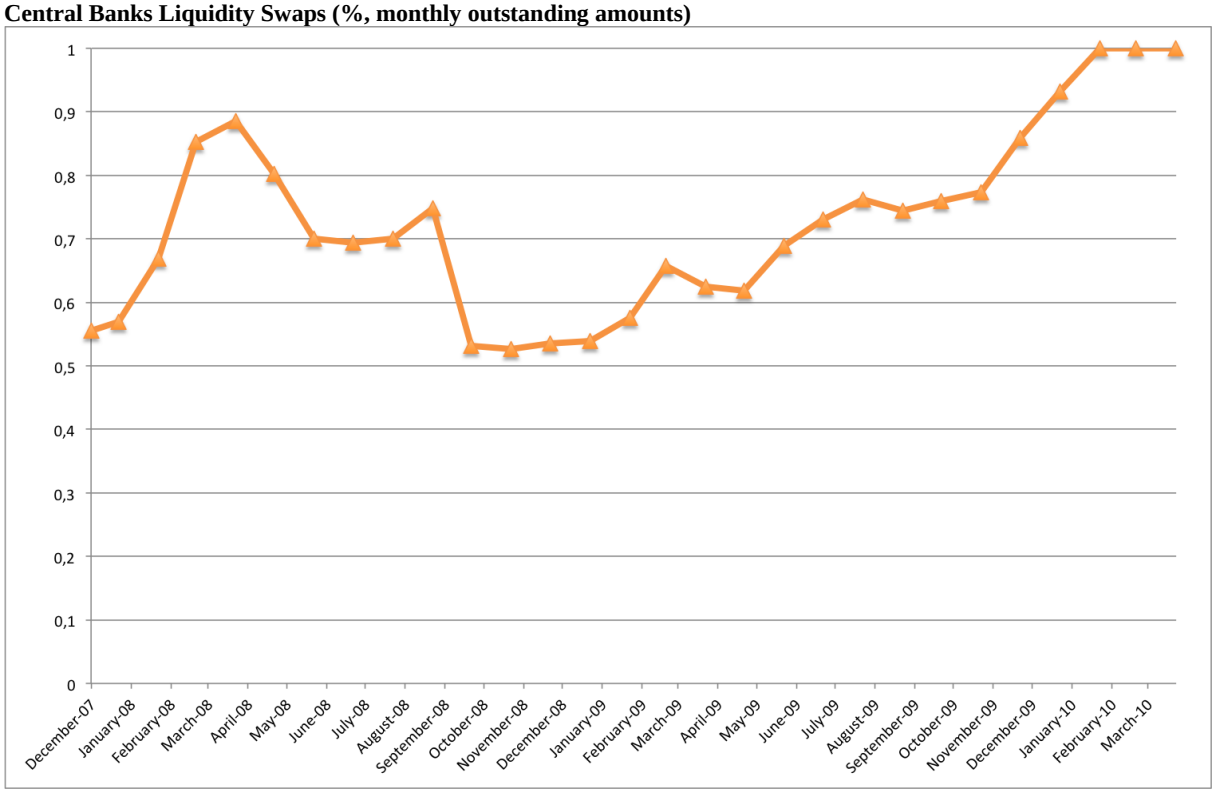
3.5. Commercial Paper Funding Facility – CPFF

The CPFF was intended to stabilize short-term funding markets and prevent liquidity driven defaults by issuers according to Adrian, Kimbrough, and Marchioni (2011). The facility purchased commercial paper rated A1/PA/F1 or higher from issuers who registered with the Federal Reserve Bank of New York. The issuer had to be U.S. based, however, it could have a foreign parent. The actual buyer of the commercial papers was a special purpose vehicle created by the Federal Reserve called the CPFF LLC. The CPFF LLC purchased qualified commercial paper from issuers using non-recourse funding supplied by the Federal Reserve. The all-in cost of the funding was three month OIS plus 200 basis points for unsecured commercial paper and three month OIS plus 300 basis points for asset-backed commercial paper.

European banks took a large fraction of the CPFF program, borrowing over $25 billion on a monthly average from October 2008 to August 2009. During this period, the European banks borrowed $318,325 million, 43.1% of the total CPFF granted by the Fed ($738,263 MUSD). 26 banks were involved (see Appendix A2). Shortly after the implementation of the CPFF in 2008, the facility replaced the TSLF as the second most heavily used Federal Reserve facility by European Banks according to Figure 2b, second only to the TAF. At its peak in granted amount, European banks obtained over 110 billion U.S. dollars from the CPFF. At its peak, in December 2008, the outstanding loans were almost equal to $ 150 billions.

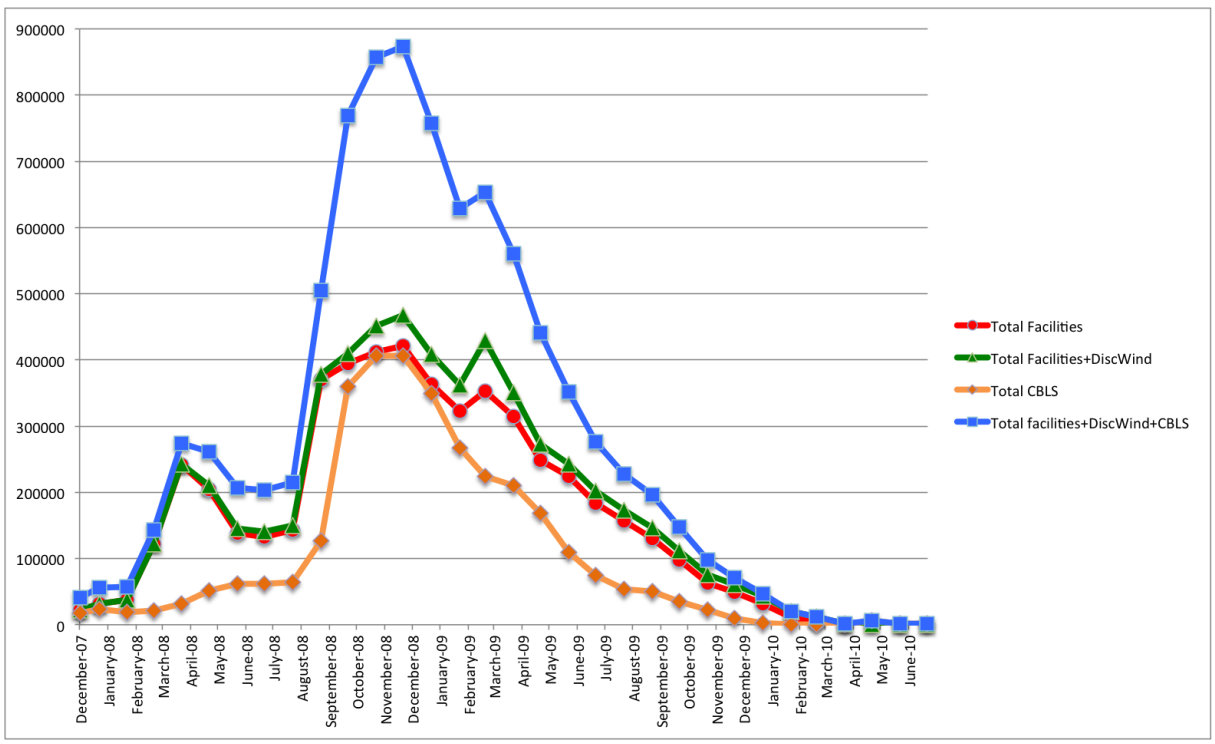
To conclude, an interesting issue is the quantitative significance of swap lines relative to Fed lending to European banks in the U.S. For instance, Goldberg et al. (2011) show that the central bank swap rate consistently exceeded the TAF stop-out rate. Hence, European banks with U.S. operations would have preferred to borrow directly from the Federal Reserve via the U.S. TAF rather than from the central bank of their home country. Figures 4a and 4b show that the borrowing by European banks in the U.S. was high relative to the swap lines. Figure 4a shows that the usage of discount window and facilities represents more than 50% of the total amounts granted by the Federal Reserve (including Central Banks Liquidity Swaps).

Figure 4a. European usage of facilities and discount window relative to Europe use of facilities, discount window and Central Banks Liquidity Swaps (%, monthly outstanding amounts)



Source: Federal Reserve

Figure 4b. European usage of facilities programs, discount window loans and Central Banks Liquidity Swaps (monthly average, outstanding amounts)



Source: Federal Reserve

4. Data and empirical method

4.1. Data sample and source

The Federal Reserve provides information about the lending programs the FED lead during the subprime mortgage crisis, from December 2007 to July 2010. We identified the operations granted to European banks, subsidiaries or branches. 50 European banks were involved (see Appendix A1). Among them, 7 are subsidiaries of a group (including one state-owned group: Hypo Real Estate Group, and one non-banking group: BMW), 3 are state-owned banks and 6 are mutual banks (most of them are German landesbanks). 34 are listed and public-owned banks. Credit Default Swaps were issued for 36 banks of the sample. 29 banks are meanwhile listed and concerned by the CDS market. The sample includes 17 systemic banks (G-SIBs: global systemically important banks), following the classification provided by the Financial Stability Board. They are all listed and CDS are issued for all of them, except Lloyds TSB and Dexia (during the period).

The FED conducted 6 different programs (see section 3). We analyze how the stock market and the CDS market reacted when one bank benefited from a FED facility (see in Appendixes A1 and A2 the details of the amount granted per bank and per program). We consider only four programs (TAF, TSLF, PDCF and CPFF). We decided to drop AMLF operations from our econometrical analysis, as only one European bank (Crédit Suisse) was involved and for a quite small amount (238 MUSD). We also dropped TOP operations from our econometrical analysis because they were only options that the banks were buying. Once the options were exercised to obtain funding, the operation appeared in the bank's TSFL participation.

In order to analysis the stock market and the CDS market reaction, we attribute to their group the facilities the subsidiaries benefited from, and we conduct the analysis at the group level, restricting the sample to 43 banks[25], as none subsidiary is listed or concerned by a CDS on its own. We first focus on the 34 listed banks. We draw our stock data from the EUROFIDAI database. We consider daily data from the 1st of December 2007 to the 31st of July 2010 (during 974 days). We use the daily Euro Stoxx Banks® Index (see below) as a benchmark of the global evolution of the European stock markets. This index is provided by EUROFIDAI. Then we focus on the banks for which Credit Default Swaps were issued during the period. 36 banks are involved. 29 are listed (and are included in the previous sub-sample). The 7 other banks are not listed (5 mutual banks and 2 state-owned banks). We

[25] We do not include in our final sample BMW, as it is not a banking group.

consider daily CDS spreads for the senior debt, maturity 5 years. The CDS data are provided by Markit. We also consider daily data from the 1st of December 2007 to the 31st of July 2010. We use the daily iTraxx Index (see below) as a benchmark of the global evolution of the CDS market. This index is provided by Bloomberg. At last, we consider the total assets by banks. This data is provided by Bankscope.

4.2. Variables and univariate analysis

We analyze the stock market reaction when a bank benefits from a FED facility. Our first dependent variable is the stock daily return ($Return_{i,t}$ for each bank *i* and for each trade date *t*), from the 1st of December 2007 to the 31st of July 2010 (Appendix A4 sums up the description of the variables. See descriptive statistics in Table 2). We focus on European stock markets. In case of cross listing, we consider the stock price in the country of the bank. A positive return means an increase in the share value, and anticipations by investors of higher profit opportunities. We also analyze the CDS market reaction: our second dependent variable is the daily relative variation of the CDS spread ($VCDS_{i,t}$). An increase in the spread – a positive relative variation – means that investors believe the default risk of the bank rose. We consider the CDS on senior debt, maturity 5 years. The returns are on average negative on the period but almost equal to zero (0.014%) (see Table 2a), and the spread variations are on average positive (equal to 0.284%). These trends are in line with the financial situation of the European banks between 2007 and 2010. The changes are not homogenous on the whole period (see Table 2b). During the first period of the financial crisis, from December 2007 to March 2008 (month of the Bear Stearns collapse) the returns are on average equal to -0.344% while the relative variation of the spreads equals to 1.390%. During the second period, from March 2008 to September 2008 (month of the Lehman Brothers collapse) the returns were equal to -0.085% on average and during the third period, from September 2008 to July 2010, they were even on average positive (equal to 0.060%). The relative variations of spreads remain positive on average, but they decrease over time, as they are equal to 0.171% during the second period and equal to 0.135% during the third period.

We assess the reaction of stock and CDS markets to FED facilities programs. The reaction can be positive if investors anticipate that the loans are an opportunity for the banks and may help them to escape from financial distress and to overcome liquidity crisis. The reaction can also be negative if the investors interpret the loan granted by the FED as a signal of serious financial distress.

Table 2: Summary statistics – Dependent variables

Table 2a. Total Period

The sample consists of 43 European banks from 12/01/2007 to 07/31/2010. This table reports means, min, max and standard deviations (total, within and between) and tests of differences between G-SIBs and non G-SIBs. ***, **, * denote that the difference between the G-SIBs versus non G-SIBs samples is significant at the 1%, 5%, or 10% level, respectively.

	Obs.	Mean	Min	Max	St. Dev.	St. Dev Within	St. Dev. Between
Return (%)	20016	-0.014	-77.573	73.242	4.353	4.356	0.106
Return for G-SIBs (%)	11340	-0.006	-66.571	73.242	4.482***	4.485	0.054
Return for non-G-SIBs (%)	8676	-0.026	-77.573	49.907	4.180***	4.182	0.140
VCDS (%)	22754	0.284	-55.300	117.390	5.658	5.662	0.123
VCDS for G-SIBs (%)	9057	0.293	-40.392	50.666	5.902	5.906	0.141
VCDS for non-G-SIBs (%)	13697	0.278	-55.300	117.390	5.492	5.495	0.111

Table 2b. Sub-Periods before the Bear Stearns collapse, between the Bear Stearns collapse and the Lehman Brothers collapse and after Lehman Brothers collapse

The sample consists of 43 European banks from 12/2007 to 03/2008, from 03/2008 to 09/2008 and from 09/2008 to 07/2010. This table reports means, min, max and standard deviations (total, within and between) and tests of differences between the different sub-periods. ***, **, * denote that the difference between the different sub-periods (between the first sub-period and the two other ones, and, in bracket, between sub-period 2 and 3) is significant at the 1%, 5%, or 10% level, respectively.

	Obs.	Mean	Min	Max	St. Dev.	St. Dev Within	St. Dev. Between
Before the Bear Stearns collapse – sub-period 1							
Return (%)	1915	-0.344***	-10.708	12.418	2.628***	2.643	0.182
VCDS (%)	1979	1.390***	-38.663	117.390	7.443***	7.491	0.340
Between the Bear Stearns collapse and the Lehman Brothers collapse – sub-period 2							
Return (%)	3950	-0.085***(*)	-18.893	19.187	3.023***(***)	3.032	0.1405
VCDS (%)	4307	0.171***(/)	-43.655	42.752	5.937***(***)	5.954	0.274
After Lehman Brothers collapse – sub-period 3							
Return (%)	14090	0.060***(*)	-77.573	73.242	4.822***(***)	4,8264	0.135
VCDS (%)	16405	0.135***(/)	-55.300	94.225	5.215***(***)	5,2197	0.130

We take into account several groups of independent variables (see descriptive statistics in Table 3). First, for each program, we consider the amount of facility the day it was traded, for each bank *i* and for each trade date *t*: $CPFFFac_{i,t}$, $PDCFFac_{i,t}$, $TAFFac_{i,t}$, $TSLFFac_{i,t}$. The variable equals zero for any day except at the trade date. The market reaction should be different depending on the amount granted. We expect that the higher the amount is, the stronger the reaction is. The amount of facility is divided by the banks total assets, in order to control the size effect.

We also include a dummy for the first day a bank *i* received a particular facility: $FirstCPFF_{i,t}$, $FirstPDCF_{i,t}$, $FirstTAF_{i,t}$, $FirstTSLF_{i,t}$. The variable equals zero for any day except the day of first trade of the operation for a given bank. The more important reaction of the market may be at the first time a bank participates to a new program. The subsequent uses give less information to the investors. To check this point and also as robustness check we assess the impact of subsequent facilities, in a second phase of the article. We include then

$SubsqCPFF_{i,t,}$ $SubsqPDCF_{i,t,}$ $SubsqTAF_{i,t}$ and $SubsqTSLF_{i,t}$. As robustness check, we also analyze the impact of any facility. We consider $AnyUseCPFF_{i,t}$, equal to 1 any day the bank receives a facility. The variable $AnyUseCPFF_{i,t}$ is the sum of $FirstCPFF_{i,t}$ and $SubsqCPFF_{i,t}$. We also insert in the ulterior regressions $AnyUsePDCF_{i,t,}$ $AnyUseTAF_{i,t}$ and $AnyUseTSLF_{i,t.}$ The third group of independent variables is the amount of outstanding facility by program for each day and for each bank: $CPFFOut_{i,t}$, $TAFOut_{i,t}$, $TSLFOut_{i,t}$. They are calculated thanks to the amount of each facility and its maturity. When several facilities of the same kind have been granted to one bank, we take into account this overlapping by summing the different outstanding facilities. We expect that the higher the outstanding loans is, the stronger the reaction is. The amount of outstanding facilities is divided by the bank total assets, in order to control the size effect. As PDCF are overnight operation, we do not include a variable $PDCFOut_{i,,t}$: it would be equal to $PDCFFac_{i,t}$. We also consider dummy variables equal to one the day each program has been announced by the Fed and equal to 0 otherwise: $AnnounceCPFF_t$, $AnnounceTAF_t$, $AnnounceTSLF_{t,.}$ and $AnnouncePDCF_t$. For instance, $AnnounceCPFF_t$ equals to one on October 7, 2008, and equals to 0 the other days. The announcement day markets reactions could have conveyed substantial information to investors about the ability of banks to obtain additional funding.

To capture the integrality of the financing the FED provided to European banks, the discount window has to be taken into account: $DiscountWindow_{i,t}$ is the discount window outstanding loans for the bank *i* as of the date *t*, divided by its total assets, in order to control for size effect. The Federal Reserve also helped European banks to overcome the liquidity crisis thanks to liquidity swap programs with European central banks (see above and see Appendix A3). We create binary variables in order to take into account the home country bank participation in the swap lines. Start is a binary variable equal to one the day of the beginning of the swap program with the central bank in each bank's home country (and equal to zero the other days). The swap program with ECB and Swiss National Banks started on 12/17/2007. The swap program with Bank of England started on 09/18/2008, the program with Danmarks Nationalbank started on 09/26/08 and the program with Sveriges Riksbank (Sweden) started on 10/15/08. Our sample does not include Norwegian banks. We also add a binary variable (called Remove) for 10/14/2008, date on which the cap on the amount of the swap lines was removed for Bank of England, European Central Bank and Swiss National Bank.

At last, we introduce four control variables. $MkCap_{it}$ is the market capitalization of the bank *i* at time *t*. $MkCap_{i,t}$ controls the size effect for the sub-sample of listed banks. For the sub-sample of banks for which CDS has been emitted, as they are not all listed, we consider

their total assets (Total Assets) to control the size effect. In order to control the global evolution of the markets, we include two additional variables. First, $VEuroStoxx_t$ is the daily relative variation of the return of the Euro Stoxx Banks® Index at time *t*. This index includes 30 European banks, only 14 of them are included in our sample. This variable controls the global evolution of the European bank market. Second, ViTraxx is the daily relative variation of the iTraxx Europe Senior Financial Index. This index represents the evolution of the CDS spread of senior debt for 25 European banks and insurance, whose risk is considered as low.

Table 3 gives summary statistics of the independent variables. The operations are aggregated at a group level. We do not include the dummy variables (equal to 1 the day of the announce or equal to 1 the first day a bank receive a facility) because it would not have any economic meaning. For the variables CPFFFac, PDCFFac, TAFFac and TSLFFac, we restrict the descriptive statistics to the observations on the days banks borrowed these facilities, to improve the meaning of the statistics. For the same reason, we restrict the descriptive statistics to the non-null observations for CPFFOut, TAFOut and TSLFOut.

22 banks benefited from the PDCF program; they received in average 17.32 loans. The average CPFF facility is equal to 0.126% of the total assets. It is higher for the non-G-SIBs (0.143%) than for the G-SIBs (0.1%). Furthermore, it is higher for the listed banks (0.132%) and for the banks with CDS (0.141%) than for the other ones. The average outstanding CPFF loans equal 0.852% of total assets, 0.679% for G-SIBs and 0.967% for non-G-SIBs. The average outstanding CPFF loans are even equal to 1.007% for listed banks, but it is only equal to 0.747% for banks with CDS. 6 banks benefited from the PDCF program. Each one, in average, received 21.5 facilities. The average PDCF facility is equal to 0.165% of the total assets, lightly higher than the average CPFF facility. All the banks that benefited from this program are G-SIBs, they are all listed and CDS were emitted for their debt. The average facility increases over time, as it was equal to 0.131% before the Lehman Brothers collapse, and equal to 0.209% after. 40 banks benefited from the TAF program. Each bank received in average 20.05 TAF facilities. It is the most important program, in amount, in number of operations and in number of beneficiary banks (see Appendix A2). The average TAF facility is equal to 0.26% of the total assets, and the average outstanding loans equal to 0.498%. As for the CPFF program, the average facility and the average outstanding loans are higher for non-G-SIBs (respectively 0.335% and 0.559%) than for G-SIBs (respectively 0.207% and 0.421%). However, the average TAF facility is lower for listed banks (0.233%) and for banks with CDS (0.260%). The average outstanding loans are quite the same (respectively 0.451% and 0.492%). The average TAF facility does not significantly change over time, but the average

outstanding TAF facilities do: 0.323% during the first period, 0.399% during the second period and 0.547% during the last period. 8 banks benefited from the TSLF program, they received in average 34,13 facilities. As for PDCF, the banks that benefited from TSLF were all G-SIBs, listed and with CDS. The TSLF program provided the largest facilities: 0.743% of total assets in average. The outstanding loans were in average equal to 0.474% of the total assets. Both facilities and outstanding loans increase over time. They were respectively equal to 0.397% and 0.360% from March 2008 to September 2008, and respectively equal to 0.959% and 0. 548% during the last period (from September 2008 to July 2010). 29 banks benefited from Discount Window operations; the Fed granted in average 60.69 operations to each one. The average outstanding loans were equal to 0.662% of total assets. They were higher for G-SIBs (0.719%) than for non-G-SIBs (0.520%). The average outstanding loans increased over time: 0.056% during the first period (before Bear Stearns collapse), 0.365% during the second period and 0.867% during the last period (after the Lehman Bothers collapse).

The Euro Stoxx Banks® Index decreased of -0.086% during the whole period. The decrease slows down with time: the variation equals -0.374% during the first period, -0.129% during the second period and -0.028% after Lehman Brothers collapse. The reduction in stock return is lower for the banks which beneficiated from FED facilities, even if the global trend is the same. The average return is even positive during the last periods for the banks included in the sample (see above and see Table 2). The iTraxx Europe Senior Financial Index increased of 0.3% during the whole period. The increase was the strongest during the first period (1.741%), whereas it was of 0.005% during the second period and of 0.116% during the last period. The evolution over time of the CDS spreads is quite the same for the banks we consider, even if the increase is lower during the first period and higher during the two last periods for the banks which beneficiated from FED facilities than for the Index (see above and see Table 2).

Table 3: Summary statistics – Independent variables

Table 3a. Total sample

The sample consists of 43 European banks from 12/2007 to 07/2010. This table reports means, min, max and standard deviations. Variable definitions are provided in Appendix A4. For the variables of facilities and outstanding, statistics are based on non-null values. t-tests for differences in means and variances between G-SIBs and non G-SIBs are ran: ***, **, * denote that the difference is significant at the 1%, 5%, or 10% level, respectively. Facilities and outstanding are given in %. Market capitalization and total assets are given in thousand of MUSD.

	Full sample					G-SIBs					Non-G-SIBs				
	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.
Number of banks	43					17					26				
CPFFFac	381	0.126	$4.725.10^{-5}$	1.256	0.167	152	0.100***	$8.450.10^{-4}$	0.630	0.131	229	0.143**	$4.725.10^{-5}$	1.256	0.185
PDCFFac	129	0.165	0.002	1.949	0.209	129	0.165	0.002	1.949	0.209	/	/	/	/	/
TAFFac	802	0.278	$2.698.10^{-4}$	1.420	0.271	357	0.207***	$2.698.10^{-4}$	1.006	0.195	445	0.335***	$7.767.10^{-4}$	1.420	0.307
TSLFFac	273	0.743	$6.924.10^{-4}$	6.371	0.859	273	0.743	$6.924.10^{-4}$	6.371	0.859	/	/	/	/	/
CPFFOut	5098	0.852	$8.454.10^{-4}$	6.548	1.010	2028	0.679***	$8.454.10^{-4}$	2.411	0.761	3070	0.967***	$8.344.10^{-3}$	6.548	1.131
TAFOut	17577	0.498	$2.698.10^{-4}$	2.454	0.455	7708	0.421***	$2.698.10^{-4}$	2.454	0.457	9869	0.559***	$6.996.10^{-4}$	1.913	0.444
TSLFOut	2732	0.474	0.007	3.185	0.585	2732	0.474	0.007	3.185	0.585	/	/	/	/	/
DiscountWindow	1760	0.662	$5.176.10^{-8}$	4.157	0.828	1253	0.719***	$5.176.10^{-8}$	4.157	0.957	507	0.520***	$1.820.10^{-7}$	1.355	0.292
MkCap	18669	32.539	0.041	149.020	29.460	10089	36.632***	0.041	130.780	27.959	8580	27.726***	0.449	149.020	30.438
Total assets	41882	958.530	77.886	3807.900	848.580	16558	1736.626***	456.860	3807.900	844.928	25324	449.780***	77.886	1209.400	263.507

Table 3b. Sub-sample #1 (listed banks)

The sample consists of 34 listed European banks from 12/2007 to 07/2010. This table reports means, min, max and standard deviations. Variable definitions are provided in Appendix A4. For the variables of facilities and outstanding, statistics are based on non-null values. t-tests for differences in means and variances between G-SIBs and non-G-SIBs are ran: ***, **, * denote that the difference is significant at the 1%, 5%, or 10% level, respectively. Facilities and outstanding are given in %. Market capitalization and total assets are given in thousand of MUSD.

	Listed banks – Full sample					Listed banks – G-SIBs					Listed banks – non-G-SIBs				
	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.
Number of banks	34					17					17				
CPFFFac	322	0.132	$8.453.10^{-4}$	1.256	0.169	152	0.100***	$8.453.10^{-4}$	0.630	0.131	170	0.161***	$2.425.10^{-3}$	1.256	0.194
PDCFFac	129	0.165	$2.005.10^{-3}$	1.949	0.209	129	0.165	$2.005.10^{-3}$	1.949	0.209	/	/	/	/	/
TAFFac	608	0.233	$2.698.10^{-4}$	1.420	0.226	357	0.207***	$2.698.10^{-4}$	1.006	0.195	251	0.271***	$7.767.10^{-4}$	1.420	0.260
TSLFFac	273	0.743	$6.924.10^{-3}$	6.371	0.859	273	0.743	$6.924.10^{-3}$	6.371	0.859	/	/	/	/	/
CPFFOut	3836	1.007	$8.453.10^{-4}$	6.548	1.109	2028	0.679***	$8.453.10^{-4}$	2.411	0.761	1808	1.374***	$9.723.10^{-3}$	6.548	1.305
TAFOut	13083	0.451	$2.698.10^{-4}$	2.454	0.453	7708	0.421***	$2.698.10^{-4}$	2.454	0.457	5375	0.494***	$6.996.10^{-4}$	1.913	0.445
TSLFOut	2732	0.474	$6.924.10^{-3}$	3.185	0.585	2732	0.474	$6.924.10^{-3}$	3.185	0.585	/	/	/	/	/
DiscountWindow	1406	0.712	$5.176.10^{-8}$	4.157	0.910	1253	0.719	$5.176.10^{-8}$	4.157	0.957	153	0.654	$6.339.10^{-7}$	0,013551	0.314
MkCap	18669	32.539	0.041	149.020	29.460	10089	36.632***	0.041	130.780	27.959	8580	27.726***	0.449	149.020	30.438
VEuroStoxx	28982	-0.086	-10.261	19.439	2.917	/	/	/	/	/	/	/	/	/	/

Table 3c. Sub-sample #2 (Banks with CDS)

The sample consists of 36 European banks with CDS from 12/2007 to 07/2010. This table reports means, min, max and standard deviations. Variable definitions are provided in Appendix A4. For the variables of facilities and outstanding, statistics are based on non-null values. t-tests for differences in means and variances between G-SIBs and non G-SIBs are ran: ***, **, * denote that the difference is significant at the 1%, 5%, or 10% level, respectively. Facilities and outstanding are given in %. Market capitalization and total assets are given in thousand of MUSD.

	Full sample					G-SIBs					Non-G-SIBs				
	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.
Number of banks	36					15					21				
CPFFFac	243	0.141	$4.725.10^{-5}$	1.256	0.186	110	0.084***	$8.453.10^{-4}$	0.630	0.138	133	0.188***	$4.725.10^{-5}$	1.256	0.207
PDCFFac	129	0.165	$2.005.10^{-3}$	1.949	0.209	129	0.165	$2.005.10^{-3}$	1.949	0.209	/	/	/	/	/
TAFFac	638	0.260	$2.698.10^{-4}$	1.420	0.249	313	0.193***	$2.698.10^{-4}$	1.006	0.176	325	0.324***	$7.767.10^{-4}$	1.420	0.290
TSLFFac	273	0.743	$6.924.10^{-3}$	6.371	0.859	273	0.743	$6.924.10^{-3}$	6.371	0.859	/	/	/	/	/
CPFFOut	3928	0.787	$8.453.10^{-4}$	6.548	1.074	1657	0.509***	$8.453.10^{-4}$	1.969	0.666	2271	0.989***	$8.344.10^{-3}$	6.548	1.254
TAFOut	13600	0.492	$2.698.10^{-4}$	2.454	0.4564	6545	0.425***	$2.698.10^{-4}$	2.454	0.453	7055	0.554***	$6.996.10^{-4}$	1.913	0.451
TSLFOut	2732	0.474	$6.924.10^{-3}$	3.185	0.585	2732	0.474	$6.924.10^{-3}$	3.185	0.585	/	/	/	/	/
DiscountWindow	1115	0.341	$5.176.10^{-8}$	1.355	0.2642	619	0.190***	$5.176.10^{-8}$	0.507	0.092	496	0.531***	$1.820.10^{-7}$	1.355	0.286
Total Assets	35064	1022.880	77.886	3807.890	901.353	14610	1850.402***	456.860	3807.890	829.298	20454	431.793***	77.886	1209.440	250.969
ViTraxx	27392	0.300	-36.548	28.947	5.836	/	/	/	/		/	/	/	/	/

Table 3d. Sub-periods: before the Bear Stearns collapse, between the Bear Stearns collapse and the Lehman Brothers collapse and after Lehman Brothers collapse

The sample consists of 43 European banks from 12/2007 to 03/2008, from 03/2008 to 09/2008 and from 09/2008 to 07/2010. Variable definitions are provided in Appendix A4. For the variables of facilities and outstanding, statistics are based on non-null values. This table reports means, min, max and standard deviations (total, within and between) and tests of differences between the different sub-periods. ***, **, * denote that the difference between the different sub-periods (between the first sub-period and the two other ones, and, in bracket, between sub-period 2 and 3) is significant at 1%, 5%, or 10%, respectively. Facilities and outstanding are given in %. Market capitalization and total assets are given in thousand of MUSD.

	Before Bear Stearns collapse					Between Bear Stearns collapse and Lehman Brothers collapse					After Lehman Brothers collapse				
	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.	Obs.	Mean	Min	Max	Std.
CPFFFac	/	/	/	/	/	/	/	/	/	/	381	0.1257	$4.725.10^{-5}$	1.256	0.167
PDCFFac	/	/	/	/	/	71	0.131**	$4.009.10^{-3}$	0.305	0.075***	57	0.209**	$2.004.10^{-3}$	1.949	0.298***
TAFFac	67	0.254	$7.767.10^{-4}$	0.907	0.227***	218	0.255	$9.212.10^{-3}$	0.843	0.214***	517	0.291	$2.698.10^{-4}$	1.420	0.295***
TSLFFac	/	/	/	/	/	105	0.397***	0.020	1.307	0.276***	168	0.959***	$6.924.10^{-3}$	6.371	1.016***
CPFFOut	/	/	/	/	/	/	/	/	/	/	5098	0.852	$8.453.10^{-4}$	6.548	1.010
TAFOut	1167	0.323***	$6.996.10^{-4}$	0.147	0.360***	3934	0.399***	$9.212.10^{-3}$	1.653	0.378***	12439	0.547***	$2.698.10^{-4}$	2.454	0.475***
TSLFOut	/	/	/	/	/	1075	0.360***	0.020	1.307	0.273***	1651	0.548***	$6.924.10^{-3}$	3.185***	0.710
DiscountWindow	12	0.056***	$1.820.10^{-7}$	0.527	0.150***	698	0.365***	$5.176.10^{-8}$	1.186	0.273***	1045	0.867***	$1.413.10^{-7}$	4.157	0.999***
MkCap	1828	49.660***	1.883	149.020	35.049***	3759	41.792***	0.107	127.710	30.822***	13025	27.436***	0.041	130.780	26.477***
Total assets	4085	900.000***	77.886	3807.900	790.500***	8299	970.620***	100.631	3807.900	858.290***	29412	963.220***	100.630	3807.900	853.280***
VEuroStoxx	2709	-0.374***	-7.321	5.855	2.008***	5762	-0.129**	-4.711	5.925	2.080***	20425	-0.028***	-10.261	19.439	3.197***
ViTraxx	2709	1.741***	-14.639	19.910	6.605***	5504	0.005***	-21.536	13.942	5.924***	19093	0.116***	-36.548	18.318	5.510***

4.3. Empirical method

In order to analyze the impact of the FED facilities program on European banks, we ran two kinds of regressions. First, we assess the impact of the FED facilities on the European banks stock return. The effect of the FED programs on the returns may be positive if the investors anticipate that these loans have a positive effect on the global situation of the bank. The loans are considered useful to overcome illiquidity problems and to improve the future profit, that is to say to restore the ability of the bank to create value and to distribute dividends. But the effect of the FED programs can be negative if they disclose information about the financial distress of the bank, generating a "stigma effect" (see for instance Armantier et al. 2011). The stock market may also react to global information: announcement by the FED of a new program (variables AnnounceCPFF, AnnouncePDCF, AnnounceTAF and AnnounceTSLF). A positive reaction may mean that investor anticipate a positive impact for the given bank, but also for the banking sector as a whole, generating positive consequences for the bank because of between banks interconnections. A negative impact also may include a systemic dimension, in addition to individual effects.

The initial model is the following:

$$
\begin{aligned}
&Return_{i,t} \\
&= \beta_0 + \beta_1 FirstCPFF_{i,t} + \beta_2 AnnounceCPFF_t + \beta_3 CPFFFac_{i,t} + \beta_4 CPFFOut_{i,t} + \beta_5 FirstPDCF_{i,t} \\
&+ \beta_6 AnnouncePDCF_t + \beta_7 PDCFFac_{i,t} + \beta_8 FirstTAF_{i,t} + \beta_9 AnnounceTAF_t + \beta_{10} TAFFac_{i,t} \\
&+ \beta_{11} TAFOut_{i,t} + \beta_{12} FirstTSLF_{i,t} + \beta_{13} AnnounceTSLF_t + \beta_{14} TSLFFac_{i,t} + \beta_{15} TSLFOut_{i,t} \\
&+ \beta_{16} Start_t + \beta_{17} Remove_t + \beta_{18} DiscountWindow_{i,t} + \beta_{19} MkCap_{i,t} + \beta_{20} VEuroStoxx_t + \epsilon_{i,t}
\end{aligned}
$$

Then, we assess the impact of the FED facilities on the European banks CDS spread. The effect of the FED programs on the CDS spreads variations may be negative if the investors anticipate that these loans have a positive impact on the default risk of the bank, that is to say if they anticipate a positive impact on the financial situation of the bank. The reaction may be negative if the "sigma effect" is stronger: the fact that the FED grants a loan to a bank reveals the seriousness of its financial distress. As on the stock market, the announcement of a new program can be interpreted as positive, providing a global benefit by improving the liquidity of the banking sector. But it may have a negative impact on CDS market, if it reveals a global degraded default risk. Because of between banks interconnection, the level of default risk of their competitors influences the financial situation of each bank.

The initial model is the following:

$$VCDS_{i,t} =$$
$$= \beta_0 + \beta_1 FirstCPFF_{i,t} + \beta_2 AnnounceCPFF_t + \beta_3 CPFFFac_{i,t} + \beta_4 CPFFOut_{i,t} + \beta_5 FirstPDCF_{i,t}$$
$$+ \beta_6 AnnouncePDCF_t + \beta_7 PDCFFac_{i,t} + \beta_8 FirstTAF_{i,t} + \beta_9 AnnounceTAF_t + \beta_{10} TAFFac_{i,t}$$
$$+ \beta_{11} TAFOut_{i,t} + \beta_{12} FirstTSLF_{i,t} + \beta_{13} AnnounceTSLF_t + \beta_{14} TSLFFac_{i,t} + \beta_{15} TSLFOut_{i,t}$$
$$+ \beta_{16} Start_t + \beta_{17} Remove_t + \beta_{18} DiscountWindow_{i,t} + \beta_{19} Total\ Assets_{i,t} + \beta_{20} ViTRAXX_t$$
$$+ \epsilon_{i,t}$$

For both models, we use a panel data analysis with fixed effects. Hausman test rejects random effects. We estimate the coefficient with the Arellano robust estimators method. It corrects for heteroskedasticity and autocorrelation.

For each variable taking a non-null value only on a given day (FirstCPFF, FirstPDCF, FirstTAF, FirstTSLF, AnnounceCPFF, AnnouncePDCF, AnnounceTAF, AnnounceTSLF, CPFFFac, PDCFFac, TAFFac and TSLFFac) we consider lags. Actually, uncertainty exists about how the information on facility usage reached the market. The market may learn of the transaction at the time the request is approved or at the time the transaction is settled. Furthermore, the markets could have learned about which banks were borrowing almost immediately through leaks from the borrowing bank (such as traders at one bank talking with traders at another bank). For instance Blau et al. (2013) show that the stock market reacts to the grant of a facility in spite of the lake of disclosure from the FED. On the other hand, the information may not have become available until the transaction was settled and the borrowing bank obtained funds or securities from the Federal Reserve. Further, European markets may trade on the information with delay because of the jetlag; and some announcements take place on Sunday, as the announcement of the PDCF program (on 16 March, 2008). For these reasons, the market reaction may take place before or after the trading day. For each variable, we consider lags from -2 to +2. We keep the lag providing the better regression.

In the base regressions, we run each model for the total sample. Furthermore, in order to compare the market reaction over time, we separate the sample in two sub-periods: before and after the collapse of Lehman Brothers (Table 4). The beginning of the period is particularly instable with new revelation about the seriousness of the financial situation of banking sector. So in Table 5 we consider three sub-periods: before the collapse of Bear Stearns (March 2008), after the collapse of Bear Stearns, and the period between the collapse of Bear Stearns and the collapse of Lehman Brothers. The TAF program was not only the first one but also

the most important concerning the granted amounts and the number of involved banks. So, in a second phase, we focus on the period before the collapse of Bear Stearns (from December 2007 to March 2008): during this period, the FED provided two kinds of loans to European banks, discount window loans and Term Auction Facilities. In order to investigate the interaction between TAF and discount window, we divide banks into four categories. Group 1 (DWbef.TAF) consists of banks that were taking discount window loans prior to the start of the TAF – before 12/20/2007. Group 1 contains 14 banks. These banks may especially benefit from the creation of the TAF. Group 2 consists of banks that obtained funds in the first TAF auctions (we consider the operations that took place during December 2007) but had not borrowed from the discount window (TAFnoDW, including 10 banks). These banks clearly benefited from the creation of the TAF. Group 3 consists of banks that had not borrowed from the discount window before the TAF and did not do so immediately after the creation of the TAF (that is to say not in December 2007). The TAF may not have had much of an impact on these banks (noTAFnoDW, including 16 banks). At last, Group 4 (TAFDW) contains the 8 banks that obtained funds from the discount window before creation of TAF and that obtained funds from the TAF in the first auctions after the creation of the TAF (during December 2007). Group 4 is included in Group 1. We run the regressions for each group (Table 6).

Then, we divide the sample in two, separating the G-SIBs from the non-G-SIBs, anticipating that the market reaction may be different (Table 7). Actually, the G-SIBs benefit from an implicit support from European States, modifying their risk. The markets reaction may be different between the two kinds of group. We also focus on the six banks that benefit from TSLF and PDCF: Barclays, BNP-Paribas, Commerzbank, Crédit Suisse, Deutsche Bank and UBS (see appendix A2). Results are given Table 8. At last, we want to verify if investors on stock market and on CDS market react as if the most important facility – or as if the one that disclose the crucial information – was the first for each program. We run the regressions considering any use of programs ($AnyUseCPFF_{i,t}$, $AnyUsePDCF_{i,t}$, $AnyUseTAF_{i,t}$ and $AnyUseTSLF_{i,t}$) instead of only the first use. Then we run the regressions considering the subsequent uses ($SubsqCPFF_{i,t}$, $SubsqPDCF_{i,t}$, $SubsqTAF_{i,t}$ and $SubsqTSLF_{i,t}$) in order to disentangle the role of each one. Results are given in Table 9.

5. Markets reaction to the FED emergency facilities

5.1. Main results

Columns (1) and (2) in Table 4 present the results of the base regressions on the full period and for the whole sample. The announcement of the TAF program (on 12/12/2007) has a positive impact on the CDS market. The TAF program was the first one and it was perceived by European CDS market as a helpful intervention of the Federal Reserve at the beginning of the liquidity crisis. The first use of TAF has not a significant impact on stock return. It has an impact on CDS market only during the period between Bear Stearns collapse and Lehman Brothers collapse. The perception of the first usage is positive. The TAF program involved a great number of banks (almost the full sample). More than 50% of the banks used this program during the first month (from 12/12/2007 to 01/15/2008). This situation may explain the absence of stigma effect: usage of TAF loans did not affect the markets view of the banks underlying financial conditions.

Even the banks that use TAF after March 2008 did not suffer from this effect: this first program is perceived as a normal way of funding. This absence of stigma effect is confirmed by the other results. The financial markets positively perceived the facilities (TAFFac) during the whole period (column (2) Table 4) and before the Bear Stearns collapse (column (2) Table 5). This positive perception is confirmed by the role of the outstanding loans on stocks market and on CDS market during all the period (columns (1) and (2) Table 4) but also during each sub-period (columns (4) and (5) Table 4, columns (1) and (3) Table 5). This result is consistent with Buch et al. (2011). They show that TAF program has a positive influence on German banks, allowing a higher growth of the credit they granted. However, a negative perception can be seen after Bear Stearns collapse (column (3) Table 5) and after the Lehman Brothers collapse (column (5) Table 4). A late usage of TAF program is interpreted as a disclosure of unsolved liquidity problems. This result is consistent with Cyree et al. (2013). They show that stock market reaction to TAF was positive in a first stage and then negative in a second stage, at least for investment banks and Too Big To Fail banks.

The announcement of the PDCF program has a negative impact on the stock market and on the CDS market. This result is robust to the different periods and sub-samples (see Tables 4 and 5). On 03/16/2008, two days after that the Federal Reserve Bank of New York agreed to provide an emergency loan to Bear Stearns, and the day that Bear Stearns accepted a merger with JP Morgan Chase, the fact that the Federal Reserve implements a new liquidity program is interpreted as a signal of global financial difficulties in the banking sector. However, the

use of this program is perceived as positive: the first use leads to a higher stock return and a reduced CDS spread; and the granted facilities have a significantly negative impact on the spread variation. Its influence on stock return is ambiguous. In order to explain the difference between the markets reaction at the announcement of the program and their reaction at the use of the program, we need to remind that only six banks benefited from PDCF (Barclays, Deutsche Bank, Crédit Suisse, UBS, BNP-Paribas and Dresdner Bank).

The announcement of the TSLF program has a negative impact on the stock market and on the CDS market. This announcement took place on 03/11/2008, three days before the collapse of Bear Stearns. So it reveals information about the seriousness of the banking sector situation. However, this announcement only affects the CDS market. This result is robust to the different periods and sub-samples (see Tables 4 and 5). The first use of TSLF program and the facilities also have a negative impact, on the stock market as on the CDS market, confirming the stigma effect for the participating banks (see Tables 4 and 5). However, the outstanding loans have a positive impact, leading to an increase of the stock returns and a reduction of the CDS spread variations. One possible interpretation is that the day the markets learn that a given bank participates to a program, the stigma effect prevails over the helpful aspect of the loan. However, with time, the global loans are interpreted like being useful to overcome the liquidity crisis. This last result is consistent with Hrung and Seligman (2015), showing that TSLF program was effective in reducing funding problems of the US banks.

We can see that the last liquidity program, the CPFF program, has a negative impact on the stock market and on the CDS market, at least when the Federal Reserve announces this program and when banks first use it. The announcement of the program took place on 10/7/2008, three weeks after the Lehman Brothers collapse. One possible explanation is that almost all of the information about the CPFF borrowers came out early in the program. The quality of the underlying assets (at least for the ABCP issues) would have been public knowledge by the end of 2008 as would the identity of the bank sponsor. Market participants could then predict which banks would continue to take advantage of the CPFF. However, the total outstanding loans are interpreted as positive on the CDS market. This result is consistent with Adrian, Kimbrough and Marchioni (2011). They show the positive consequence of CPFF programs for banks, improving their funding thanks to commercial papers. The financial markets may realize this consequence in a second phase. After the collapse of Lehman Brothers, the results are quite the same as this program starts in October 2008 – columns (5) and (6). However, the negative influence of the program appears on the stock market, with a negative coefficient of the outstanding loans. As a robustness check, we can see that the

columns (3) and (4) of Table 5 lead to the same conclusion (regressions are run on the post Bear Stearns collapse period).

The Central Banks Liquidity Swaps also play an important role to help banks during the liquidity crisis. The beginning of the swaps lines in each monetary zone plays a positive role, as shown by the CDS market reaction: the impact on the relative variation of spread is significantly negative for all the periods (see Tables 4 and 5). The reaction on stock returns is significantly positive only during the period before the Lehman Brothers collapse, that is to say only for the swap lines to ECB and to Swiss National Bank (the most important lines in terms of amount and of number of involved banks). The remove of the cap on the amount of the swap lines for Bank of England, European Central Bank and Swiss National Bank also plays a positive role on CDS market for each period (see Tables 4 and 5). The investors on the CDS market anticipated that the Central Banks Liquidity Swaps were useful to reduce the European banks default risk.

The usage of discount window loans is perceived as positive by the stock market on the full period (see column (1) Table 4). However, the markets reaction is different over time: before Lehman Brothers collapse, both the stock market and the CDS market anticipate a positive effect of the usage of discount window loans (see columns (3) and (4) Table 4) whereas after September 2008, the markets reaction is not statistically significant. Table 5 shows that the usage of discount window loans seems to play a significant role particularly between the Bear Stearns collapse and the Lehman Brothers collapse, at the peak of uncertainty of the crisis.

Table 4. Base regressions and comparison between the periods before and after the Lehman Brothers collapse

	Full Period		*Before Lehman Brothers collapse*		*After Lehman Brothers collapse*	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$FirstCPFF_{i,t+1}$	-3.057***	3.388***			-3.186***	3.342***
	(-3.248)	(3.303)			(-3.434)	(3.274)
$AnnounceCPFF_{i,t+1}$	-2.205***	3.187***			-2.333***	3.368***
	(-2.825)	(2.552)			(-2.839)	(2.728)
$CPFFFa_{i,}t$	-154.155	33.487			-165.302	23.700
	(-1.008)	(0.262)			(-1.068)	(0.183)
$CPFFOut_{i,t}$	-14.421	-9.879*			-24.173*	-2.058
	(-1.497)	(-1.943)			(-1.872)	(-0.280)
$FirstPDCF_{i,t-2}$	2.874***	-1.584	2.851***	-2.882*	2.910***	0.655
	(4.589)	(-1.338)	(3.366)	(-1.796)	(5.695)	(0.490)
$AnnouncePDCF_{i,t+2}$	-0.956***	2.632***	-0.889***	2.439**		
	(-2.691)	(2.599)	(-2.578)	(2.424)		
$PDCFFac_{i,t-1}$	294.223***	-260.167**	-257.171***	-869.602***	389.477***	-196.152
	7.003	(-2.381)	(-5.824)	(-3.229)	(9.601)	(-1.351)
$FirstTAF_{i,t-1}$	-0.525	0.544	-0.027	-0.148	-2.553	3.691
	(-0.973)	(0.654)	(-0.060)	(-0.216)	(-1.392)	(1.236)
$AnnounceTAF_{i,t}$	-0.138	-2.996***	-0.153	-2.809***		
	(-0.780)	(-3.450)	(-0.901)	(-3.233)		
$TAFFac_{i,t+2}$	-186.790	-77.775**	-24.458	-23.463	-275.207*	-100.728**
	(-1.556)	(-2.102)	(-0.512)	(-0.283)	(-1.853)	(-2.123)
$TAFOut_{i,t}$	20.248*	-17.436*	11.402	-47.475*	26.562*	-10.296
	(-1.922)	(-1.758)	(1.054)	(-1.797)	1.881	(-0.845)
$FirstTSLF_{i,t+1}$	-0.406***	-1.783	-0.171	-2.522	-0.709***	0.779***
	(-3.786)	(-0.709)	(-0.829)	(-0.831)	(-7.262)	(27.890)
$AnnounceTSLF_{i,t-1}$	0.389	2.484***	0.381	2.375***		
	(1.065)	(3.933)	(1.201)	(3.709)		
$TSLFFac_{i,t+1}$	-23.759*	134.370**	17.280	151.702***	-31.167*	132.299**
	(-1.730)	(2.293)	(0.622)	(2.691)	(-1.745)	(1.962)
$TSLFOut_{i,t}$	27.280***	-9.400	33.465*	-141.973***	38.328***	-3.512
	(3.608)	(-0.640)	(1.704)	(-5.219)	(3.361)	(-0.225)
$Start_t$	0.2696	-2.406***	0.274**	-1.225**	0.324	-5.340**
	(0.359)	(-2.887)	(1.973)	(-2.276)	0.121	(-2.150)
$Remove_t$	1.372	-11.139***			1.339	-11.333***
	(0.618)	(6.431)			0.603	(-6.545)
$DiscountWindow_{i,t}$	81.881**	-97.188	98.302**	-74.195***	123.188	-108.398
	(1.966)	(1.629)	(2.257)	(-3.897)	(0.940)	(-1.244)
$MkCapi_{i,t}$	$0.866\ .10^{-3}$		$5.247.10^{-3}$***		$3.103.10^{-3}$	
	(0.926)		(3.088)		(1.391)	
$VEuroStoxx_t$	1.050***		1.073***		1.044***	
	(26.040)		(20.820)		(24.720)	
Total $Assets_{i,t}$		$0.211.10^{-3}$		$2.307.10^{-3}$***		$-0.033.10^{-3}$
		(1.061)		(4.644)		(-0.244)
$ViTraxx_t$		0.495***		0.509***		0.470***
		(13.740)		(12.970)		(12.940)
Intercept	-0.002	0.022	-0.252***	-1.748***	-0.055	0.171
	(-0.042)	(0.117)	(-2.835)	(-3.851)	(-0.636)	1.292
Observations	15430	20850	4686	5946	10720	14871
Fixed effects	no	no	no	no	no	no
Adjusted R^2	54.01%	26.67%	62.71%	24.43%	0.525671	0.260252

The full sample consists of 43 European banks from December 2007 to July 2010. Two sub-periods are considered: December 2017 to September 2008; from September 2008 to July 2010. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Table 5. Base regressions and comparison between the periods before and after the Bear Stearns collapse

	Before Bear Stearns collapse		*After Bear Stearns collapse*		*Between Bear Stearns collapse and Lehman Brothers collapse*	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$FirstCPFF_{i,t+1}$			-3.083***	3.440***		
			(-3.284)	(3.349)		
$AnnounceCPFF_{i,t+1}$			-2.198***	3.215***		
			(-2.813)	(2.582)		
$CPFFFa_{i,}t$			-157.737	39.918		
			-1.032	(0.316)		
$CPFFOut_{i,t}$			-16.973*	-6.047		
			(-1.702)	(-0.999)		
$FirstPDCF_{i,t-2}$			2.866***	-1.499	2.787***	-2.135
			(4.593)	(-1.267)	(3.362)	(-1.360)
$AnnouncePDCF_{i,t+2}$			-0.905***	2.691***	-0.856***	2.752***
			(-2.740)	(2.653)	(-2.677)	(2.811)
$PDCFFac_{i,t-1}$			294.792***	-251.462**	-261.258***	-807.561***
			(7.199)	(-2.238)	(-6.697)	(-3.008)
$FirstTAF_{i,t-1}$	-0.015	0.272	-1.546	0.450	-0.226	-3.693**
	(-0.064)	(0.460)	(-1.017)	(0.212)	(-0.097)	(-2.250)
$AnnounceTAF_{i,t}$	-0.218	-3.204***				
	(-1.261)	(-3.733)				
$TAFFac_{i,t+2}$	285.855	-515.145***	-204.681*	-60.444	-49.627	89.301
	(1.127)	(-2.596)	(-1.699)	(-1.504)	(-1.190)	(0.953)
$TAFOut_{i,t}$	60.442**	-68.077	22.178*	-14.358	31.558	12.793
	(2.341)	(-1.219)	(1.897)	(-1.278)	(1.071)	(0.215)
$FirstTSLF_{i,t+1}$			-0.420***	-1.710	-0.354*	-2.143
			(-4.043)	(-0.683)	(-1.683)	(-0.708)
$AnnounceTSLF_{i,t-1}$			0.392	2.566***	0.307	2.819***
			(1.079)	(4.038)	(1.029)	(4.315)
$TSLFFac_{i,t+1}$			-23.788*	133.335**	19.068	145.440***
			(-1.761)	(2.312)	(0.634)	(2.657)
$TSLFOut_{i,t}$			26.790***	-4.106	-0.287	-91.667***
			(3.601)	(-0.332)	(-0.018)	(-2.565)
$Start_t$	0.129	-1.246**	0.405	-5.420**		
	(1.148)	(-2.069)	(0.154)	(-2.213)		
$Remove_t$			1.347	-11.069***		
			(0.607)	(-6.419)		
$DiscountWindow_{i,t}$	175.896	4269.890	90.000*	-88.837	81.579*	-42.468
	(1.425)	(0.857)	(1.891)	(-1.507)	(1.789)	(-1.155)
$MkCapi_{i,t}$	$20.128.10^{-3}$***		$1.065.10^{-3}$		$4.369.10^{-3}$	
	(3.272)		(1.013)		(1.587)	
$VEuroStoxx_t$	0.996***		1.052***		1.105***	
	(19.980)		(25.740)		(18.670)	
Total $Assets_{i,t}$		$4.114.\ 10^{-3}$***		$0.053.10^{-3}$		
		(5.113)		(0.289)		
$ViTraxx_t$		0.445***		0.498***		0.537***
		(10.29)		(13.130)		(11.600)
Intercept	-1.099***	-2.927***	-0.009	0.117	-0.218	0.191*
	(-3.257)	(-4.221)	(-0.171)	(0.658)	(-1.513)	(1.750)
Observations	1517	1889	13888	18931	3144	4027
Fixed effects	no	no	no	no	no	no
Adjusted R^2	62.67%	0.169641	53.67%	28.38%	62.84%	30.15%

The full sample consists of 43 European banks from December 2007 to July 2010. Three sub-periods are considered: from December 2007 to March 2008; from March 2008 to July 2010; from March 2008 to September 2008. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

5.2. Focus on the period before the Bear Stearns collapse and interaction between TAF and Discount Window

In this paragraph, we focus on the first period (before the Bear Stearns collapse, that is to say from December, 2007 to March, 2008). We want to analyze the interaction between discount window loans and TAF (Table 6).

Group 1 includes the 14 banks that obtained discount window loans before the creation of TAF program. They are the only banks for which the financial markets react negatively to discount window loans (see columns (3) and (8) Table 6). Actually, protecting banks from the stigma effect of the discount window was one of the aims of the TAF implementation (see above). The negative reaction is even strongest for the 8 banks that borrowed from the discount window and from the earliest TAF operations – group 4, columns (7) and (8). The markets punish the banks that have too much recourse to the Federal Reserve loans, and that borrowed from the early beginning of the crisis, before the seriousness of the liquidity crisis was disclosed. This is confirmed by the negative reaction to the first usage of TAF by the group 4 (an usage of the two first auctions, following the definition of group 4), and the negative reaction of the stock market to the announcement of TAF program. However, the banks of the group 1 may be especially benefit from the creation of the TAF because they encounter early liquidity problems. Indeed, the facilities generated a positive reaction on both markets (see columns (1) and (2) Table 6). An explication of the difference in markets reaction (negative for discount window and positive for TAF) is provided by Gauthier et al. (2015). Their model provides a theory behind the banks' choice of TAF versus discount window. Discount window loans can be obtained when needed whereas TAF loans can only be purchased at a regularly scheduled auction and, even then, TAF borrowers only received their funds three days later. In Gauthier et al. (2015), the risky banks take the discount window loans because they need the flexibility whereas the healthier banks signal their quality by using the less flexible TAF.

The idea that a very early usage – in the two first weeks – is perceived as negative and stigmatizing is confirmed by the difference between group 2 – columns (3) and (4) – and group 3 – columns (5) and (6). The group 2 includes the 10 banks that not borrowed at the discount window before the implementation of TAF and that participated to the two first auctions. The group 3 includes the 16 banks that not borrowed at the discount window before the implementation of TAF and that participated later to the TAF program (from January, 2008). The markets reaction is positive for the two groups. But, whereas we can observe only one significant coefficient for the group 2 (for TAFFac), for the group 3 the reaction is

stronger. The stock market considers the first usage as a good news and rewards high outstanding loans. The CDS market considers the announcement of the TAF program and each new facility as good news. Furthermore, it also rewards high outstanding loans.

5.3. Comparison between G-SIBs and non-G-SIBs

Table 7 presents the results of the regressions ran on two sub-samples: the G-SIBs and the non-G-SIBs. Table 8 presents the results of the regressions ran on the six banks that benefited from TSLF and PDCF: Barclays, BNP-Paribas, Commerzbank (including Dresdner Bank), Crédit Suisse, Deutsche Bank and UBS.

The positive reaction to the announcement of TAF program is confirmed. The CDS market considered the TAF program as useful and positive for the G-SIBs – in particular the six banks considered in Table 8 – as for the non-G-SIBs (Table 7). The financial markets react positively to the usage of TAF loans by non-G-SIBs (to outstanding loans on stock market – column (3) Table 7 – to facilities on CDS market – column (4) Table 7), even if we can observe a negative reaction to facilities on stock market. The reaction is more ambiguous for G-SIBs: the first usage of TAF loans implied a stigma effect (see column (1) Table 7). Table 8 confirms this effect: the six banks suffered from the same reaction at their first usage of TAF, especially at the beginning of the program. The other variables have no significant coefficients for the G-SIBs, but facilities generate an increase of stock returns before the Bear Stearns collapse for the six banks considered in Table 8.

The impact of the announcement of the PDCF program is negative, even for the non-G-SIBs whereas they did not benefit from the program. However, they are concerned by the negative consequence of a weakened banking sector. The financial markets reacted positively when the G-SIBs used this program (see the positive coefficient of FirstPDCF and of PDCFFac in Table 7). Table 8 shows that the results are quite the same on the total period for the 6 banks that benefited from the PDCF program – see columns (1) and (2) – even if the impact is not significant on CDS market. The over time analysis gives interesting results: whereas the markets reaction is ambiguous between March 2008 (month of the implementation of the program) and September 2008, the stock market reaction is clearly positive after September 2008 – see column (7) – showing a modification of perception. After the Lehman Brothers collapse, the stock market believed that participating to PDCF program may help these six banks to overcome their liquidity issues.

Table 6. Regressions during the period before the Bear Stearns collapse and role of the discount window

	Group 1: DWbef.TAF		*Group 2:* TAFnoDW		*Group3:* noTAFnoDW		*Group 4:* TAFDW	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***
$FirstTAF_{i,t-1}$	-0.487	0.944	-0.109	0.518	0.462***	-0.822	-0.711**	1.155***
	(-1.623)	(1.159)	(-0.244)	(0.559)	(4.324)	(-0.898)	(-2.366)	(3.195)
$AnnounceTAF_{i,t}$	-0.103	-2.003*	-0.193	-0.893	-0.339	-5.276***	-0.394*	-1.882*
	(-0.310)	(-1.962)	(-0.464)	(-0.579)	(-1.241)	(-3.361)	(-1.682)	(-1.738)
$TAFFac_{i,t+2}$	367.390**	-411.327*	655.219	-570.455*	-109.676	-3493.320***	339.331***	-452.999**
	(11.510)	(-1.949)	(0.836)	(-1.749)	(-1.138)	(-10.560)	(7.643)	(-2.411)
$TAFOut_{i,t}$	46.661	-63.199	26.150	-35.104	99.839**	-1741.060***	57.520**	-72.155
	(1.617)	(-0.804)	(0.483)	(-0.407)	(2.168)	(-12.540)	(1.972)	(-0.938)
$Start_t$	0.238	-1.257**	0.186	-1.252***	-0.009	-1.129	0.229	-0.493
	(1.618)	(-2.149)	(0.642)	(-4.404)	-0.047	(-1.025)	(1.259)	(-1.236)
$DiscountWindow_{i,t}$	1221.660	33125.200***	256.276***	14.442	4225.810***	-64732.600***	-4882.630***	23359.500***
	(0.673)	(3.772)	(7.650)	(0.025)	(2.025)	(-10.400)	(-7.698)	(5.234)
$MkCapi_{i,t}$	$22.200.10^{-3}$***		$9.097.10^{-3}$		$27.961.10^{-3}$***		$53.373.10^{-3}$***	
	(6.124)		(0.391)		4.202		(3.976)	
$VEuroStoxx_t$	1.131***		1.014***		0.934***		1.199***	
	(20.790)		(14.370)		(9.222)		(17.070)	
Total $Assets_{i,t}$		$4.099.10^{-3}$***		$5.609.10^{-3}$***		$4.222.10^{-3}$***		$7.212.10^{-3}$***
		(3.424)		(3.106)		(3.425)		(3.605)
$ViTraxx_t$		0.457***		0.436***		0.386***		0.399***
		(7.199)		(5.342)		(7.884)		(5.904)
Intercept	-0.909***	-3.502***	-0.594	-4.570**	-1.585***	-2.924***	-1.674***	-5.465***
	(-6.223)	(-3.006)	(-0.386)	(0.518)	(-3.916)	(-2.714)	(-4.092)	(-3.273)
Observations	475	732	352	366	524	548	241	427
Fixed effects	no	no	no	no	no	no	no	no
Adjusted R^2	67.22%	24.17%	63.06%	20.11%	62.35%	14.55%	70.96%	25.22%

The subsample consists of 43 European banks from December 2007 to March 2008. Four groups are considered, following their access to Discount Window loans and to Term Auction Facilities: Discount Window before TAF (Group 1), TAF and no Discount Window (Group 2), no TAF either no Discount Window (Group 3) and TAF and Discount Window (group 4) – see paragraph 4.3. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

As for PDCF program, the announcement of TSLF program is perceived as negative, even for the non-G-SIBs whereas they did not benefit from the program (Table 7). However, when considering only the six banks that benefited from this program, the announcement has a positive impact on stock market; it seems that the benefit for these six banks overweighed the negative signal about the banking sector situation (Table 8). The first use of TSLF is perceived as negative by the stock market (see Table 7 and Table 8), and the facilities have also a negative impact, but only after the Lehman Brothers collapse: Table 8 shows that for the 6 banks, the variable TSLFFac has no impact, as if the two effects balance each other. The outstanding loans have a significant effect, may be for the same reason. However, the outstanding loans have not either a positive impact for the G-SIBs. One possible interpretation is that the financial markets anticipated that the TSLF programs, helping six of the biggest European banks, indirectly helped all the G-SIBs thanks to the between banks interactions.

The negative impact of the CPFF program is confirmed by the results presented in Table 7. The first use of CPFF and the announcement of the program lead to a decreased return and an increase of the CDS spread variation, for the G-SIBs as for the non-G-SIBs. The CPFF facility (CPFFFac) also generate an increase of the CDS spread variation for the G-SIBs and the outstanding loans have a negative impact on stock return for the non-G-SIBs. However, the outstanding loans reduce the CDS spread variation for the non-G-SIBs as for the G-SIBs, as in Table 4. This result does not seem to be consistent with Cyree et al. (2013) finding of a significantly positive role of CPFF loans on stock market for US traditional commercial banks, and no significantly role for US Too Big To Fail banks during the 9/12/2008 to 12/31/2008 period. However, our result of a positive impact of outstanding loans on CDS market for European banks shows that the investors may believe, at last, on a reduction of default risk thanks to the CPFF program, consistent with Cyree et al. (2013). The negative role of CPFF program seems to be even worse for the 6 banks we consider in the regressions of Table 8. Actually, CFFFFac has a negative impact on the CDS market: see column (2) and (8) of Table 8 (as for the G-SIBs, see Table 7). However, among the six banks only two benefited from this program: UBS and Dresdner Bank (Commerzbank at the group level).

The impact of Central Banks Liquidity Swaps on CDS market is confirmed, for the G-SIBs as for the non-G-SIBs: the market considered that all banks would be able to benefit from this swap lines. However, these results are qualified for the 6 banks that benefited from both PDCF and TSLF programs: the market reaction is not significant before March 2008, and the stock market reaction was negative after September 2008, that is for the start of the swap lines to the Bank of England, the Danmarks Nationalbank and the Sveriges Riskbank (see Table 8).

We can assume Barclays was particularly concerned, as among the six banks, it is the only one whose headquarters is located in one of these monetary zones.

The usage of discount window loans is perceived as positive by the stock market on the full period for the G-SIBs: the stock market anticipates that these loans may help the G-SIBs to restore their profitability. The CDS market perceives the usage of discount window loans as positive on the full period for the non-G-SIBs: it anticipates that these loans could reduce their default risk (Table 7). The markets reaction to the usage of discount window loans by the six banks considered in Table 8 is interesting. During the whole period, the reactions are non statically significant. In fact, the first reaction (before Bear Stearns collapse) is negative (see column (4) in Table 8): the stigma effect is strong, usage of discount window reveals that these banks encounter liquidity problems. This result is consistent with the stigma effect of discount window loans for the group 1 (see Table 6): 4 among 6 of the banks we consider here are included in the group 1. They borrowed from the discount window before the TAF program. But the second reaction – after Bear Stearns collapse for the stock market – see column (5) – and after Lehman Brothers collapse for the CDS market – see column (8) – is positive: the market believe that discount window is helpful to overcome the global liquidity crisis. This result is also consistent with Armantier et al. (2011) that find that a stigma effect exists for discount window loans.

Table 7. Regressions on G-SIBs and non-G-SIBs – Full period

	Full Sample		*G-SIBs*		*non-G-SIBs*	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$FirstCPFF_{i,t+1}$	-3.057***	3.388***	-4.166***	3.506***	-1.084***	3.360**
	(-3.248)	(3.303)	(-3.587)	(3.721)	(-3.687)	(2.518)
$AnnounceCPFF_{i,t+1}$	-2.205***	3.187***	-1.531*	3.670***	-3.030*	2.866
	(-2.825)	(2.552)	(-1.723)	(2.755)	(-2.315)	(1.539)
$CPFFFa_{i,}t$	-154.155	33.487	-286.229	222.321***	-57.914	-61.503
	(-1.008)	(0.262)	(-1.052)	(3.185)	(-0.284)	(-0.283)
$CPFFOut_{i,t}$	-14.421	-9.879*	-8.063	-8.117***	-24.711***	-18.120*
	(-1.497)	(-1.943)	(-0.615)	(-4.444)	(-3.045)	(-1.766)
$FirstPDCF_{i,t-2}$	2.874***	-1.584	2.928***	-0.305		
	(4.589)	(-1.338)	(4.695)	(-0.302)		
$AnnouncePDCF_{i,t+2}$	-0.956***	2.632***	-1.466***	1.063	-0.352	3.468***
	(-2.691)	(2.599)	(-3.213)	(0.566)	(-0.748)	(3.017)
$PDCFFac_{i,t-1}$	294.223***	-260.167**	269.616***	-172.314*		
	7.003	(-2.381)	(5.796)	(-1.799)		
$FirstTAF_{i,t-1}$	-0.525	0.544	-1.296**	1.702	0.683	0.005
	(-0.973)	(0.654)	(-1.974)	(1.117)	(1.157)	(0.007)
$AnnounceTAF_{i,t}$	-0.138	-2.996***	-0.267	-3.569***	0.006	-2.580**
	(-0.780)	(-3.450)	(-1.639)	(-3.882)	0.019	(-2.042)
$TAFFac_{i,t+2}$	-186.790	-77.775**	-116.800	-82.121	-325.672**	-83.439**
	(-1.556)	(-2.102)	(-0.901)	(-0.893)	(-2.122)	(-2.217)
$TAFOut_{i,t}$	20.248*	-17.436*	14.945	-10.073	27.477***	-19.518
	(-1.922)	(-1.758)	(1.374)	(-0.776)	(2.671)	(-1.540)
$FirstTSLF_{i,t+1}$	-0.406***	-1.783	-0.472***	-1.313		
	(-3.786)	(-0.709)	(-4.601)	(-0.535)		
$AnnounceTSLF_{i,t-1}$	0.389	2.484***	0.922	3.168**	-0.174	1.993***
	(1.065)	(3.933)	(1.545)	(2.508)	(-0.536)	(3.054)
$TSLFFac_{i,t+1}$	-23.759*	134.370**	-24.961	130.867**		
	(-1.730)	(2.293)	(-1.753)	(2.319)		
$TSLFOut_{i,t}$	27.280***	-9.400	28.454***	-9.726		
	(3.608)	(-0.640)	(3.101)	(-0.681)		
$Start_t$	0.2696	-2.406***	-0.539	-1.499**	1.173	-2.841**
	(0.359)	(-2.887)	(-1.309)	(-1.997)	(0.799)	(-2.236)
$Remove_t$	1.372	-11.139***	2.332	-14.237***	0.256	-9.159***
	(0.618)	(6.431)	(0.962)	(-6.080)	(0.067)	(-3.953)
$DiscountWindow_{i,t}$	81.881**	-97.188	73.819**	-23.851	80.066	-123.538*
	(1.966)	(1.629)	(2.557)	(-0.641)	(1.446)	(-1.711)
$MkCapi_{i,t}$	$0.866.10^{-3}$		$0.427.10^{-3}$		$1.194.10^{-3}$	
	(0.926)		0.287		(1.276)	
$VEuroStoxx_t$	1.050***		1.109***		97.835***	
	(26.040)		(25.070)		(15.310)	
$Total\ Assets_{i,t}$		$0.211.10^{-3}$		$0.198.10^{-3}$		$1.702.10^{-3}$
		(1.061)		1.132		(1.494)
$ViTraxx_t$		0.495***		0.631***		40.584***
		(13.740)		(16.030)		(9.213)
Intercept	-0.002	0.022	0.005	-0.192	0.009	-0.479
	(-0.042)	(0.117)	(0.064)	(-0.626)	(0.256)	(-0.982)
Observations	15430	20850	8565	8303	6865	12547
Fixed effects	no	no	no	no	no	no
Adjusted R^2	54.01%	26.67%	59.73%	40.03%	47.37%	18.98%

The full sample consists of 43 European banks from December 2007 to July 2010. We consider two subsamples: the 17 banks considered as G-SIBs by the Financial Stability Board and the 26 banks considered as non-G-SIBs. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Table 8. Regressions for the 6 banks that benefited from PDCF programs – Full period and sub-periods

	Full Period		*Before Bear Stearns collapse*		*Between Bear Stearns collapse and Lehman Brothers collapse*		*After Lehman Brothers collapse*	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
$FirstCPFF_{i,t+1}$	-3.543**	4.194***					-3.743**	4.106***
	(-2.233)	(5.327)					(-2.498)	(5.496)
$AnnounceCPFF_{i,t+1}$	-2.120	6.186***					-2.326*	6.398***
	(-1.631)	(3.139)					(-1.703)	(3.219)
$CPFFFa_{i,}t$	-207.679	273.026***					-205.028	263.880***
	(-0.703)	(4.000)					(-0.686)	(3.420)
$CPFFOut_{i,t}$	-23.384	-9.083***					-29.621	3.037
	(-1.081)	(-3.883)					(-1.334)	(1.444)
$FirstPDCF_{i,t-2}$	2.866***	0.423			2.843***	2.689	2.780***	-0.200
	(4.485)	(0.387)			(3.200)	(1.250)	(4.690)	(-0.124)
$AnnouncePDCF_{i,t+2}$	-2.553***	3.830			-2.161***	5.938*		
	(-6.446)	(1.142)			(-7.762)	(1.683)		
$PDCFFac_{i,t-1}$	270.378***	-125.565			-323.652***	-408.291*	369.979***	-80.147
	(5.852)	(-1.496)			(-6.140)	(-1.793)	(8.306)	(-0.635)
$FirstTAF_{i,t-1}$	-2.040**	-1.679	-0.747*	-0.068	-3.849***	-12.088***	-6.241***	-2.297***
	(-2.232)	(-1.191)	(-1.780)	(-0.076)	(-12.020)	(-3.463)	(-18.430)	(-4.427)
$AnnounceTAF_{i,t}$	-0.213	-4.095***	-0.386	-4.118***				
	-1.000	(-4.055)	(-1.599)	(-4.177)				
$TAFFac_{i,t+2}$	-131.586	-44.963	352.826***	-1145.480***	-3.893	33.068	-245.556	-54.792
	(-0.709)	(-0.461)	(11.290)	(-3.768)	(-0.632)	(0.532)	(-0.886)	(-0.292)
$TAFOut_{i,t}$	18.163	-4.374	41.015	99.402***	-12.220	150.614	20.334	-3.276
	(1.230)	(-0.324)	(1.062)	(3.298)	(-0.317)	(1.223)	(1.204)	(-0.711)
$FirstTSLF_{i,t+1}$	-0.392***	-1.446			-0.542***	-0.711		
	(-3.994)	(-0.503)			(-2.851)	(-0.246)		
$AnnounceTSLF_{i,t-1}$	1.675*	3.959*			1.275*	5.122**		
	(1.803)	(1.709)			(1.741)	(2.246)		
$TSLFFac_{i,t+1}$	-23.694	127.087**			22.206	27.917	-29.773	134.317**
	(-1.504)	(2.280)			(0.667)	(0.516)	(-1.492)	(1.996)
$TSLFOut_{i,t}$	18.355	-6.426			-0.983	-40.838	20.574	-3.689
	(1.490)	-0.446			(-0.046)	(-0.970)	(1.176)	(-0.223)
$Start_t$	-0.729	-2.241**	0.211	-0.346			-5.686***	-6.452***
	(-0.867)	(-1.97)	(1.326)	(-0.337)			(-204.100)	(-64.980)
$Remove_t$	4.919	-19.599***					5.020	-19.881***
	(1.356)	(-5.693)					(1.374)	(-5.808)
$DiscountWindow_{i,t}$	42.924	-68.372	1082.42	34274.800***	446.473***	135.035	32.280	-120.064***

	(0.563)	(-1.241)	(0.612)	(2.662)	(2.722)	(0.241)	(0.395)	(-3.221)
$MkCapi_{i,t}$	$-3.325.10^{-3}$		$19.223.10^{-3***}$		$5.171.10^{-3*}$		$-4.762.10^{-3}$	
	(-1.145)		(7.789)		(1.696)		(-0.991)	
$VEuroStoxx_t$	1.105^{***}		1.135^{***}		1.230^{***}		1.086^{***}	
	(30.410)		520.400)		(10.330)		(31.250)	
Total $Assets_{i,t}$		$0.068.10^{-3}$		$2.904.10^{-3***}$				$-0.067.10^{-3}$
		(0.437)		(5.637)				(-0.708)
$ViTraxx_t$		0.709^{***}		0.565^{***}		0.828^{***}		0.675^{***}
		(49.630)		(12.480)		(18.700)		(39.480)
Intercept	0.119	-0.041	-1.119^{***}	-5.318^{***}	-0.121	-0.253	0.180	0.142
	(0.789)	(-0.139)	(-7.950)	(-5.270)	(-0.947)	(-0.805)	(0.819)	(0.784)
Observations	3952	3713	365	315	785	729	2790	2658
Fixed effects	no	no	no	no	no	no	no	no
Adjusted R^2	56.46%	48.41%	69.78%	38.06%	69.30%	55.44%	54.41%	46.20%

The subsample consists of the 6 European banks that benefited from PDCF program. December 2007 to March 2008. Three sub-periods are considered: from December 2007 to March 2008; from March 2008 to September 2008; from September 2008 to July 2010. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

5.4 Role of any use of facilities and comparison with the first use

Table 9 presents the results of the regressions integrating the subsequent uses of the programs. The global positive impact of TAF program is consistent with the previous results as shown by the significant coefficient of TAFFac and TAFOut. The introduction of the subsequent uses of TAF confirms the stigma effect for the late usage of this program. Columns (5) to (8) show the negative reaction of both markets to subsequent usages of TAF. And columns (5) and (4) show that this effect overweighs the impact of the first usage: markets reaction is negative to any usage of the TAF program. The impact of CPFF program is consistent with the previous results (Tables 4, 5 and 7). According to our expectations, markets only react to the first use of the program. The impact of the announcement of PDCF is negative again (on stock market and on CDS market) and consistent with previous results. It is the same for the positive impact of the facilities. A new interesting result is that, even if the first use of PDCF leads to an increase of stock returns, the impact of subsequent uses appears to be negative, leading to an increase of the CDS spread variation – see column (6) and (8). The role of TSLF program is confirmed. Its announcement played a negative role whereas the outstanding amounts have a positive role on stock market. An interesting result is that even the subsequent uses have a native consequence on CDS market – see column (6).

These regressions also provide robustness check for base regressions (full sample and total period, i.e. columns (1) and (2) of Table 4). We can see that Table 9 confirms the roles of Start and Remove – that is to say the positive perception of Central Bank Liquidity Swaps – and the positive role of Discount Window.

Table 9. Regressions with any use of facilities by banks – Full period

	First use (Base Regressions)		*Any use*		*Subsequent use*		*First and subsequent uses*	
	Returns	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*	*Returns*	*VCDS*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
$FirstCPFF_{i,t+1}$	-3.057***	3.388***					-3.068***	3.412***
	(-3.248)	(3.303)					(-3.258)	(3.324)
$SubsqCPFF_{i,t+1}$					0.247	0.712	0.245	0.714
					(0.407)	(0.940)	(0.405)	(0.942)
$AnyUseCPFF_{i,t+1}$			0.050	0.877				
			(0.086)	(1.161)				
$AnnounceCPFF_{i,t+1}$	-2.205***	3.187***	-2.225***	3.207**	-2.225***	3.207**	-2.228***	3.210***
	(-2.825)	(2.552)	(-2.847)	(2.565)	(-2.846)	(2.564)	(-2.845)	(2.566)
$CPFFFa_{i,}t$	-154.155	33.487	-161.951	-69.146	-183.857	-50.593	-184.263	-50.203
	(-1.008)	(0.262)	(-0.935)	(-0.357)	(-1.066)	(-0.262)	(-1.068)	(-0.260)
$CPFFOut_{i,t}$	-14.421	-9.879*	-14.190	-11.993**	-14.548	-11.673*	-14.810	-11.476*
	(-1.497)	(-1.943)	(-1.462)	(-1.964)	(-1.478)	(-1.914)	(-1.488)	(-1.889)
$FirstPDCF_{i,t-2}$	2.874***	-1.584					2.895***	-1.506
	(4.589)	(-1.338)					(4.446)	(-1.221)
$SubsqPDCF_{i,t-2}$					-0.551	0.444**	-0.526	0.490***
					(-0.872)	(2.142)	(-0.806)	(2.644)
$AnyUsePDCF_{i,t-2}$			-0.225	0.272				
			(-0.326)	(1.049)				
$AnnouncePDCF_{i,t+2}$	-0.956***	2.632***	-0.826***	2.513**	-0.847**	2.531**	-0.823**	2.512**
	(-2.691)	(2.599)	(-2.388)	(2.517)	(-2.342)	(2.554)	(-2.428)	(2.505)
$PDCFFac_{i,t-1}$	294.223***	-260.167**	339.274***	-325.602***	377.071***	-347.562***	365.139***	-341.939***
	7.003	(-2.381)	(8.334)	(-2.721)	(14.490)	(-3.210)	(9.708)	(-2.985)
$FirstTAF_{i,t-1}$	-0.525	0.544					-0.545	0.569
	(-0.973)	(0.654)					(-1.006)	(0.686)
$SubsqTAF_{i,t-1}$					-0.439***	0.507**	-0.449***	0.511**
					(-2.736)	(2.507)	(-2.787)	(2.530)
$AnyUseTAF_{i,t-1}$			-0.452***	0.513***				
			(-2.931)	(2.696)				
$AnnounceTAF_{i,t}$	-0.138	-2.996***	-0.145	-2.989***	-0.144	-2.990***	-0.144	-2.988***
	(-0.780)	(-3.450)	(-0.818)	(-3.448)	(-0.814)	(-3.449)	(-0.818)	(-3.445)
$TAFFac_{i,t+2}$	-186.790	-77.775**	-195.850	-70.885*	-196.053	-70.758*	-196.513	-70.307*
	(-1.556)	(-2.102)	-1.604	(-1.958)	(-1.608)	(-1.952)	(-1.612)	(-1.942)
$TAFOut_{i,t}$	20.248*	-17.436*	23.779**	-21.456**	23.447**	-21.431**	23.555**	-21.478***
	(-1.922)	(-1.758)	(2.155)	(-2.164)	(2.145)	(-2.160)	(2.114)	(-2.159)
$FirstTSLF_{i,t+1}$	-0.406***	-1.783					-0.297	-1.820
	(-3.786)	(-0.709)					(-1.313)	(-0.733)

$SubsqTSLF_{i,t+1}$					-0.045	0.587*	-0.019	0.551
					(-0.214)	(1.893)	(-0.088)	(1.628)
$AnyUseTSLFF_{i,t+1}$			-0.104	0.484				
			(-0.524)	(1.162)				
$AnnounceTSLF_{i,t-1}$	0.389	2.484***	0.382	2.497***	0.384	2.496***	0.382	2.497***
	(1.065)	(3.933)	(1.046)	(3.959)	(1.049)	(3.955)	(1.045)	(3.957)
$TSLFFac_{i,t+1}$	-23.759*	134.370**	-14.541	104.436	-17.460	98.812	-23.339*	104.344
	(-1.730)	(2.293)	(-1.217)	(1.595)	(-1.417)	(1.598)	(-1.867)	(1.627)
$TSLFOut_{i,t}$	27.280***	-9.400	27.489***	-9.242	27.754***	-9.252	29.008***	-10.790
	(3.608)	(-0.640)	(3.477)	(-0.612)	(3.408)	(-0.613)	(3.619)	(-0.696)
$Start_t$	0.2696	-2.406***	0.264	-2.409***	0.262	-2.413***	0.261	-2.410***
	(0.359)	(-2.887)	(0.352)	(-2.878)	(0.350)	(-2.882)	(0.347)	(-2.879)
$Remove_t$	1.372	-11.139***	1.368	-11.122***	1.370	-11.125***	1.363	-11.121***
	(0.618)	(6.431)	(0.615)	(-6.433)	(0.616)	(-6.434)	(0.613)	(-6.430)
$DiscountWindow_{i,t}$	81.881**	-97.188	81.388*	-99.396*	81.199*	-98.838*	82.387*	-99.778*
	(1.966)	(1.629)	(1.913)	(-1.690)	(1.899)	(-1.673)	(1.954)	(-1.698)
$MkCapi_{i,t}$	$0.866\ .10^{-3}$		$0.930.10^{-3}$		$0.948.10^{-3}$		$0.927.10^{-3}$	
	(0.926)		0.995		(1.006)		(0.980)	
$VEuroStoxx_t$	1.050***		1.049***		1.049***		1.049***	
	(26.040)		(26.030)		(26.050)		(26.09)	
Total $Assets_{i,t}$		$0.211.10^{-3}$		$0.200.10^{-3}$		0.200		0.205
		(1.061)		(1.045)		(1.044)		(1.061)
$ViTraxx_t$		0.495***		0.495***		0.495***		0.495***
		(13.740)		(13.780)		(13.780)		(13.790)
Intercept	-0.002	0.022	0.002	0.024	0.001	0.0250	-0.002	0.019
	(-0.042)	(0.117)	(0.044)	(0.130)	(0.015)	(0.137)	(-0.045)	0.105
Observations	15430	20850	15430	20850	15430	20850	15430	20850
Fixed effects	no	no	no	no	no	no	no	no
Adjusted R^2	54.01%	26.67%	54.00%	26.69%	54.00%	26.69%	54.04%	26.71%

The full sample consists of 43 European banks from December 2007 to July 2010. The dependent variables are the daily stock return and the daily relative variation of the CDS spread. Variable definitions are provided in Appendix A4. The panel data regressions with fixed effects are based on the Arellano robust estimators method. The p-values are in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), or 10% (*) level.

6. Conclusion

This study has investigated the European stock markets and the CDS market reactions to the usage by European banks – through their US branches – to the FED liquidity programs. The aim of the study was to show if the European financial markets believed that these programs were helpful to overcome the liquidity crisis. If they did, announcement of a new program or the granting of a new loan is expected to reduce the CDS spreads and to increase the share values. However, the implementation of a new program can reveal the seriousness of the global liquidity crisis; the granting of a new loan can disclose bad information about the financial situation of the bank. A stigma effect may exist and lead to a negative reaction of the markets.

Our results show that such a stigma effect exists for discount window, but only for a few numbers of banks – the ones which borrowed the more from the FED – and only for the very beginning of the crisis (before the Bear Stearns collapse). From 2008 to 2010 and for the majority of the banks, borrowing from discount window generated a positive reaction from financial markets. The Bank Central Liquidity Swaps also were interpreted as positive for the European banks by the financial markets, helping European banks to overcome their illiquidity position in US dollars.

The financial markets reaction to TAF program implementation, in December 2007, was globally positive, excepted for the few banks that borrowed the more from the FED. The markets perception to the first usage of TAF was negative for these later banks. However the first usage did not generate a significant reaction for the other banks. Borrowing from the TAF was considered as normal and did not reveal information about the financial situation of the bank. The first positive reaction was confirmed: during the whole period, the outstanding loans and the granted facilities have a positive influence on financial markets. However, a too frequent usage or a late usage of TAF program has been stigmatizing for banks: European market reacted negatively to subsequent loans.

The European financial markets reaction to the announcement of the three subsequent liquidity programs (TSLF and PDCF in March, 2008 and CPFF in October, 2008) is negative. They perceived them as the acknowledgment of a serious liquidity crisis, especially in March 2008, about the Bear Stearns collapse. For TSLF and CPFF, the markets confirm this first negative perception: their reaction is negative when a bank uses one of these programs. At the opposite, the markets reaction is positive when a bank borrowed from the PDCF program, especially after the Lehman Brothers collapse. And the outstanding loans have a positive impact for the three programs.

Therefore our results suggest that in spite of stigma effect, in spite of the disclosure of the deteriorated financial situation of a given bank or of the banking sector by the announcement and the usage of the different liquidity programs, the Federal Reserve action was perceived as helpful for European banks in overcoming the liquidity crisis.

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Appendix

A1. List of European Banks included in the FED lending facilities

*If the bank is a subsidiary, the name of its group is given in brackets. * and ** mean respectively state-owned bank and mutual bank.*

Name	*Nationality*	*Listed*	*CDS*	*G-SIBs*	*Name*	*Nationality*	*Listed*	*CDS*	*G-SIBs*
Abbey National (Santander Group)	GB	N	N	N	Eurohypo (Commerzbank Group)	DE	N	N	N
ABN-Amro	NL	Y	Y	N	Fortis	BE	Y	N	N
Allied Irish Banks - AIB	IR	Y	Y	N	Governor & Company of The Bank of Ireland	IR	Y	Y	N
Banco Espirito Santo	PT	Y	Y	N	HSBC	GB	Y	Y	Y
Banco Popular	ES	Y	Y	N	HSH Nordbank**	DE	N	Y	N
Bank of Scotland	GB	Y	Y	N	HypoVereinsbank – HVB (Unicredit Group)	DE	N	N	N
Barclays	GB	Y	Y	Y	ING Group	NL	Y	Y	Y
Bayerische Hypo Vereins (Unicredit Group)	AL	N	N	N	Intesa Sanpaolo	IT	Y	Y	N
Bayerische Landesbank Giro*	AL	N	Y	N	KBC Bank & Verzekering	BE	Y	Y	N
BBVA	ES	Y	Y	N	Landesbank Baden Wuerttemberg**	DE	N	Y	N
BMW Bank (BMW Group)	DE	N	N	N	Landesbank Hessen-Thurin – Helaba**	DE	N	Y	N
BNP-Paribas	FR	Y	Y	Y	Lloyds TSB	GB	Y	N	Y
Caixa Geral De Depositos*	ES	N	Y	N	Natixis	FR	Y	Y	Y
Caja Madrid	ES	Y	N	N	Norddeutsche Landesbank**	DE	N	Y	N
Commerzbank	DE	Y	Y	Y	Nordea Bank	SE	Y	Y	Y
Crédit Agricole	FR	Y	Y	Y	Rabobank**	NL	N	N	N
Crédit Industriel et Commercial – CIC	FR	Y	N	N	Royal Bank of Scotland – RBS	GB	Y	Y	Y
Crédit Suisse	CH	Y	Y	Y	Santander Group	ES	Y	Y	Y
Danske Bank	DK	Y	Y	N	Skandinaviska Enskilda Banken - SEB	SE	Y	Y	N
DEPFA (Hypo Real Estate Group*)	IR	N	N	N	Société Générale	FR	Y	Y	Y
Deutsche Bank	DE	Y	Y	Y	Standard Chartered	GB	Y	Y	N
Dexia	BE	Y	N	Y	Svenska Handelsbanken	SE	Y	Y	N
Dresdner Bank (Commerzbank Group)	DE	N	N	N	UBS	CH	Y	Y	Y
DZ Bank**	DE	N	Y	N	Unicredit	IT	Y	Y	Y
Erste Group Bank	AT	Y	Y	N	Westlb*	DE	N	N	N

A2. Total of the facilities received by European Banks from the FED, from December 2007 to March 2010 (*In MUSD*) *Source: Federal Reserve*

	Total	*TAF*	*TSLF*	*TOP*	*PDCF*	*AMLF*	*CPFFCP*		*Total*	*TAF*	*TSLF*	*TOP*	*PDCF*	*AMLF*	*CPFFCP*
Barclays	836,787	232,283	186,561	7,506	410,437			Landesbank Baden Wuerttemberg	22,580	22,580					
Deutsche Bank	374,186	76,882	276,878	19,926	500			BBVA	22,205	22,205					
RBS	506,507	170,650	291,315	40,796			3,747	Erste Group Bank	21,966	17,000					4,966
Crédit Suisse	272,290	5	260,536	10,010	1,500	238		Abbey National	18,999	18,999					
UBS	287,202	55,500	121,771		35,400		74,531	Eurohypo	13,255	13,255					
BNP-Paribas	158,503	31,275	41,187	19,666	66,375			KBC Bank &Verzekering	11,007	4,788					6,220
Bank of Scotland	180,920	180,920						ING Group	10,878	5					10,873
DEXIA	158,643	105,167					53,476	LLOYDS TSB	10,506	10,506					
Dresdner Bank	135,331	123,328	1,282		93		10,627	HSBC	10,056	4,000	3,550				2,506
Société Générale	124,377	124,377						BMW Bank	9,600	3,350					6,250
Bayerische Landesbank Giro	112,535	108,190					4,345	Santander Group	9,191	9,191					
Fortis	100,492	58,650					41,842	SEB	8,915	8,915					
Westlb	86,606	78,406					8,200	Norddeutsche Landesbank	8,499	8,230					269
Unicredit	64,093	62,210					1,883	Governor & Company of The Bank of Ireland	6,050	6,050					
Commerzbank	55,451	51,161					4,290	Svenska Handelsbanken	14,875	8,914					5,961
Natixis	55,069	32,817					22,252	Crédit Agricole	5,500	5,500					
HSH Nordbank	54,736	52,550					2,186	Danske Bank	5,461						5,461
DEPFA	46,798	46,798						Landesbank Hessen-Thurin	4,549	4,549					
DZ Bank	41,776	39,477					2,299	Banco Espirito Santo	1,521						1,521
AIB	41,303	34,700					6,603	Banco Popular	1,200	1,200					
ABN-Amro	36,270	1,500					34,770	Caja Madrid	1,035	1,035					
Bayerische Hypo Vereins	34,490	34,490						HVB	650						650
Rabobank	25,900	23,751					2,150	Caixa Geral De Depositos	447						447
Standard Chartered	25,100	25,100						Nordea Bank	50	50					
CIC	23 910	23 910						Intesa Sanpaolo	6	6					

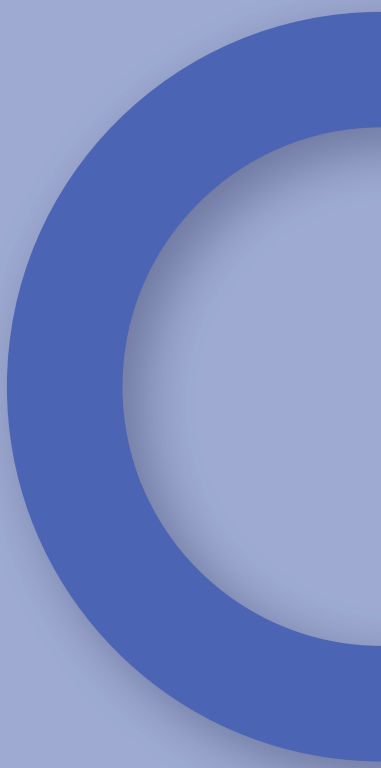
A3. Liquidity swaps extended to the European Central Banks (million of USD, total amounts per month)

Date	Bank of England	Danmarks Nationalbank	European Central Bank	Norges Bank	Sveriges Riksbank	Swiss National Bank
December-07	0	0	20000	0	0	4000
January-08	0	0	20000	0	0	4000
February-08	0	0	0	0	0	0
March-08	0	0	15000	0	0	6000
April-08	0	0	30000	0	0	6000
May-08	0	0	50000	0	0	12000
June-08	0	0	75000	0	0	12000
July-08	0	0	50000	0	0	18000
August-08	0	0	50000	0	0	12000
September-08	216044	5000	464742	3000	0	102139
October-08	539612	15000	2057531.2	2500	20000	156026
November-08	102195	5000	799419.7	8950	5000	20677
December-08	26430	5000	762755.6	2200	0	22255
January-09	11713	4100	705830.5	7050	5000	16646
February-09	17143	7875	594617.2	0	18000	15108.3
March-09	1600	7590	626408.7	0	0	23117.5
April-09	2475	9175	409682.1	5000	5000	21278.9
May-09	513	3775	257167	0	11500	10844.7
June-09	1040	3930	198957.9	0	0	3711.1
July-09	0	3453	211638.2	1000	2700	9
August-09	13	2310	166414.6	0	0	0
September-09	0	580	198610.4	0	0	0
October-09	0	0	109131.3	0	0	0
November-09	52	0	81995	0	0	0
December-09	0	0	34253	0	0	0
January-10	0	0	6575	0	0	0
February-10	0	0	0	0	0	0
March-10	0	0	0	0	0	0
April-10	0	0	0	0	0	0
May-10	0	0	15637	0	0	0
Total	918830	72788	8011366.4	29700	67200	465812.5

Source: Federal Reserve

A4. Variable index: definitions

	Name	Definition	Source
Dependent variables	Return	Daily stock return	EUROFIDAI
	VCDS	Daily relative variation of the CDS spread	Markit
CPFF	FirstCPFF	Variable equals to one the day of first trade of an operation for a bank (0 otherwise)	Federal Reserve
	AnnounceCPFF	Variable equals to zero for any day except the day t he program was announced	Federal Reserve
	CPFFFac	Amount of facility / total assets (day of trade, 0 otherwise)	Federal Reserve
	CPFFOut	Amount of outstanding / total assets	Federal Reserve
PDCF	FirstPDCF	Variable equals to one the day of first trade of an operation for a bank (0 otherwise)	Federal Reserve
	AnnouncePDCF	Variable equals to zero for any day except the day the program was announced	Federal Reserve
	PDCFFac	Amount of facility / total assets (day of trade, 0 otherwise)	Federal Reserve
TAF	FirstTAF	Variable equals to one the day of first trade of an operation for a bank (0 otherwise)	Federal Reserve
	AnnounceTAF	Variable equals to zero for any day except the day the program was announced	Federal Reserve
	TAFFac	Amount of facility / total assets	Federal Reserve
	TAFOut	Amount of outstanding / total assets	Federal Reserve
TSLF	FirstTSLF	Variable equals to one the day of first trade of an operation for a bank (0 otherwise)	Federal Reserve
	TSLFFac	Amount of facility / total assets (day of trade, 0 otherwise)	Federal Reserve
	AnnounceTSLF	Variable equals to zero for any day except the day the program was announced	Federal Reserve
	TSLFOut	Amount of outstanding/total assets	Federal Reserve
Discount Windows	DiscountWindow	Discount window loans / total assets	Federal Reserve
Control variables	MkCap	Market capitalization	EUROFIDAI
	TotalAssets	Total Assets	Bankscope
	VEuroStoxx	Relative variation of the Euro Stoxx Banks® Index	EUROFIDAI
	ViTraxx	Relative variation of iTraxx European Financials senior CDS index	Bloomberg



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