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Does Lack of Financial Stability Impair the Transmission of Monetary Policy?

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Abstract

We investigate the transmission of central bank liquidity to bank deposit and loan spreads of European firms over the January 2006 to June 2010 period. When the European Central Bank (ECB) allocated liquidity to banks in a competitive tender at the beginning of the crisis, higher "aggregate" central bank liquidity (i.e. the total liquidity in the banking system that is held at the ECB) reduces bank deposit rates of low risk banks but has no effect on deposit rates of high risk banks or on corporate loan spreads of high or low risk banks. After the ECB started to fully allot all liquidity requested by banks via its refinancing operations on October 8, 2008, an increase in liquidity decreases deposit rates of both high and low risk banks. While loan spreads of low risk banks decrease, those of high risk banks remain unchanged also under full allotment of liquidity. We find that borrowers of high risk banks refinance term loans drawing down loan commitments. They have lower payouts, lower capital expenditures and lower asset growth compared with borrowers of low risk banks. Our results suggest a differential transmission of central bank liquidity of low versus high risk banks, and an impaired transmission to corporate borrowers of high risk banks.

JEL Classification: E43, E58, G01, G21.
Keywords: Central Bank Liquidity, Corporate Deposits, ECB, Financial Crisis, Loans.

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"Commercial bank reserves have risen because central banks have injected them into a closed system from which they cannot exit. Whether commercial banks let the reserves they have acquired through QE (Quantitative Easing) sit "idle" or lend them out in the interbank market 10,000 times in one day among themselves, the aggregate reserves at the central bank at the end of that day will be the same."

Peter Stella (IMF)

I. Introduction

In the course of the financial crisis the European Central Bank (ECB) as well as other central banks around the world addressed the fallout from the crisis using a set of standard and non-standard monetary policy measures. These measures led to a surge in central bank liquidity in the financial system. In non-crisis periods and at the beginning of the financial crisis, the ECB issues liquidity in a competitive tender without directly meeting all liquidity requested by all banks but liquidity distributes in the interbank, deposit and loan markets such that each bank is able to meet its reserve requirements.[1] On October 8, 2008, the ECB announced to fully allot all liquidity requested by banks via the refinancing operations at a fixed interest rate.

This paper examines the transmission channel of ECB liquidity to loan and bank deposit spreads for non-financial firms at the transaction-level. By doing so, it specifically investigates differences in the transmission of monetary policy between high and low risk banks. We construct a novel and unique data set of bank deposit and loan spreads of European firms during the January 2, 2006 to June 30, 2010 period. We split our data into the "pre-financial crisis" period (January 2, 2006 to August 7, 2007), the "financial crisis until full allotment" period (August 8, 2007 until October 7, 2008), and the "full allotment" period (October 8, 2008 until June 30, 2010).

[1] The allocation and flow of aggregate central bank liquidity from the ECB to and in the system is explained in detail in an Online Appendix. We also provide several illustrative examples, which show that the ECB is the only institution which is able to create aggregate bank liquidity. Also relating to our quote in the beginning, funds might flow between firms and banks in various combinations but this does not change the aggregate liquidity in the banking system.

Our results show no effect of "aggregate" central bank liquidity (i.e., the total liquidity in the banking system that is held at the ECB) on corporate deposit and loan spreads in the pre-financial crisis period. This changes substantially after the onset of the crisis. An increase in aggregate central bank liquidity is associated with a significant decrease of bank deposit spreads in the financial crisis period. Differentiating by bank risk, we find that deposit spreads of low risk banks decrease in response to larger amounts of liquidity in the financial crisis until full allotment period. High risk banks, on the contrary, do not decrease deposit rates prior to the full allotment period. However, during the full allotment period both high and low risk banks reduce deposit rates when aggregate central bank liquidity increases.

These results hold when we include bank-risk-time fixed effects to account for unobservable (and time-invariant) variation that is both bank-risk specific in different quarters and common across high and low risk banks in the same quarter. They are also confirmed when we include bank-month fixed effects. We address possible concerns that deposit spread and deposit volume might be jointly determined using an instrumental variable approach. Our findings are consistent with an insufficient amount of aggregate bank liquidity in the banking system prior to the full allotment, for example, because of a precautionary hoarding of liquidity by banks when interbank markets were dysfunctional (e.g.; Afonso, Kovner and Schoar 2011; Ashcraft, McAndrews and Skeie, 2011; Acharya and Merrouche, 2012).

In contrast to the deposit market, we do not observe an impact of aggregate central bank liquidity on loan spreads during the financial crisis until the full allotment period. During the full allotment period, however, we find that loan spreads of low risk banks decrease in response to higher amounts of aggregate central bank liquidity while loan spreads of high risk banks remain

unchanged. This implies that changes in aggregate central bank liquidity do not transmit to loan spreads of high risk banks.[2]

We investigate loan spreads for borrowers that borrow from the same group of either low or high risk banks before and after the full allotment period (intensive margin) as well as the likelihood that a firm starts borrowing from this group of lenders (extensive margin). Our attention focuses on the intensive margin to address the potential concern that low risk borrowers match only with low risk banks in the full allotment period and high risk borrowers only with high risk banks. Conditioning on observing borrowing on the intensive margin in the first stage, we investigate the differential effect of aggregate central bank liquidity for high versus low risk banks using a Heckman regression model. We also match firms of low and high risk banks in the full allotment period using propensity score matching (PSM) models. Overall, these tests support our prior result that more aggregate central bank liquidity translates into lower loan spreads of low risk banks relative to high risk banks in the full allotment period.

We then investigate this bank balance sheet channel further by differentiating between loan maturities, i.e. between short, medium and long-term loans. We find three important results. First, long-term loan spreads of neither low nor high risk banks change if aggregate central bank liquidity increases. Second, medium-term loan spreads decrease only for low risk banks. Third, short-term loan spreads of both low and high risk banks decrease. Our results suggest that the transmission channel is impaired particularly for medium- and long-term loans, that is, for loans beyond a maturity of one year.

[2] One concern might be that high risk banks do not have sufficient collateral to obtain liquidity. However, the ECB did whatever it takes (as later on confirmed in a speech by Mario Draghi, President of the ECB, on July 26, 2012) to preserve the financial system in the Eurozone. The ECB monthly bulletin in October 2010 states on page 66: "… the list of assets accepted as eligible collateral for refinancing operations was extended to further ease access to Eurosystem operations in an attempt to reduce asset-side constraints on banks' balance sheets. At the same time, the list of counterparties eligible for fine-tuning operations was extended, implying an increase from around 140 to around 2,000 eligible counterparties." Insufficient collateral is therefore a very unlikely explanation for our findings.

In a final step, we analyze changes in borrower capital structure and financial characteristics conditional on borrowing during the full allotment period. Importantly, we find that borrowers of high risk banks draw down credit lines significantly more than borrowers of low risk banks. We also find that the amount of debt of borrowers of high risk banks *increases* over the three-year period after we observe a loan relative to borrowers of low risk banks. In other words, revolving loan commitments are an important funding source for borrowers of high risk banks during financial crises (Ivashina and Scharfstein, 2010, and Cornett et al., 2011).

We observe that borrowers of high risk banks have lower payouts, lower capital expenditures and lower asset growth over a three-year period after having received a loan in the full allotment period compared with borrowers of low risk banks. We do not observe differences in investment or employment between borrowers of low and high risk banks. This is in line with Acharya et al. (2014) and Chodorow-Reich (2014) who show that small and medium firms experience declines in investment or employment, but not large firms; our sample, in contrast, includes mostly large firms. Overall, our findings suggest that the impaired transmission of monetary policy in the full allotment period is associated with differences in bank lending between high and low risk banks.

The paper proceeds as follows. The next section presents the literature related to our study. Section III describes our data and provides some descriptive statistics. Section IV shows the results for the effect of aggregate central bank liquidity on corporate money market deposits and Section V the impact of aggregate central bank liquidity on corporate loans. The results for firm capital structure and financial characteristics are provided in Section VI and Section VII concludes.

II. Literature and Hypotheses

Our analyses relate to the literature on the transmission of monetary policy, bank risk in the financial crisis and the impact of the crisis on real economic activity.

The classical works on the transmission of monetary policy can be distinguished between the money and the credit channel. While the former argues that an expansionary monetary policy decreases the (single) interest rate due the liquidity effect, the latter additionally incorporates changes in banks' loan supply (and accordingly not only money and bonds but also loans) and suggests that supply decreases either due to the (weaker) bank lending or balance sheet channels (e.g.; Bernanke, 1988; Bernanke and Blinder, 1988; Gertler and Gilchrist, 1993; Keeton, 1993; Kashyap and Stein, 1994, 1995, 2000; Bernanke and Gertler, 1995; Peek and Rosengren, 1995; Holmström and Tirole, 1997; Morgan, 1998; Ashcraft, 2006; Martin, McAndrews and Skeie, 2013). Most empirical studies on the money channel suggest that the liquidity effect outweighs the opposing income, price level and price anticipation effects (e.g.; Christiano and Eichenbaum, 1991; Strongin, 1995; Hamilton, 1997). Results on the credit channel are ambiguous because several factors, such as non-reservable funds, liquid assets, regulatory capital requirements and loan commitments of banks as well as the share of non-bank intermediaries, might weaken or even offset the bank lending channel (e.g.; Romer and Romer, 1991; Bernanke and Blinder, 1992; Gertler and Gilchrist, 1993; Kashyap, Stein and Wilcox, 1993; Kashyap and Stein, 1994, 2000; Peek and Rosengren, 1995; Thakor, 1996; Morgan, 1998; Kishan and Opiela, 2000; Altunbas, Fazylov and Molyneux, 2002; Ashcraft, 2006; Bolton and Freixas, 2006). Given that the full allotment of liquidity reflects a significant change and substantial easing of monetary policy we hypothesize that loan and bank deposit spreads decrease in the full allotment period in response to higher amounts of aggregate central bank liquidity.

The literature on bank risk in the financial crisis discusses interbank market stress and precautionary liquidity reserves of banks in more detail. Afonso, Kovner and Schoar (2011) show that at the peak of the financial crisis interbank markets in the US were stressed and almost dried up. Acharya and Skeie (2008) show that counterparty risk may result in a freeze of the interbank market. Furthermore, banks might also start hoarding liquidity in expectation of stress in the wholesale funding market (Acharya and Merrouche, 2012) and hold precautionary reserves (Ashcraft, McAndrews and Skeie, 2011). Several studies suggest that both market stress and precautionary hoarding of liquidity might be important at the same time (Acharya, Shin and Yorulmazer, 2009; Allen, Carletti and Gale, 2009; Baglioni, 2009; Eisenschmidt and Tapking, 2009; Heider, Hoerova and Holthausen, 2010; Afonso, Kovner and Schoar, 2011; Bolton, Santos and Scheinkman, 2011; Freixas, Martin and Skeie, 2011) and even induce feedback effects between each other (Malherbe, 2014). In addition to a precautionary hoarding of liquidity strong banks might even bid strategically in central bank tenders (Fecht, Nyborg and Rocholl, 2011; Cassola, Hortacsu and Kastl, 2013) and deliberately under-provide lending to weaker banks (Acharya, Gromb and Yorulmazer, 2012). In light of these results we hypothesize that liquidity transmits less for high risk banks compared with low risk banks in the financial crisis period.

Our paper also relates to the literature on the yield-chasing behavior of banks in the financial crisis and real effects for corporate borrowers. Eurozone banks invested substantially in high-yielding government debt resulting in a crowding out of lending to non-financial firms (Acharya and Steffen, 2014; Becker and Ivashina, 2014a). Building on Bernanke and Gertler (1989) and Kiyotaki and Moore (1997), Gertler and Kiyotaki (2010) furthermore illustrate how financial distress and disruptions in financial intermediation can adversely affect lending to non-financial firms and real activity. Banks with riskier portfolios reduced their lending in the crisis

(Popov and van Horen, 2013; Becker and Ivashina, 2014b; Chodorow-Reich, 2014; De Marco, 2014) which provides a channel on real economic activity (Acharya et al., 2014; Benmelech et al., 2014; Chodorow-Reich, 2014). We therefore hypothesize that borrowers who obtain loans from riskier banks experience more negative real effects.

III. Data

A. Sample Selection

To investigate the effect of aggregate central bank liquidity on deposit spreads we employ a unique and proprietary data set from a European trading platform which ranks among the three largest platforms by volume in Europe. Prior to trading, banks and firms agree on a mutual basis on the procedures and execution of trades in a framework agreement. This agreement applies to all future trades on the platform. On the platform, firms are able to offer any amount of funds with any maturity. When a firm offers funds to deposit all banks using the platform observe this offer and are able to bid for it during a pre-specified time period which is in general limited to two minutes (chosen by the firm in advance). Until the end of this time period the firm can select a bid based on its preferences. Banks do not observe other banks' bids but can adjust their offer during the bidding period. This implies that banks adjust their pricing during the bidding process only idiosyncratically but not in response to other banks' bidding actions. Interest rates are quoted on an actual/360 day count convention and transactions settled on the same day.

We limit our sample to executed deposit transactions with a maximum maturity of seven days between non-financials firms and banks during the January 2006 to June 2010 period. Note that the maximum maturity is in line with the Eurosystem's regular open market operations. The deposit spread is defined as the deposit interest rate of a transaction minus the risk free interest

rate where we use the marginal deposit facility interest rate of the ECB.[3] We do not use interbank interest rates such as LIBOR or EURIBOR as a measure for the risk free interest rate for two reasons. Firstly, we expect the interbank market interest rate to be stressed in the crisis comparable to the US (Afonso, Kovner and Schoar, 2011) implying that it is not risk free. Secondly, interbank rates came under scrutiny of regulators because they seem to have been misreported.[4] We do not have specific information on the individual depositing firms available but have a unique platform-specific identifier for each firm what allows us to distinguish between depositors. Bank competition is measured by the number of banks bidding for the offered deposit amount where we include each bank only once irrespective of its individual number of bids in the transaction. A higher value therefore reflects higher bank competition.

To investigate the effect of aggregate central bank liquidity on loan spreads we obtain loan contract information from LPC Dealscan for the period January 2006 until June 2010. We construct the merger history for each lender in Dealscan using information obtained from the FDIC and the National Information Center (NIC) and exclude loans from banks which do not operate on the deposit trading platform in this time period. Using Robert's Dealscan-Compustat Linking Database (Chava and Roberts, 2008), we collect annual financial statement information from Compustat for all non-financial borrowers and merge it (with a one year lag) to each loan contract.

To measure the amount of aggregate central bank liquidity available in the banking system we use the natural logarithm of the sum of banks' current account and deposit facility holdings

[3] Most prior studies on money market interest rates investigate interbank transactions and use the target rate of the central bank as the risk free interest rate (e.g.; Soares and Rodrigues, 2010; Afonso, Kovner and Schoar, 2011; Acharya and Merrouche, 2012; Beirne, 2012). To our knowledge, we are the first using corporate money market deposit rates on the transaction level. We repeat all analyses also with the main refinancing rate of the ECB. All results remain robust.

[4] Snider and Youle (2010) provide some evidence. UBS alerted regulators to the LIBOR and Barclays to the EURIBOR scandal which resulted in fines for several banks in 2012 and 2013. Some traders even argue that the interbank interest rates might have been misreported since 1991 (Douglas J. Keenan in the Financial Times on July 27, 2012, "My thwarted attempt to tell of Libor shenanigans").

with the ECB, centered by their mean value in 2006.[5] These daily data are provided by the ECB. We call this variable "adjusted liquidity in the banking sector" and use it as the main measure for aggregate central bank liquidity in our analyses.[6]

Annual bank-specific characteristics are collected from Bankscope and matched (with a one year lag) to each deposit and loan transaction. As a measure for bank risk we use bank CDS spreads with a maturity of 5-years from Credit Market Analysis (CMA) shown by Mayordomo, Pena and Schwartz (2013) to be leading in price discovery compared with other data sources. Using an iterative procedure explained in more detail in Appendix A1, we ensure that high risk banks have in each week on average at least double the spread compared to low risk banks.[7] The 3 Month EURIBOR-EONIA Swap is obtained from the Deutsche Bundesbank and proxies for the risk in the market.[8] The indicator variable End of the Reserve Maintenance Period is one on the last day of the reserve maintenance period and is derived using data from the ECB.

[5] An exemplary balance sheet of the ECB is shown in the Online Appendix.

[6] We also use other measures for aggregate central bank liquidity. These are the liquidity in the banking sector, the excess liquidity ratio, and the liquidity monetary operations, as defined in Appendix A1. Where the first two are alternatives to the adjusted liquidity in the banking sector, which only differ in level or normalization, the third one is actually an incorrect measure. However, it is often cited in the financial press as a measure for bank liquidity although it measures parts of the ECB's but not the banks' assets. A detailed explanation of all our measures for aggregate central bank liquidity in the banking sector is provided in Appendix A1. We perform all our analyses also with these other measures but do not report them for brevity. Irrespective of the measure for aggregate central bank liquidity, all results remain robust.

[7] We also use banks' Moody's long-term issuer credit rating as a measure of credit risk and classify banks with a rating of A1 or worse as high risk banks and re-run all our analyses. All results remain robust. Additionally, we also build three bank risk classes defining low risk banks as those with a rating of Aa1 or better and high risk banks having a rating of A1 or worse with the remainder being medium risk banks. All our results remain robust with medium risk banks revealing comparable results to low risk banks. Note that irrespective if we use CDS or ratings to differentiate between high and low risk banks, individual banks change their risk classification very infrequently. In unreported robustness checks we exclude all banks which migrate between risk classes in the full allotment period and re-run our regressions. The results remain the same.

[8] While in a EURIBOR transaction the principal is exchanged, in an EONIA transaction only swap payments are made. The spread between the 3-month EURIBOR and the EONIA is therefore an indicator for the risk in the market excluding interest rate change risk and interest rate expectations (Coeuré, 2012). We acknowledge that it is only an approximate measure due to potential distortions in the EURIBOR scandal. In unreported regressions, we also include the Composite Indicator of Systemic Stress (CISS) provided by the ECB. It proxies as a measure for already materialized systemic risk in the Eurozone (Hollo, Kremer and Lo Duca, 2012). Our main results remain unchanged, irrespective if we use it together with or instead of the 3 Month EURIBOR-EONIA Swap in our regression specifications.

All variables are described in Appendix A1. The final dataset includes 40,638 money market firm-bank Euro-denominated deposit transactions from 145 firms to 43 banks and 2,632 firm-bank loan facilities from 38 banks to 566 firms.

B. Descriptive Statistics

Our data range from January 2, 2006 until June 30, 2010. Table 1 reports descriptive statistics on aggregate ECB market liquidity (Panel A), corporate deposits (Panel B), bank characteristics (Panel C), loans (Panel D), and borrower characteristics (Panel E). All data are measured in real terms with 2006 as the base year.

[Table 1]

The average deposit (loan) has a maturity of 1.86 days (54.17 months) with an annual interest rate of 226.7bps and a spread over the risk free interest rate of 51.41bps (183.45bps). The average amount deposited (borrowed) is €71 million (€799 million). Deposit rates and spreads strongly decrease from the pre-full allotment to the full allotment period. The opposite applies to loan spreads and also to aggregate central bank liquidity irrespective of its measurement. On average, about 3 banks bid for an offered deposit amount. Bank and borrower characteristics reflect the increase in risk in the financial crisis period. Banks show an increase in leverage, cost to income ratio, and non-performing loans from the start of the financial crisis to the full allotment period, while their return on assets and asset growth strongly decrease. Borrower leverage increases and coverage and the market-to-book ratio decrease, with the fraction of non-investment grade rated firms increasing from 26.94% to 36.83%.

Figure 1 depicts the evolvement of our measures for aggregate central bank liquidity. All measures reflect the same patterns. Prior to the financial crisis, the ECB allocated liquidity to banks such that these were able to fulfill their reserve requirements with very limited excess holdings.

Variation in aggregate liquidity in this time period derives from forecasting errors of the autonomous factors which are neutralized in subsequent operations (Bindseil and Seitz, 2001; Würtz, 2003; Ejerskov, Moss and Stracca, 2008). After the start of the financial crisis the ECB started a "frontloading" policy and allocated funds to the market in excess of the benchmark liquidity in the early maintenance period and absorbed these gradually later on (Eisenschmidt, Hirsch and Linzert, 2009). Figure 1 shows that the amount of liquidity as well as its variance started to increase. The start of the full allotment of liquidity at a fixed rate resulted in a strong increase of bank liquidity since October 8, 2008. Note that the ECB announced on June 25, 2009 to furthermore provide liquidity via long term refinancing operations (LTRO) with a maturity of one year what caused additional increases in bank liquidity.

[Figure 1]

Figure 2 depicts the development of interest rates from 2006 to mid-2010. It shows that prior to the financial crisis money market deposit rates closely followed the policy rate. This provides empirical evidence that a functioning interbank market together with tender operations with limited allotment provide an incentive for banks to manage their liquidity actively and efficiently and allow the central bank to steer the market rate close to the key policy rate (Clerc, 2011). Although deposit interest rates became more volatile with the beginning of the financial crisis, a pattern also observable for aggregate central bank liquidity in Figure 2.B, the ECB was able to keep the overnight (interbank) interest rate close to the key policy rate (Aucremanne, Boeckx and Vergote, 2007; Cassola, Holthausen and Würtz, 2009). Figure 2.A shows that also the corporate deposit rate remained close to the main refinancing rate on most days. However, with the announcement of the full allotment corporate money market deposit rates dropped to and remained at the lower bound of the interest rate corridor as a direct effect of excess liquidity in the

market (Cassola, Holthausen and Würtz, 2009; Furfine, 2011). This might cause problems as the ECB is not able to establish its desired key policy rate in the market any more (Abbassi and Nautz, 2010; Beirne, 2012; Coeuré, 2012). Figure 2.B also depicts the strong negative relation between corporate money market deposit spreads and aggregate bank liquidity. It reveals that the full allotment of liquidity resulted in several occurrences of deposit spreads being below the marginal deposit facility interest rate of the ECB.[9] Overall Figure 2 provides graphical evidence that monetary expansion lowers short-term nominal rates in crises, an effect difficult to trace down in times of "regular" monetary policy (Leeper and Gordon, 1992; Strongin, 1995; Hamilton, 1997; Bernanke and Mihov, 1998; Hamilton, 1998; Kim and Ghazali, 1998; Thornton, 2001).

[Figure 2]

Figure 3 investigates banks' risk and the corresponding deposit and loan spread differences in more detail. Panel A shows the average CDS spread difference between low and high risk banks. As explained before, we ensure that the spread of low risk banks is in each week on average half the spread of high risk banks to ensure a clear distinction between bank risk classes. Panel A shows that irrespective of banks' risk bank CDS spreads strongly increased at the start of the financial crisis and remained at high levels, especially for high risk banks, until the end of our observation period. Panel B (Panel C) depicts the (percentage difference between) corporate money market deposit spreads of low and high risk banks. Panel B (Panel C) shows that the full allotment of liquidity resulted in a large (percentage) difference with low risk banks paying substantially lower deposit spreads than high risk banks what was not eliminated by the LTRO on June 25, 2009. A comparable pattern can be observed for loan spreads of borrowers on the intensive margin in Panel

[9] These occurrences represent arbitrage opportunities for banks. Arbitrage might occur in segmented markets when banks' bargaining power is elevated (Shleifer and Vishny, 1997; Bech and Klee, 2011).

D which shows that low risk banks charge much lower spreads than high risk banks in the full allotment period in line with Santos (2011). Intensive margin is defined as borrowers who receive a loan from one bank risk category prior to the full allotment period and receive another loan from the same bank risk category in the full allotment period.

[Figure 3]

IV. Monetary Policy and Corporate Deposits

A. The transmission of central bank liquidity to corporate deposit spreads

We first investigate the general impact of aggregate central bank liquidity on corporate money market deposit spreads. We analyze the period from January 2, 2006 until June 30, 2010 and additionally split this period into the pre-financial crisis period (January 2, 2006 to August 8, 2007), the financial crisis until full allotment period (August 8, 2007 until October 7, 2008), and the full allotment period (October 8, 2008 until June 30, 2010). Table 2 shows the results of pooled OLS regressions. In addition to aggregate central bank liquidity[10] we also include an indicator variable for high bank risk, bank accounting variables and further control variables to control for the notional deposit amount and duration, the number of banks bidding for a deposit (bank competition), market risk (3-month EURIBOR to the 3-month EONIA Swap Spread) and an indicator variable for the last day of the reserve maintenance period. All models include firm, time (quarter), and bank accounting standard fixed effects and use heteroscedasticity-robust standard errors clustered at the bank level.[11]

[Table 2]

[10] In our regressions, we use aggregate central bank liquidity on the same day as the deposit transaction. In robustness tests, we also use aggregate central bank liquidity lagged by one day and as the average over the week prior to the transaction. The results are the same.

[11] We also repeat all analyses clustering standard errors at the bank and at the firm level using the methodology of Petersen (2009). The results are the same.

Model I in Table 2 shows that larger amounts of aggregate central bank liquidity result in lower corporate deposit spreads. Models II to IV reveal that this applies only to the financial crisis period. An increase of aggregate central bank liquidity significantly reduces deposit spreads in the financial crisis until full allotment period as well as in the full allotment period. Table 2 also shows that high bank risk per se does not have an effect on corporate deposit spreads. However, in the financial crisis larger banks pay lower spreads, especially during the full allotment period consistent with the interpretation that some banks are perceived as too big to fail (O'Hara and Shaw, 1990; Stern and Feldman, 2009). Fecht, Nyborg, Rocholl (2011) show that larger banks also pay less for liquidity in the ECB's main refinancing operations. Surprisingly, higher market risk results in higher deposit spreads in the pre-financial crisis period but lower spreads in the financial crisis until full allotment period. This might reflect changes in bank borrowing from depositors depending on investment opportunities for banks and risk aversion of depositors. The negative coefficient in the financial crisis until full allotment period argues for firms preferring shorter durations in crises in line with a flight to money market depositing (Baglioni, 2009) what causes short term deposit spreads to decrease. On the last day of the reserve maintenance period deposit spreads on average decline. This might be driven by most banks holding excess liquidity over the reserve maintenance period and therefore offering overnight funds on this day which compete with the depositors' offers.[12] The remaining control variables are as expected: deposits with a longer maturity and more bank competition have higher spreads while deposit spreads in general strongly

[12] Figure 2 seems to indicate that deposit spreads rather increase than decrease on these days. However, our data show that although the increases are substantial in some instances (and can therefore be better observed in the figure) the frequency of decreases on the last day of the reserve maintenance period is much higher.

decreased in the full allotment period. Note that the high explanatory power in Model 1 derives from the time fixed effects which alone explain more than 80% of the regression.[13]

B. The transmission of central bank liquidity to corporate deposit spreads by bank risk

The results in the previous subsection show that in the financial crisis period a higher amount of aggregate central bank liquidity decreases corporate deposit spreads in the financial crisis. In this subsection, we test if there are differences in the transmission of aggregate central bank liquidity between low risk and high risk banks. We interact liquidity with indicator variables for high and low risk banks and analyze the financial crisis period, also split into the financial crisis until full allotment period and the full allotment period. Note that in addition to Table 2 we also include bank risk-time fixed effects. Table 3 shows the results.

[Table 3]

It documents substantial differences between bank risk types in the transmission of aggregate central bank liquidity to corporate money market deposit spreads in the financial crisis until full allotment period. While the deposit spreads of low risk banks decrease in response to larger amounts of liquidity the coefficient for aggregate central bank liquidity for high risk banks is only significant at the 10% level and much smaller. A Wald test under the null hypotheses that these coefficients are equivalent is rejected at the 1% confidence level. However, this difference disappears in the full allotment period where higher aggregate central bank liquidity translates into the same reduction of deposit spreads irrespective of bank risk.

The differences between bank risk types in the transmission of aggregate central bank liquidity to corporate money market deposit spreads in the financial crisis until full allotment period argue for a potentially insufficient amount of aggregate bank liquidity in the banking

[13] In robustness checks, we also employ monthly, semi-annual and annual time fixed effects what does not qualitatively change our findings.

system. Factors for this might be precautionary hoarding of liquidity by banks and a stressed interbank market, which does not allow aggregate liquidity to distribute among banks any more such that each bank is able to efficiently fulfill its reserve requirement. In the financial crisis until full allotment period the ECB only allocated that amount of aggregate liquidity to the market which was sufficient for banks to fulfill (almost exactly) their reserve requirements. Accordingly, strong banks might bid strategically in central bank tenders (Fecht, Nyborg and Rocholl, 2011; Cassola, Hortacsu and Kastl, 2013) and deliberately under-provide lending to weaker banks (Acharya, Gromb and Yorulmazer, 2012). Note that the general demand for a precautionary hoarding of liquidity can also be inferred from Figure 1, which shows that irrespective of its measurement aggregate central bank liquidity strongly increases in the full allotment period.

C. The transmission of central bank liquidity to corporate deposit spreads by bank risk-Robustness

In this subsection, we test the robustness of our results for corporate deposits. Other bank and regulatory actions have been undertaken in the financial crisis which might affect our results. We re-run all our regressions including monthly time fixed effects to account for specific actions related to all banks in a specific month (such as regulatory or announcements of other monetary policy changes). In one set of regressions, we include bank risk group multiplied with these monthly fixed effects to account for changes in one month specific to our bank risk groups. In another set of regressions we employ bank-month fixed effects, controlling for changes in a certain month specific to one bank. The results are shown in Table 4.

[Table 4]

The results strengthen our previous findings. The differences between bank risk types in the transmission of aggregate central bank liquidity to corporate money market deposit spreads in

the financial crisis until full allotment period are substantial with the coefficient for high risk banks now being insignificant. In the full allotment period this difference disappears and higher aggregate central bank liquidity induces deposit spreads to reduce independent of bank risk.

Another potential concern might be that deposit amount and deposit spread are jointly determined. Firms might offer different amounts depending on the level of deposit rates. Moreover, banks might bid different interest rates depending on the notional amount offered. Although firms on the platform first offer their funds and then receive interest rate bids some firms might cancel a request given the observed interest rates, change the amount and place another, different, request.[14] Additionally, some firms might communicate interest rates between each other and adjust amounts accordingly. We account for this possible endogeneity in two-stage least squares (2SLS) regressions similar to Acharya and Mora (2014). We instrument the notional amount of a transaction with the number of outstanding money market deposits of a firm. The rationale is that firms with many outstanding money market deposit transactions should have a lower supply, that is, offer lower amounts, irrespective of the deposit rate. Table 5 shows the results.

[Table 5]

Higher aggregate central bank liquidity lowers deposit spreads only for low risk banks in the financial crisis until full allotment period while it lowers spreads for all banks equably in the full allotment period. Note that the deposit amount is insignificant now in both time periods in the second stage regressions. Our instrumental variable is significant in the first stage and the coefficient in line with our hypothesis.[15] Bank risk does not enter the regressions significantly.

[14] We are able to observe all requests and their outcome. Excluding transactions which are executed after requests of the same firm have been canceled before on the same day does not change our findings.

[15] In unreported regressions we also include our instrument in the second stage regression setup and find that it has no statistically significant influence on deposit spreads, in line with the 2SLS assumption of orthogonality between

Overall, our results indicate that higher amounts of aggregate central bank liquidity decrease deposit spreads with the exception of high risk banks in the financial crisis until full allotment period. Accordingly, high risk banks have to pay larger interest on their deposits prior to the full allotment period. This argues for the capital of high risk banks to deplete more compared with low risk banks due to higher funding costs for short term debt related to aggregate central bank liquidity. We investigate the revenue side of banks' when transforming these short term deposits to long term loans in the next section.

V. Monetary Policy and Corporate Loans

A. The transmission of central bank liquidity to corporate loans by bank risk

In the second step we investigate the impact of aggregate central bank liquidity on corporate loan spreads using a similar empirical set-up compared to our analysis of deposit rates. Table 6 shows the results of pooled OLS regressions for loan spreads during the financial crisis.[16] We use the average of aggregate central bank liquidity over the quarter prior to loan origination (that is, the previous three months) assuming that the negotiation process for loans takes some time before it is settled.[17] The regressions include borrower and bank characteristics as well as further variables to control for loan size and maturity, the number of previous loans of the borrower,

instrument and second stage dependent variable. We also repeat the 2SLS regressions using the amount of a firm's outstanding money market deposits. The results are very comparable. In another set of instrumental variable regressions we employ a three-stage least squares (3SLS) approach and estimate two structural equations simultaneously via the generalized method of moments (GMM). All variables not included in one structural equation serve as instruments for the other structural equation. We do not include aggregate central bank liquidity, bank risk, bank competition and bank accounting variables in the structural equation of the notional deposit amount and do not include the number of outstanding deposit transactions in the structural equation for the deposit spread such that we have a sufficient number of instruments available in both structural equations. Our results are confirmed also in this setup.

[16] We do not report multivariate regression results for loan spreads comparable to Table 2 and accordingly not for the pre-financial crisis period for brevity. The results for the pre-financial crisis period show that borrower, bank and further control variables are comparable to the financial crisis until full allotment period results in Table 6 while aggregate central bank liquidity and high bank risk are insignificant.

[17] We also use the average of aggregate central bank liquidity over the week and the month prior to loan origination. The results are very comparable.

whether the loan is secured and contains a performance pricing grid and market risk (3-month EURIBOR to the 3-month EONIA Swap Spread). All models also contain bank, time, bank risk-time, borrower industry and rating, and loan purpose, loan type and loan currency fixed effects and use heteroscedasticity-robust standard errors clustered at the borrower level.

[Table 6]

Model I in Table 6 shows that an increase in aggregate central bank liquidity reduces loan spreads in the financial crisis. Again, we find a differential effect for high versus low risk banks (model II): while low risk banks reduce loan spreads, the interaction term with high risk bank does not enter significantly into the regression. When we subdivide the time period into the financial crisis until full allotment period and the full allotment period we observe that an increase of aggregate central bank liquidity reduces loan spreads of low risk banks in the full allotment period while it has neither an effect on the loan spreads of high risk banks nor any effect on loan spreads in the financial crisis until full allotment period. Taken together, changes in aggregate central bank liquidity do not transmit to loan spreads charged by high risk banks. Only low risk banks charge lower spreads in the full allotment period when liquidity increases.

The impact of bank characteristics is either insignificant or mixed whereas borrowers with a high market to book ratio pay lower spreads. In the financial crisis until full allotment period loans with longer maturities, a smaller size, and those which are secured have higher spreads. Higher market risk results in higher spreads in the full allotment period.[18]

[18] We acknowledge that we have much less degrees of freedom in our loan regressions compared with our deposit regressions. We therefore also check our results in many other specifications excluding several combinations of our fixed effects. The results for aggregate central bank liquidity are qualitatively comparable.

B. The transmission of central bank liquidity to corporate loans by bank risk – Intensive versus extensive margin

We provide robustness tests that help us to rule out that our results are driven by changes in borrower-lender matching over time. We are specifically concerned that low risk banks might be able to attract borrowers with lower credit risk in the full allotment period whereas high risk banks match with riskier borrowers what might influence our results. For this purpose, we investigate borrowing on the intensive and the extensive margin. In addition, we use propensity score matching methods to ensure comparability of borrowers on the intensive margin between high and low risk banks. Finally, we also account for loan maturity to ensure that differences in loan spreads between high and low risk banks are not driven by differences in the maturity of granted loans.

i. Intensive and Extensive Margin - Borrower Characteristics

We investigate loan spreads for borrowers that borrow from the same group of either low or high risk banks before and after the full allotment period (intensive margin) as well as the likelihood that a firm discontinues borrowing from this group of lenders in the full allotment period (extensive margin). We carry out most of our analyses on the intensive margin.

In a first step, we investigate differences in borrower characteristics between the intensive and extensive margin as well as between low and high risk banks. Panel A in Table 7 shows that in the full allotment period 221 firms borrow 775 loan facilities out of which 345 are intensive margin facilities. It reports that out of these, 20.29% are facilities from borrowers who borrow only from high risk banks in our observation period, 4.928% are facilities from borrowers who receive a loan only from low risk banks in our observation period, and 74.783% are facilities from borrowers who receive a loan both from low and high risk banks in the period prior to full allotment

and borrow again in the full allotment period. Table 7 also shows that 345 firms which receive a loan in the period prior to full allotment do not obtain a loan in the full allotment period whereas out of the 221 borrowers receiving a loan in the full allotment period 96 are borrowers who received a loan also in the period prior to full allotment and 125 are first time borrowers in our dataset. 55.484% of all loans in the full allotment period are extensive margin loans out of which 81.86% (64.186% + 17.674%) are loans granted by high risk banks.

[Table 7]

Panel B in Table 7 compares borrower characteristics by bank risk and between borrowers on the intensive and the extensive margin. It seeks to rule out that borrower risk characteristics on the intensive and the extensive margin are substantially different between bank risk groups. For this purpose, we slit borrowers on the extensive margin into those who switch to the other bank risk group and those who are new and compare these two groups to borrowers on the intensive margin, respectively. Panel B reveals that new borrowers have a higher market to book ratio compared with firms on the intensive margin within both bank risk groups while coverage is higher and tangibility lower in the low bank risk group and size and leverage lower and the current ratio higher in the high bank risk group. We are especially interested in the differences of borrower characteristics between bank risk groups. The last column in Table 7 shows that high bank risk borrowers are smaller and seem to have a lower tangibility and a slightly lower market to book ratio. The latter difference is however only significant at the 10% level.

We also investigate in a multivariate setup that borrower-lender matching on the intensive and the extensive margin is not substantially different between bank risk groups. For this purpose, we regress an indicator variable which is one if the borrower is a borrower on the intensive margin and zero when it is a borrower on the extensive margin on bank risk and borrower, bank and further

control variables. If firms on the intensive margin and banks match only on quality we would expect bank risk and specific bank characteristics to be different between borrowers on the intensive and the extensive margin. We use an OLS, a Probit and a Logit regression without fixed effects as well as an OLS regression with bank, time, bank risk-time, borrower industry and rating, and loan type, loan purpose and loan currency fixed effects.[19] Panel C of Table 7 shows the results. It confirms that bank characteristics and bank risk are not correlated to the selection of firms to borrow on the intensive or the extensive margin. Neither our bank risk indicator variable nor any of the banks' characteristics are significant with the exception of bank size in Model IV which is however only significant at the 10% level. This argues for borrowers on the intensive and the extensive margin being comparable between low risk and high risk banks. Panel C of Table 7 furthermore shows that borrowers on the intensive margin are larger and have a higher tangibility.

ii. The transmission of central bank liquidity to corporate loans – Intensive margin

Table 8 shows the effect of central bank liquidity on loan spreads by bank risk only for borrowers on the intensive margin in the full allotment period. Model I shows a pooled OLS regression model, Model II a Heckman selection model using Model III of Panel A as first stage.[20] The regression results confirm our prior findings. In both models, higher amounts of aggregate central bank liquidity translate into lower loan spreads for low risk banks also when we control for borrower-lender matching. While the coefficient for high risk banks is significant at the 10% level in Model I it is not significant in Model II. The Wald test for the equality of both coefficients is rejected at the 5% level in both models. Accordingly, we conclude that higher amounts of

[19] We only use an OLS regression together with these fixed effects because we are concerned of the incidental parameters problem in non-linear regressions (e.g.; Green, 2004).

[20] We are aware that this does not fulfill the exclusion restriction and that identification is only weak in model II. However, we would need an instrument which distinguishes between borrowing on the intensive and the extensive margin but is not correlated to loan spreads. As both borrower types receive a loan in the same time period, we are not aware of any such instrument.

aggregate central bank liquidity result in stronger decreases of loan spreads of low risk banks compared with high risk banks in the full allotment period.

[Table 8]

To ensure that our results are not driven by differences in borrowers' characteristics between high and low risk banks we employ propensity score matching models following the approach outlined in Rosenbaum and Rubin (1983) and applied in for example Drucker and Puri (2005), Bharath et al. (2011) and Saunders and Steffen (2011).

We use different estimation methods: nearest neighbor matching with 10, 50 and 100 neighbors and kernel matching using both the Gaussian and the Epanechnikov kernel.[21] We restrict the match of neighbors for the nearest neighbor matching to a caliper of 0.1 and for the kernel matching to a bandwidth of 0.01 and employ bootstrapped standard errors.[22] Table 9 shows the results.

[Table 9]

Panel A shows that borrowers of high risk banks pay on average 100 bps more when we use the kernel matching methods and even 120 bps more when using the nearest neighbor matching methods than borrowers of low risk banks in the full allotment period. This difference is significant at the one percent level in almost all cases.

To further investigate the transmission of monetary policy, we focus on borrowers matched via propensity score matching in multivariate intensive margin regressions. For both the nearest

[21] We match borrowers in the full allotment period based on total assets, leverage, current ratio, coverage, market to book ratio, and tangibility, and year, borrower industry code, borrower rating, loan type, loan purpose, loan currency, loan maturity, secured, loan amount, performance pricing and the number of previous loans of a borrower.

[22] The restriction to a caliper of 0.1 for the nearest neighbor matching and to a bandwidth of 0.01 for the kernel matching ensures that the matched neighbor is very comparable to the treated firm with respect to matching characteristics. This can result in a different number of matches between the nearest neighbor and the kernel matching because in some instances there is no neighbor within the defined caliper or bandwidth, respectively, as it is the case in Panel B.

neighbor and the kernel matching, we use the nearest match to each treated firm within the defined caliper or bandwidth. Panel B of Table 9 shows the results of regressions of loan spreads on bank risk and aggregate central bank liquidity. We find that in the full allotment period higher amounts of aggregate central bank liquidity in general only reduce interest rates of loans of low risk banks. This reinforces our prior result that loan spread differentials are driven by an impaired transmission of monetary policy because of a fragile banking system.

iii. Monetary policy and loan maturity

We focus on the provision of (short-term) central bank liquidity in our analyses. To investigate whether monetary policy transmits also into long-term corporate lending, we differentiate between short-, medium-, and long-term loans. These loans have maturities of smaller/equal to one year, one to five years or more than 5 years, respectively. We run our tests both on the full sample (column I and II) and on the intensive margin (column III). Table 10 reports the results.

[Table 10]

We find that high and low risk banks reduce interest rates on short-term loans when aggregate central bank liquidity increases during the full allotment period. Wald tests show that the reduction is not significantly different for either bank risk group. In contrast, we observe significant loan spread differences between low and high risk banks for medium-term loans. Low risk banks require significantly lower interest rates for medium-term loans when aggregate central bank liquidity increases. Finally, Table 10 shows that the transmission of central bank liquidity is impaired for long-term loans. Both bank risk groups do not reduce loan spreads when central bank liquidity increases. Overall, our results suggest that monetary policy transmission is impaired for loans with maturities above 1 year.

VI. Capital Structure Decisions and Real Effects

The transmission of monetary policy through bank balance sheets is impaired because banks' balance sheets are fragile. Particularly high risk banks do not pass on funding advantages associated with central bank liquidity to their borrowers. In the last part of this paper, we investigate how this ultimately affects their borrowers' financial decisions.

Our previous results show that high risk banks only decrease loan spreads of short-term loans in response to higher amounts of aggregate central bank liquidity while low risk banks reduce spreads both for short- as well as for medium-term loans. These financing constraints might imply differences in "real effects." For example, Acharya et al. (2014) and Chodorow-Reich (2014) show that borrowers with a higher exposure to riskier banks experience negative real effects during crises.

To get a better understanding of the capital structure of our sample borrowers, we collect additional (capital structure related) data from Capital IQ. This information includes the relative percentage of term loans and revolving loans within a firm's capital structure, and the notional amount of debt outstanding.

We use data from Compustat to investigate potential differences in firm characteristics between borrowers who receive a loan from a high risk bank relative to borrowers of low risk banks in the full allotment period. Specifically, we use a borrower's total liabilities, payouts, capital expenditures, asset growth, investment, and number of employees.

Our focus is on the intensive margin and we investigate changes in firm characteristics over a period of one, two, and three years after a firm has received a loan in the full allotment period.[23]

[23] We also investigate these changes for one, two, and three years before a firm has received a loan in the full allotment period to check the parallel trend assumption. Our results confirm that characteristics of high bank risk borrowers develop comparably to those of low bank risk borrowers prior to obtaining a loan in the full allotment period. We provide these results in an Online Appendix.

We include the same borrower accounting control variables as in Table 6 as well as time (year), borrower industry, and borrower rating fixed effects in all regressions. Besides investigating the general differences in the development of borrower characteristics between high and low bank risk borrowers, we additionally distinguish between borrowers who receive a loan only from high risk banks in our observation period (group 1) and borrowers who receive a loan from a high risk bank in the full allotment period and received a loan from a high and a low risk bank in the financial crisis until full allotment period (group 2). Table 11 shows the results.

[Table 11]

We observe that the portion of term loans of borrowers of high risk banks decreases while the portion of revolving loans increases. Interestingly, the total amount of debt outstanding increases suggesting that borrowers of high risk banks draw down their loan commitments. Our results are consistent with Ivashina and Scharfstein (2010) and Cornett et al. (2011) who show that loan commitments are an important source of financing for borrowers of high risk banks in times of financial crises.

We also find that high bank risk borrowers have lower payouts, lower capital expenditures and exhibit lower asset growth over the three years after loan origination in the full allotment period compared with borrowers of low risk banks. We do not observe differences in investment or employment between borrowers of low and high risk banks. A possible explanation is the number of large firms on our sample. Acharya et al. (2014) and Chodorow-Reich (2014) show that investments and employment decrease only for small- and medium-sized borrowers.

VII. Conclusion

We investigate the impact of aggregate central bank liquidity on bank deposit and corporate loan spreads during the June 2006 to June 2010 period. Our results suggest that the transmission

channel of monetary policy was impaired particularly at the beginning of the crisis. While higher aggregate central bank liquidity decreased deposit spreads of low risk banks, it did not have an impact on deposit spreads of high risk banks. Loan spreads were also not affected by changes in aggregate central bank liquidity. After the ECB started to fully allot all requested liquidity to banks via the refinancing operations in October 2008, we find that an increase in aggregate central bank liquidity results in the same decrease of deposit spreads for low and high risk banks. However, we still document differences in the transmission via loan markets for high versus low risk banks. We find that more aggregate central bank liquidity implies a reduction of loan spreads charged by low risk banks but has almost no effect on loan spreads of high risk banks. We also show that borrowers of high risk banks refinance expiring term loans with loan commitments. They decrease (increase) the percentage of term loans (commitments) in their capital structure and experience negative real effects in the years after having received a loan from a high risk bank.

Our results have several important implications. Furfine (2011) suggests that high levels of bank liquidity decrease the importance of the interbank market. If the level of aggregate bank liquidity is very high for an extended period some banks might become fully dependent on ECB liquidity and do not have incentives to restructure to be able to obtain funding in competitive markets. This is an important factor for monetary policy as low risk banks have a competitive disadvantage compared to high risk banks that are subsidized through large amounts of liquidity at interest rates that do not adequately reflect risk.

Finally, the ECB currently implements targeted LTROs to improve bank lending to the non-financial private sector. However, given that these targeted LTROs are conducted together with a full allotment of liquidity it is not clear if these are able to improve the transmission channel.

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Figure 1. Aggregate Central Bank Liquidity

The figure shows four measures of aggregate market liquidity provided to the banking sector by the ECB over the time period January 2006 to June 2010 without taking logarithms. The first vertical dashed line in each figure indicates the start of the financial crisis on August 8, 2007, the second vertical dashed line the start of the period when the ECB announced to fully allot the amount banks request via the refinancing operations at a fixed rate given sufficient adequate collateral, and the third vertical dashed line the first longer-term refinancing operation (LTRO) with a maturity of one year as fixed rate tender procedure with full allotment. All measures are derived from ex post data published by the ECB on daily aggregate liquidity conditions in the Eurosystem and explained in detail in Appendix A1.

Figure 1.A Liquidity in Banking Sector

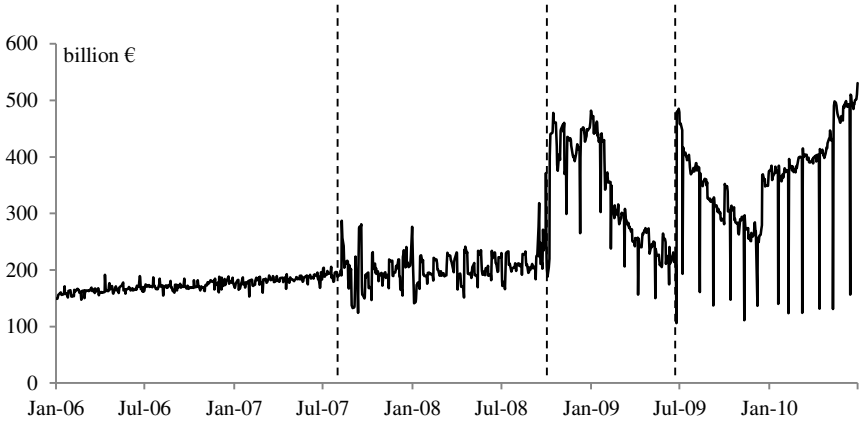


Figure 1.B Adjusted Liquidity in Banking Sector

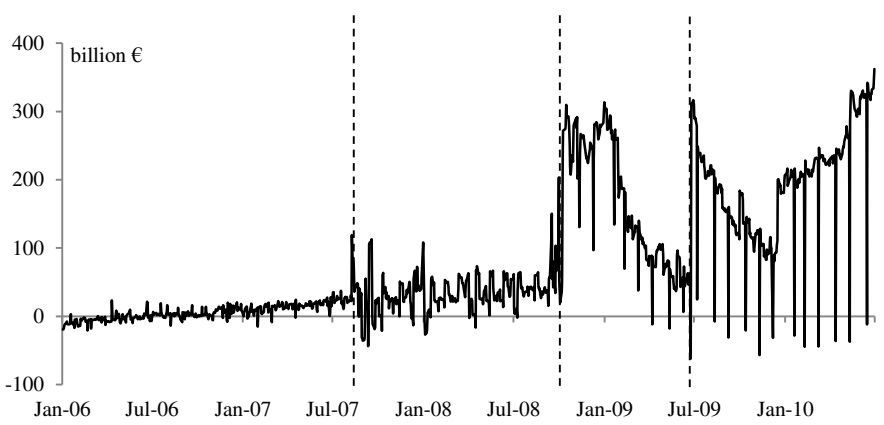


Figure 1.C Excess Liquidity Ratio

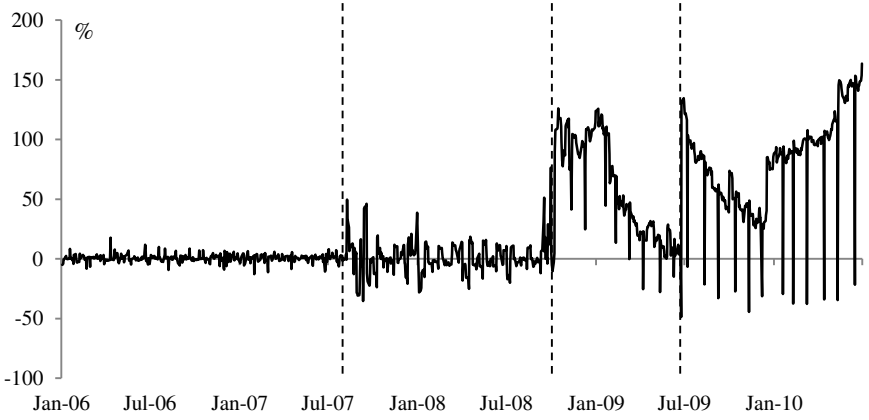


Figure 1.D Liquidity Monetary Operations

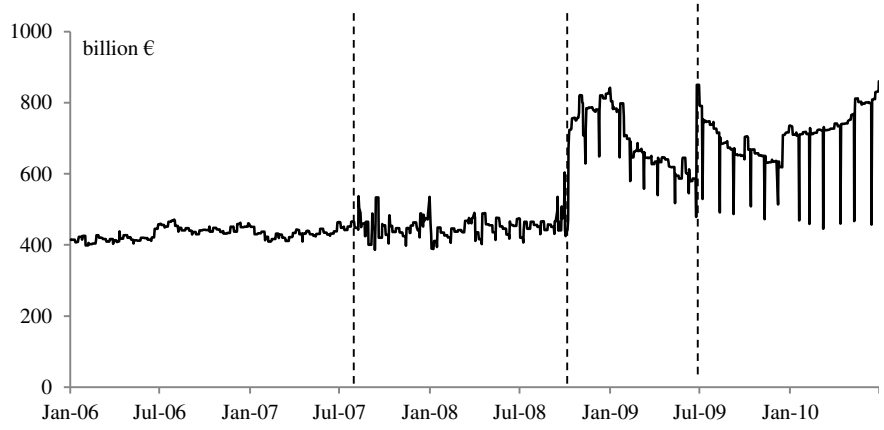


Figure 2. Short-term Interest Rates and Aggregate Central Bank Liquidity

The figure depicts the development of interest rates and the amount of aggregate central bank liquidity without taking logarithms over the period 2006 to June 2010. Figure 2.A shows the development of the interest rates for the ECB deposit facility, the ECB main refinancing rate, and the ECB marginal lending facility, together with the average daily corporate money market deposit rate in percent. Figure 2.B illustrates the development of the corporate money market deposit spread and the adjusted liquidity in the banking sector. The corporate money market deposit spread is the solid line and defined as the average daily spread between corporate short-term deposit rates on the transaction level and the ECB deposit facility rate in basis points (bps). The adjusted liquidity in the banking sector in € billion is the dashed line and defined in Appendix A1. The first vertical dashed line in each figure indicates the start of the financial crisis on August 8, 2007, the second vertical dashed line the start of the period when the ECB announced to fully allot the amount banks request via the refinancing operations at a fixed rate given sufficient adequate collateral, and the third vertical dashed line the first longer-term refinancing operation (LTRO) with a maturity of one year as fixed rate tender procedure with full allotment.

Figure 2.A: Short-term Interest Rates

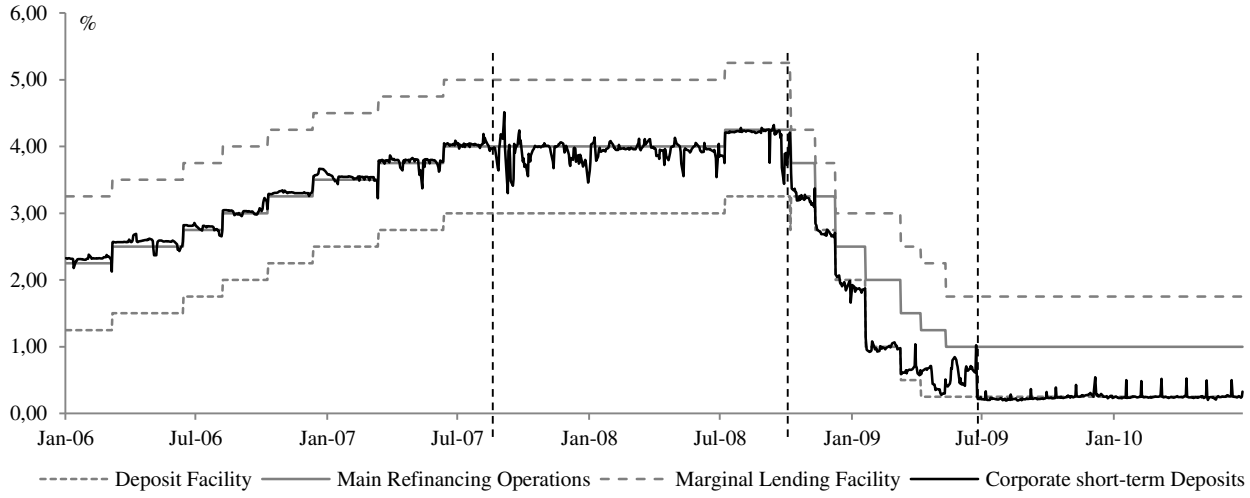


Figure 2.B: Aggregate Central Bank Liquidity and Deposit Spread

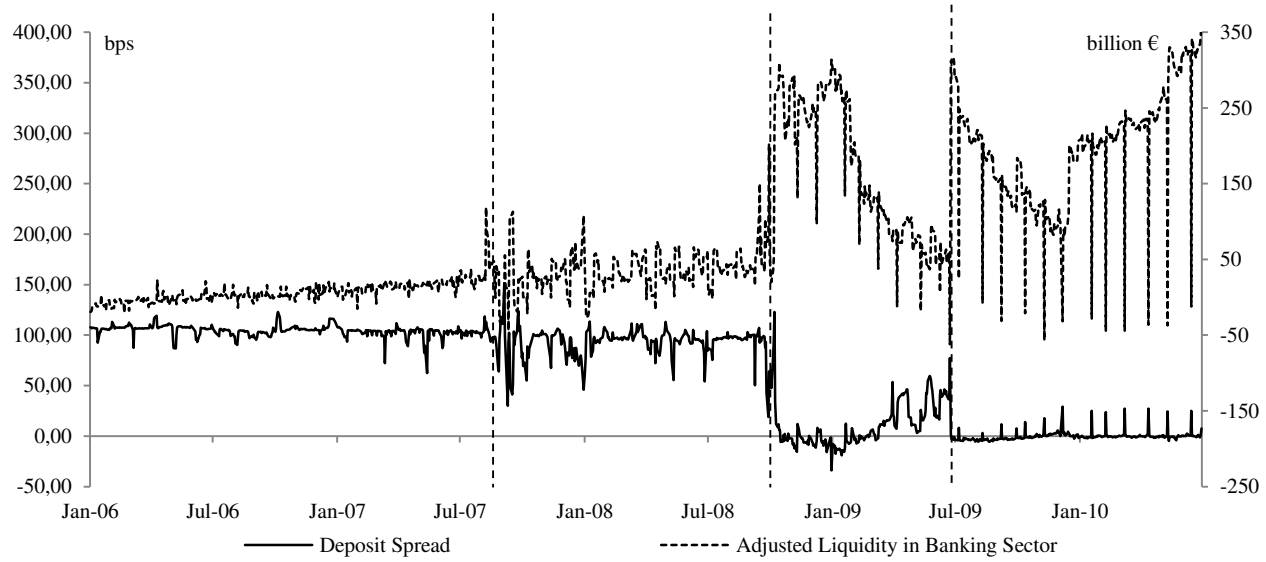
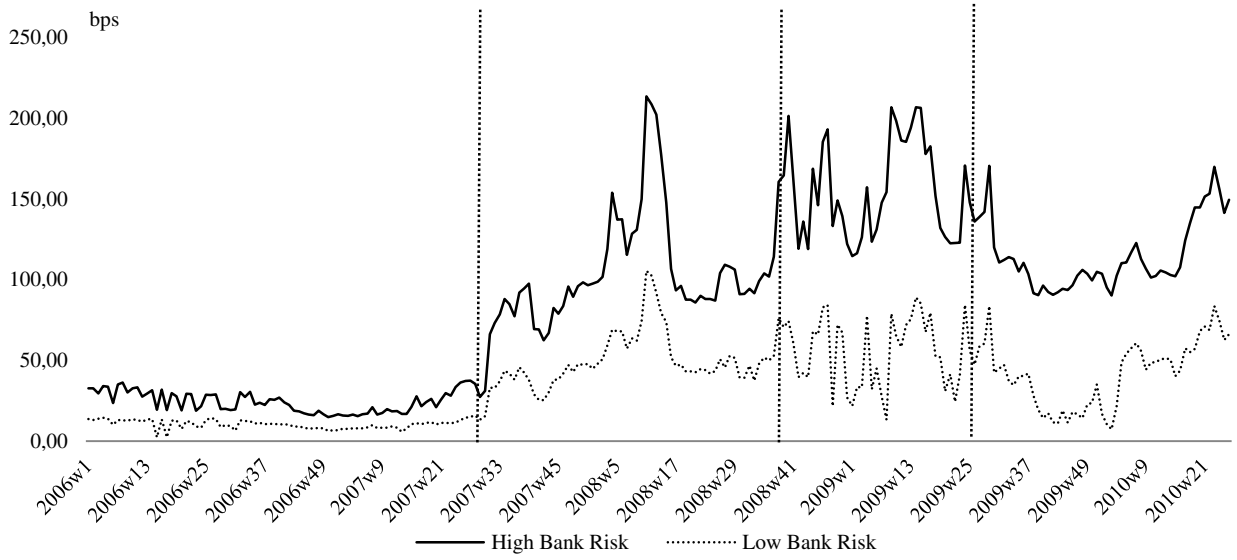


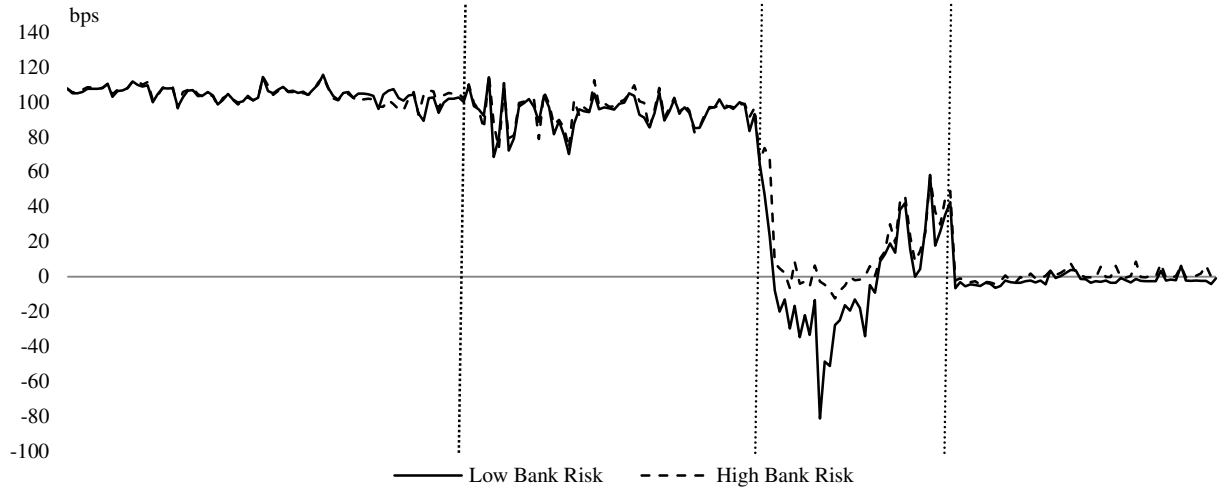
Figure 3. Bank Risk and Deposit and Loan Spreads

The figure shows bank's average 5 year CDS spread by bank risk (Panel A), the corporate money market deposit spread by bank risk (Panel B) and the corporate syndicated loan spread difference of borrowers on the intensive margin by bank risk (Panel D) in basis points from 2006 to 2010:Q2. Panel C shows the percentage difference of average corporate deposit spreads of low risk minus high risk banks divided by the deposit rate. High and low bank risk are dummy variables defined using banks' CDS spreads and explained in detail in Appendix A1. Panels A, B and C show weekly, Panel D monthly averages using all banks active in the corporate deposit money market in our sample. The first vertical dashed line in each figure indicates the start of the financial crisis on August 8, 2007, the second vertical dashed line the start of the period when the ECB announced to fully allot the amount banks request via the refinancing operations at a fixed rate given sufficient adequate collateral, and the third vertical dashed line the first longer-term refinancing operation (LTRO) with a maturity of one year as fixed rate tender procedure with full allotment.

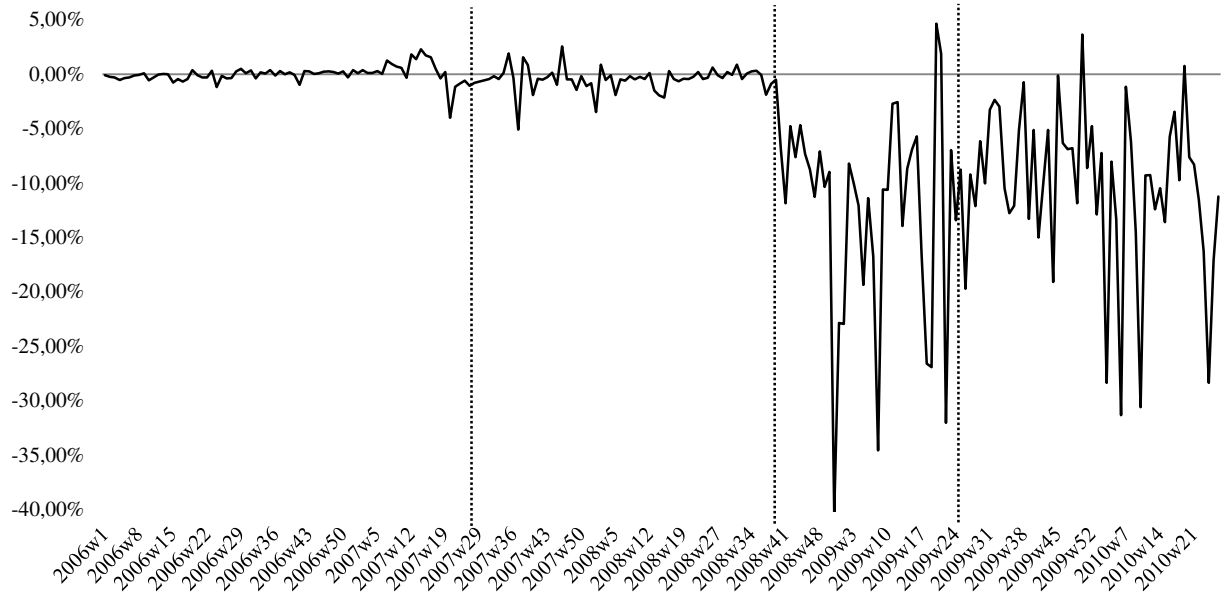
Panel A: Banks' CDS Spread by Bank Risk



Panel B: Corporate Money Market Deposit Spread by Bank Risk



Panel C: Percentage Difference between Deposit Spreads of Low Risk and High Risk Banks



Panel D: Loan Spread Difference between Low and High Bank Risk Borrowers on the Intensive Margin

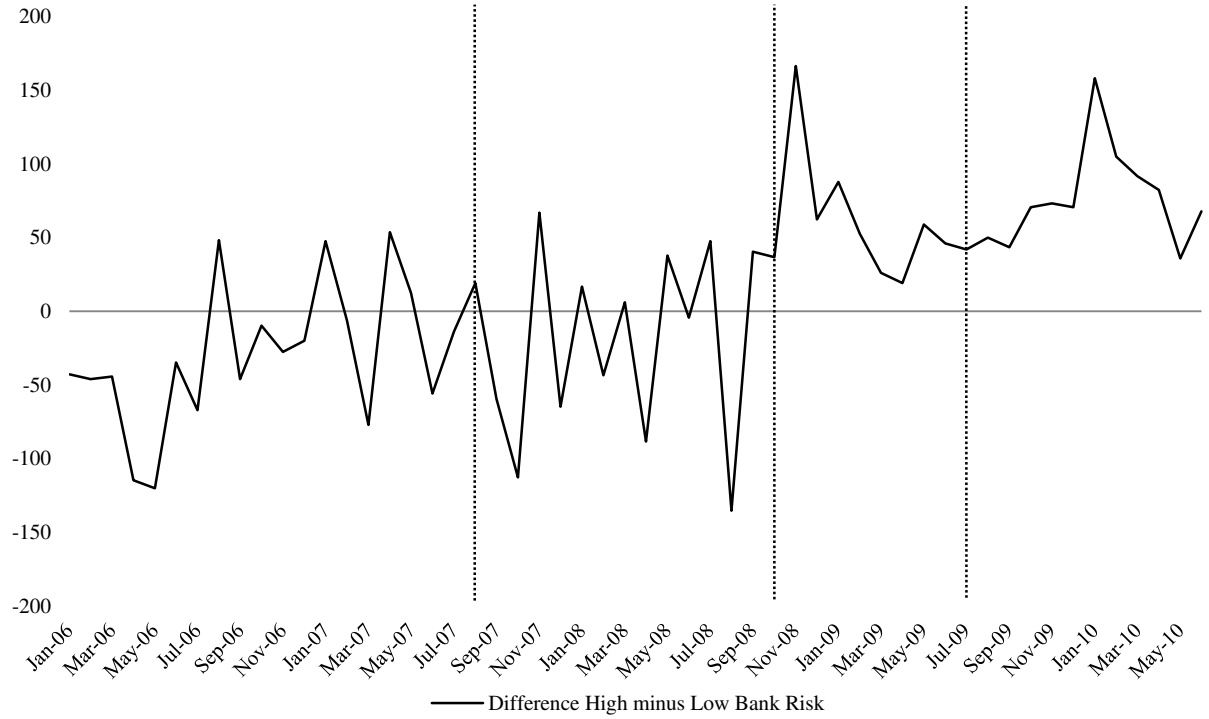


Table 1. Descriptive Statistics

The table shows descriptive statistics of variables for the time period January 2006 until June 2010. This period is also split into the financial crisis period from August 9, 2007 to June 30, 2010, the financial crisis until the full allotment period from August 9, 2007 to October 7, 2008, and the full allotment period from October 8, 2008 until June 30, 2010. All variables are defined in Appendix A1. Panel A reports the aggregate market liquidity for banks provided by the ECB without taking logarithms. Panel B and D report transaction data. The deposit rate is reported in basis points (bps) per annum using an actual/360 day count convention. The deposit spread is calculated as the difference between the deposit rate and the ECB deposit facility rate. The All in Spread Drawn is taken from the LPC Dealscan database. Panel C (Panel E) shows bank (borrower) averages of accounting variables. Where appropriate, standard errors are provided in parentheses.

Panel A: Aggregate ECB Market Liquidity

	Total Period (2006:Q1 - 2010:Q2)	Financial Crisis (Aug. 9, 2007 - 2010:Q2)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
Adjusted Liquidity in Banking Sector (€ billion)	81.798 (98.979)	123.490 (101.149)	35.214 (28.498)	183.142 (88.136)
Liquidity in Banking Sector (€ billion)	250.043 (98.979)	291.735 (101.149)	203.459 (28.498)	351.386 (88.136)
Excess Liquidity Ratio (%)	28.241 (44.333)	43.434 (48.913)	1.213 (13.575)	71.964 (43.189)
Liquidity Monetary Operations (€ billion)	540.635 (137.361)	600.012 (138.511)	450.020 (27.129)	701.367 (78.415)

Panel B: Corporate Money Market Deposits

	Total Period (2006:Q1 - 2010:Q2)	Financial Crisis (Aug. 9, 2007 - 2010:Q2)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
Number of Transactions	40,638	32,182	12,078	20,104
Deposit Rate (bps)	226.70 (162.88)	200.24 (171.22)	398.46 (21.00)	81.15 (94.19)
Deposit Spread (bps)	51.41 (50.36)	37.61 (47.65)	93.29 (19.16)	4.16 (20.80)
Average Notional Deposit Amount (€)	70,800,000 (91,500,000)	70,700,000 (91,900,000)	78,800,000 (96,000,000)	65,900,000 (89,000,000)
Average Duration (days)	1.86 (1.55)	1.87 (1.55)	1.83 (1.53)	1.89 (1.56)
Bank Competition	3.16 (2.62)	3.05 (2.62)	3.29 (2.64)	2.91 (2.60)

Panel C: Bank Characteristics

	Total Period (2006:Q1 - 2010:Q2)	Financial Crisis (Aug. 9, 2007 - 2010:Q2)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
Number of Banks	43	43	35	40
Bank Risk	3.464 (1.259)	3.419 (1.169)	2.868 (0.949)	3.751 (1.164)
Total Assets (€ million)	764,962 (558,161)	798,370 (592,358)	778,176 (540,678)	810,502 (621,039)
Leverage (%)	96.067 (1.789)	95.995 (1.861)	95.824 (2.039)	96.098 (1.736)
Off-Balance-Sheet Exposure (%)	21.638 (16.476)	21.900 (16.420)	21.988 (15.103)	21.847 (17.164)
Return on Assets (%)	0.185 (0.536)	0.112 (0.565)	0.447 (0.292)	-0.090 (0.593)
Total Asset Growth (%)	7.720 (20.835)	6.547 (21.526)	14.680 (21.441)	1.695 (20.064)
Net Interest Margin (%)	1.005 (0.536)	1.007 (0.554)	0.907 (0.470)	1.067 (0.591)
Cost/Income Ratio (%)	70.622 (22.192)	72.984 (23.926)	65.320 (13.709)	77.871 (27.500)
Net Loans/Customer Deposits (%)	143.903 (44.037)	145.562 (44.188)	145.935 (43.247)	145.338 (44.743)
NPL/Loans (%)	2.874 (1.539)	2.952 (1.511)	2.380 (1.400)	3.284 (1.474)
Net Derivative Exposure (%)	-0.173 (2.180)	-0.178 (2.288)	-0.483 (1.302)	0.006 (2.698)
Liquid Assets / Short-Term Funding (%)	57.032 (32.590)	57.447 (33.081)	62.394 (34.344)	54.475 (31.933)
Total Deposits/Total Assets (%)	55.343 (13.101)	54.791 (13.277)	55.503 (13.372)	54.364 (13.201)

Panel D: Loan Characteristics

	Total Period (2006:Q1 - 2010:Q2)	Financial Crisis (Aug. 9, 2007 - 2010:Q2)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
Number of Facilities	2,632	1,500	725	775
All in Spread Drawn (bps)	183.45 (145.66)	232.11 (156.91)	160.40 (128.66)	306.52 (148.86)
Maturity in Months	54.17 (26.26)	46.80 (25.47)	50.07 (27.57)	43.42 (22.63)
Facility Size (€ million)	799 (1,440)	819 (1,050)	997 (1,200)	634 (824)
Number of Previous Loans of Borrower	5.61	6.01	5.09	6.98
Secured	38.84%	35.22%	29.53%	41.13%
Performance Pricing	37.82%	41.16%	35.23%	47.31%
Loan Type				
Term Loan	45.74%	44.53%	46.76%	42.45%
Revolver/Line >= 1 Yr.	42.21%	41.67%	35.03%	47.87%
364-Day Facility	7.56%	8.07%	10.48%	5.81%
Bridge Loan	3.91%	5.13%	7.03%	3.35%
Revolver/Line < 1 Yr.	0.57%	0.60%	0.69%	0.52%
Loan Purpose				
Corporate purposes	43.43%	50.13%	40.83%	58.84%
M&A related	31.57%	30.07%	44.97%	16.13%
Debt Repayment	14.13%	9.67%	6.48%	12.65%
Working Capital	9.27%	9.47%	7.45%	11.35%
Other	1.60%	0.67%	0.28%	1.03%

Panel E: Borrower Characteristics

	Total Period (2006:Q1 - 2010:Q2)	Financial Crisis (Aug. 9, 2007 - 2010:Q2)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
Number of Firms	566	370	208	221
Total Assets (€ million)	7,944 (7,117)	8,226 (7,150)	8,046 (7,142)	8,413 (7,164)
Leverage	0.554 (0.134)	0.548 (0.131)	0.526 (0.141)	0.571 (0.115)
Current ratio	1.685 (1.271)	1.644 (1.075)	1.631 (1.068)	1.657 (1.085)
Coverage	17.962 (96.884)	21.424 (131.294)	28.439 (173.490)	14.145 (61.922)
Market to Book	1.685 (0.850)	1.661 (0.932)	1.916 (1.000)	1.396 (0.772)
Tangibility	0.388 (0.253)	0.385 (0.265)	0.360 (0.263)	0.410 (0.265)
Borrower IPO (years)	10.615	11.387	10.424	12.195
Credit Rating				
Investment Grade Rating	32.97%	35.49%	38.34%	32.53%
Non-Investment Grade Rating	34.95%	31.79%	26.94%	36.83%
Not Rated	32.08%	32.72%	34.72%	30.65%

Table 2. The Transmission of Central Bank Liquidity to Deposit Spreads

The table reports OLS regression results of the deposit spread of corporate deposits with a maximum maturity of 7 days on aggregate central bank liquidity, bank risk and further control variables. It shows 4 different regression specifications over different time periods, indicated at the top of each regression. Aggregate Central Bank Liquidity is measured by the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. The bank accounting and further control variables are as in Table 2. All variables are defined in Appendix A1. Bank accounting standard FE are either the general accepted accounting principles (GAAP) of the respective country of the bank or the international financial reporting standards (IFRS). Bank accounting variables are used as stated in the annual report in the year prior to the transaction. Constant term is included but omitted. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the bank-level.

	Total Period (2006:Q1 - 2010:Q2)	Pre Financial Crisis (2006:Q1 - Aug. 8, 2007)	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
	I	II	III	IV
ECB Market Liquidity				
Aggregate Central Bank Liquidity	-28.997***	0.406	-21.687***	-35.648***
Bank Risk				
High Bank Risk	-0.115	-0.110	1.683	0.162
Bank Accounting Variables				
log(Total Assets)	-4.319***	-0.347	-2.172*	-4.681***
Leverage	0.128	0.416**	0.311	-0.762
Off-Balance-Sheet Exposure	-0.006	0.028**	0.019	-0.082
Return on Assets	-1.212	-4.720*	-0.232	-0.511
Total Asset Growth	0.039**	-0.021***	0.007	0.032
Net Interest Margin	-3.409	1.854**	-2.308	-6.674*
Cost/Income Ratio	-0.009	-0.104*	-0.030	-0.021
Net Loans/Customer Deposits	-0.036**	-0.013	-0.001	-0.032
Non-performing Loans/Total Loans	0.511	-0.178	-0.406	1.180*
Net Derivative Exposure / Total Assets	0.113	-0.068	-0.083	0.511**
Liquid Assets/Short-Term Funding	-0.005	-0.019	-0.001	-0.001
Total Deposits/Total Assets	0.019	-0.070***	0.025	-0.015
Further Control Variables				
log(Notional Deposit Amount)	-0.194	0.160	0.069	-0.694**
Deposit Duration	0.704***	0.295***	0.724**	0.660***
Bank Competition	0.427***	-0.040	0.414**	0.592***
3 Month EURIBOR-EONIA Swap Spread	-15.717***	56.222***	-29.075***	-5.255
End of Reserve Maintenance Period	-8.239***	-6.834***	-6.633***	-14.102***
Crisis Until Full Allotment	-1.984			
Full Allotment Period	-52.048***			
Fixed Effects (FE) and Clustering				
Firm FE	Yes	Yes	Yes	Yes
Time (quarter) FE	Yes	Yes	Yes	Yes
Accounting Standard FE	Yes	Yes	Yes	Yes
Clustering (Bank)	Yes	Yes	Yes	Yes
Observations	31,201	4,963	10,179	16,059
R-squared	0.918	0.498	0.288	0.531

Table 3. The Transmission of Central Bank Liquidity to Deposit Spreads by Bank Risk

The table reports OLS regression results of the deposit spread of corporate deposits with a maximum maturity of 7 days on aggregate central bank liquidity, bank risk and further control variables. It shows 6 different regression specifications over different time periods, indicated at the top of each regression. Aggregate Central Bank Liquidity is measured by the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. All variables are defined in Appendix A1. Bank accounting standard FE are either the general accepted accounting principles (GAAP) of the respective country of the bank or the international financial reporting standards (IFRS). Bank accounting variables are used as stated in the annual report in the year prior to the transaction. Constant term is included but omitted. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the bank-level.

	Financial Crisis Period (Aug. 9, 2007 - 2010:Q2)		Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)		Full Allotment Period (Oct. 8, 2008 - 2010:Q2)	
	I	II	III	IV	V	VI
ECB Market Liquidity						
Aggregate Central Bank Liquidity	-30.062***		-21.814***		-36.173***	
Aggregate Central Bank Liquidity * High Bank Risk		-31.392***		-10.720*		-35.761***
Aggregate Central Bank Liquidity * Low Bank Risk		-26.991***		-24.868***		-38.511***
Control Variables						
High Bank Risk	2.740	1.573	3.245	7.235	7.893	6.441
Bank Accounting Variables	Yes	Yes	Yes	Yes	Yes	Yes
Further Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (FE) and Clustering						
Bank Risk * Time (quarter) FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Time (quarter) FE	Yes	Yes	Yes	Yes	Yes	Yes
Accounting Standard FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustering (Bank)	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test of Interaction Terms				0.0064		0.3356
Observations	26,238	26,238	10,179	10,179	16,059	16,059
R-squared	0.899	0.899	0.301	0.303	0.535	0.535

Table 4. The Transmission of Central Bank Liquidity to Deposit Spreads

The table reports OLS regression results of the deposit spread of corporate deposits with a maximum maturity of 7 days on aggregate central bank liquidity, bank risk and further control variables. It shows different regression specifications over different time periods, indicated at the top of each regression. Aggregate Central Bank Liquidity is measured by the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. All variables are defined in Appendix A1. Bank accounting standard FE are either the general accepted accounting principles (GAAP) of the respective country of the bank or the international financial reporting standards (IFRS). Bank accounting variables are used as stated in the annual report in the year prior to the transaction. Constant term is included but omitted. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the bank-level.

	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)				Full Allotment Period (Oct. 8, 2008 - 2010:Q2)			
	I	II	III	IV	V	VI	VII	VIII
ECB Market Liquidity								
Aggregate Central Bank Liquidity	-26.722***		-25.887***		-38.898***		-38.572***	
Aggregate Central Bank Liquidity * High Bank Risk		-2.814		-4.961		-38.805***		-38.401***
Aggregate Central Bank Liquidity * Low Bank Risk		-33.062***		-31.780***		-39.485***		-39.632***
Control Variables								
High Bank Risk	0.031	5.749**	-0.523	4.801*	12.152	11.772	-0.538	-0.920
Bank Accounting Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (FE) and Clustering								
Bank Risk * Time (month) FE	Yes	Yes	No	No	Yes	Yes	No	No
Bank * Time (month) FE	No	No	Yes	Yes	No	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time (month) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Accounting Standard FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering (Bank)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test of Interaction Terms		0.0019		0.0020		0.8409		0.4900
Observations	10,179	10,179	10,179	10,179	16,059	16,059	16,059	16,059
R-squared	0.342	0.348	0.416	0.422	0.574	0.574	0.747	0.747

Table 5. Notional Deposit Amounts and Deposit Spreads

The table reports two-stage least squares (2SLS) regression results. In the first stage, the logarithm of the notional deposit transaction amount is instrumented with the number of all outstanding money market transactions of the firm at the time the new deposit transaction is initiated. In the second stage, the table shows regression results of the deposit spread of corporate deposits with a maximum maturity of 7 days on the instrumented logarithm of the notional deposit transaction amount as well as on aggregate central bank liquidity, bank risk and further control variables. Aggregate Central Bank Liquidity is measured by the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. All variables are defined in Appendix A1. All models incorporate firm fixed effects (FE), time (quarter) FE, time*bank risk FE, and bank accounting standard FE. The latter are either the general accepted accounting principles (GAAP) of the respective country of the bank or the international financial reporting standards (IFRS). Constant term is included but omitted. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the bank-level.

	Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
	I	II
	First Stage	*First Stage*
Dependent Variable	log(Notional Deposit Amount)	log(Notional Deposit Amount)
Instrument		
Number Outstanding Transactions of Firm	-0.019***	-0.018**
Control Variables from 2nd Stage	Yes	Yes
Observations	10,179	16,059
R-squared	0.763	0.712
	Second Stage	*Second Stage*
Dependent Variable	Deposit Spread	Deposit Spread
Instrumented Variable		
log(Notional Deposit Amount)	0.490	-2.970
ECB Market Liquidity		
Aggregate Central Bank Liquidity * High Bank Risk	-10.968	-35.467***
Aggregate Central Bank Liquidity * Low Bank Risk	-24.624***	-38.288***
Control Variables		
High Bank Risk	6.834	5.804
Bank Accounting Variables	Yes	Yes
Further Control Variables	Yes	Yes
Fixed Effects (FE) and Clustering		
Bank Risk * Time (quarter) FE	Yes	Yes
Firm FE	Yes	Yes
Time (quarter) FE	Yes	Yes
Accounting Standard FE	Yes	Yes
Clustering (Bank)	Yes	Yes
Wald Test of Interaction Terms	0.0087	0.3240
Observations	10,179	16,059
R-squared	0.303	0.534

Table 6. The Transmission of Aggregate Central Bank Liquidity to Loan Spreads

The table reports OLS regression results of syndicated loan spreads on aggregate central bank liquidity, bank risk and further control variables. It shows 6 different regression specifications over different time periods, indicated at the top of each regression. Aggregate Central Bank Liquidity is measured by the average over the quarter prior to loan origination of the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. All variables are defined in Appendix A1. Bank and borrower accounting variables are used as stated in the annual report in the year prior to the transaction. Constant term is included but omitted. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the firm-level.

	Financial Crisis Period (Aug. 9, 2007 - 2010:Q2)		Crisis until Full Allotment (Aug. 9, 2007 - Oct. 7, 2008)		Full Allotment Period (Oct. 8, 2008 - 2010:Q2)	
	I	II	III	IV	V	VI
ECB Market Liquidity						
Aggregate Central Bank Liquidity	-114.148**		390.122		-73.328	
(1) Aggregate Central Bank Liquidity * High Bank Risk		-87.537		518.803*		-24.971
(2) Aggregate Central Bank Liquidity * Low Bank Risk		-165.117***		200.293		-188.184***
Bank Risk						
High Bank Risk	24.613	45.057**	41.583***	122.705	-0.974	-47.840*
Borrower Accounting Variables						
log(Total Assets)	-4.999	-5.058	7.637	7.399	-17.294	-17.930
Leverage	-15.458	-14.700	35.855	36.851	3.122	8.525
Current ratio	-3.801	-4.391	20.250	19.705	0.056	-0.105
Coverage	0.157***	0.158***	0.056	0.058	0.179	0.129
Market to Book	-16.495**	-16.741**	-17.013**	-17.317**	-31.581**	-32.389**
Tangibility	21.727	18.774	-31.006	-32.173	88.244	79.981
Bank Accounting Variables						
log(Total Assets)	16.417	17.304	-128.378*	-122.530*	70.394*	70.005**
Leverage	-3.378	-2.941	-5.931	-6.321	-5.621	-4.085
Return on Assets	-2.464	-2.061	-20.090	-20.345	3.043	3.978
Total Asset Growth	0.062	0.053	0.543**	0.529**	-0.168	-0.187
Non-performing Loans/Total Loans	4.029	3.935	21.325**	22.101**	1.303	0.703
Further Control Variables						
log(Maturity in Months)	15.626	15.772	28.200***	28.401***	-1.612	-1.091
Secured	25.677	26.033	40.870***	41.469***	-12.607	-12.956
log(Facility Size)	-18.572***	-18.522***	-14.821***	-14.527***	-11.977*	-12.100*
log(Number of Loans of Borrower)	5.123	4.913	1.215	1.432	7.268	6.745
Performance Pricing	-9.106	-8.806	-24.523*	-24.951*	-3.849	-2.315
3 Month EURIBOR-EONIA Swap Spread	74.857**	82.702***	-17.152	-14.308	83.349**	101.956***
Full Allotment Period	51.682	45.812				
Fixed Effects (FE) and Clustering						
Bank Risk * Time (year) FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time (year) FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Rating FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Industry Code FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type, Purpose, Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustering (Firm)	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test of Interaction Terms				0.231		0.0268
Observations	1,156	1,156	533	533	623	623
R-squared	0.752	0.753	0.812	0.813	0.721	0.724

Table 7. Intensive and Extensive Margin – Summary Statistics

The table reports descriptive statistics of how borrowers and lenders match (Panel A), borrower and lender characteristics by bank risk (Panel B), and regression results of borrowers on the intensive margin (Panel C) in the full allotment period. Intensive margin is defined as a borrower having received a loan from one bank risk category prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from the same bank risk category in the full allotment period. Extensive margin is defined as a borrower who receives a loan from a bank risk category in the full allotment period but did not receive a loan from this bank risk category or did not receive any loan prior to the full allotment period over our observation period. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. Panel B reports differences in means. The statistical significance of the differences is determined using a t-test for unpaired data with unequal variance. The dependent variable in Panel C is an indicator variable which is one if the loan is an intensive margin loan and zero otherwise. All other variables are defined in Appendix A1. Bank and borrower accounting variables are used as stated in the annual report in the year prior to the transaction. Standard errors are heteroscedasticity-robust and clustered at the firm-level. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level.

Panel A: Borrower-Lender Matching

	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)	
Number of Firms	221	
Firms dropping out in Full Allotment Period	345	
Existing Firms borrowing in Full Allotment Period	96	
New Firms borrowing in Full Allotment Period	125	
Number of Facilities	775	
Intensive Margin - Facilities	44.516%	345
High Bank Risk only	9.032%	20.290%
Low Bank Risk only	2.194%	4.928%
borrowed from Both Bank Risk categories before	33.290%	74.783%
Extensive Margin - Facilities	55.484%	430
New Borrower, High Bank Risk	35.613%	64.186%
New Borrower, Low Bank Risk	7.484%	13.488%
Switching from Low to High Bank Risk	9.806%	17.674%
Switching from High to Low Bank Risk	2.581%	4.651%

Panel B: Descriptive Lender and Borrower Characteristics by Bank Risk and Extensive Margin

					Full Allotment Period (Oct. 8, 2008 - 2010:Q2)
	Low Bank Risk		*High* Bank Risk		Total Sample
	Difference Switching vs. Intensive Margin	Difference New vs. Intensive Margin	Difference Switching vs. Intensive Margin	Difference New vs. Intensive Margin	Difference High Bank Risk vs. Low Bank Risk
Borrower Accounting Variables					
log(Total Assets)	0.737	0.227	-0.237	-0.841***	-0.455***
Leverage	0.031	-0.006	0.036	-0.047**	0.010
Current ratio	-0.478	-0.687	-0.008	0.165**	0.002
Coverage	1.319	3.923***	-5.798*	5.099	1.736
Market to Book	-0.352***	0.624***	0.032	0.366***	-0.044*
Tangibility	-0.267***	-0.137***	0.165***	-0.033	-0.045**

Panel C: Probability to Observe a Loan of an Existing Borrower of Bank Risk Category (Intensive Margin)

	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)			
	Total Sample			
	I	II	III	IV
Estimation Method	OLS	Logit	Probit	OLS
Bank Risk				
High Bank Risk	-0.110	-0.558	-0.341	0.083
Borrower Accounting Variables				
log(Total Assets)	0.080**	0.402**	0.234**	0.070**
Leverage	-0.161	-0.880	-0.553	-0.427*
Current ratio	0.040	0.220	0.140	0.061
Coverage	-0.000	-0.002	-0.001	-0.002
Market to Book	-0.078	-0.529	-0.321	0.030
Tangibility	0.346**	1.751**	1.065**	0.417**
Bank Accounting Variables				
log(Total Assets)	-0.013	-0.088	-0.052	-0.330*
Leverage	0.014	0.065	0.041	-0.033
Return on Assets	0.022	0.103	0.066	0.010
Total Asset Growth	0.000	0.003	0.001	0.001
Non-performing Loans/Total Loans	-0.022	-0.116	-0.065	0.029
Further Control Variables				
log(Maturity in Months)	-0.080	-0.429*	-0.260*	-0.109**
Secured	-0.141	-0.720*	-0.438*	-0.149*
log(Facility Size)	-0.047	-0.214	-0.128	0.013
log(Number of Loans of Borrower)	0.061	0.297	0.180	0.103***
Performance Pricing	-0.136*	-0.675**	-0.419**	0.042
3 Month EURIBOR-EONIA Swap Spread	-0.122	-0.594	-0.325	-0.177
Fixed Effects (FE) and Clustering				
Bank Risk * Time (year) FE	No	No	No	Yes
Bank FE	No	No	No	Yes
Time (year) FE	No	No	No	Yes
Borrower Rating FE	No	No	No	Yes
Borrower Industry Code FE	No	No	No	Yes
Loan Type, Purpose, Currency FE	No	No	No	Yes
Clustering (Firm)	No	No	No	Yes
Observations	754	754	754	623
R-squared / Pseudo R-squared	0.207	0.172	0.171	0.547

Table 8. Aggregate Central Bank Liquidity and Loan Spreads - Intensive Margin

The table reports OLS regression results of borrowers on the intensive margin in the full allotment period. Intensive margin is defined as a borrower having received a loan from one bank risk category prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from the same bank risk category in the full allotment period. The table reports intensive margin regressions of syndicated loan spreads on aggregate central bank liquidity, bank risk and further control variables. It only includes loans from high risk banks conditional on the same borrower also having received loans from high risk banks prior to the full allotment period, and loans from low risk banks conditional on the same borrower also having received loans from low risk banks prior to the full allotment period. Model II shows the second stage of a Heckman regression model using model III of Panel C in Table 7 as first stage. Aggregate Central Bank Liquidity is measured by the average over the quarter prior to loan origination of the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. All other variables are defined in Appendix A1. Bank and borrower accounting variables are used as stated in the annual report in the year prior to the transaction. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level. Model I uses heteroscedasticity-robust standard errors clustered at the firm-level and model II standard errors derived using resampling via the jackknife method and clustered at the firm-level.

	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)	
	I	II
		Heckman Model
ECB Market Liquidity		
(1) Aggregate Central Bank Liquidity * High Bank Risk conditional on borrowing from High Bank Risk Prior Full Allotment	-174.808*	-221.681
(2) Aggregate Central Bank Liquidity * Low Bank Risk conditional on borrowing from Low Bank Risk Prior Full Allotment	-284.557**	-333.108**
Control Variables		
High Bank Risk	-14.187	25.252
Borrower Accounting Variables	Yes	Yes
Bank Accounting Variables	Yes	Yes
Further Control Variables	Yes	Yes
Fixed Effects (FE) and Clustering		
Bank Risk * Time (year) FE	Yes	Yes
Bank FE	Yes	Yes
Time (year) FE	Yes	Yes
Borrower Rating FE	Yes	Yes
Borrower Industry Code FE	Yes	Yes
Loan Type, Purpose, Currency FE	Yes	Yes
Clustering (Firm)	Yes	Yes (Jackknife)
Observations	272	Uncensored / Censored / Total Obs. 272 / 422 / 694
Observations - Borrow only from High Bank Risk prior full allotment	58	58
Observations - Borrow only from Low Bank Risk prior full allotment	13	13
Observations - Borrow from both Bank Risk categories prior full allotment	201	201
Wald Test of Interaction Terms	0.0335	0.0309
R-squared	0.771	

Table 9. Aggregate Central Bank Liquidity and Loan Spreads - Intensive Margin & PSM

The table reports regression results of borrowers on the intensive margin in the full allotment period. Intensive margin is defined as a borrower having received a loan from one bank risk category prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from the same bank risk category in the full allotment period. Panel A shows results from propensity score matching using a nearest neighbor estimator with 10, 50 and 100 nearest neighbors all with a caliper of 0.1 together with a Gaussian and an Epanechnikov kernel estimator both with a bandwidth of 0.01. The propensity score is estimated using a logit regression model and borrowers are matched on the odds ratio. Borrowers of low risk and high risk banks are matched in the full allotment period based on a borrower's log of total assets, leverage, current ratio, coverage, market to book ratio, and tangibility, and year, borrower industry code, borrower rating, loan type, loan purpose, loan currency, loan maturity, secured, loan amount, performance pricing and the number of previous loans of a borrower. Standard errors are reported in parentheses using 50 bootstrap replications. Panel B reports intensive margin OLS regressions of syndicated loan spreads of matched borrowers on aggregate central bank liquidity split by bank risk, a high bank risk indicator and a constant. It only includes loans from high risk banks conditional on the same borrower also having received loans from high risk banks prior to the full allotment period, matched to loans from low risk banks conditional on the same borrower also having received loans from low risk banks prior to the full allotment period. Model I shows the results for high and low risk bank borrowers matched using the nearest neighbor via a propensity score within a caliper of 0.1 and determined via the odds ratio. Model II reports the results for high and low risk bank borrowers matched using kernel matching within a bandwidth of 0.1 and determined via the odds ratio. Aggregate Central Bank Liquidity is measured by the average over the quarter prior to loan origination of the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the firm-level.

Panel A: Propensity Score Matching (PSM)

	Estimation Method	Intensive Margin Full Allotment Period
High Bank Risk	Nearest Neighbor (n=10)	121.385***
High Bank Risk	Nearest Neighbor (n=50)	121.277***
High Bank Risk	Nearest Neighbor (n=100)	121.277***
High Bank Risk	Gaussian Kernel	99.725**
High Bank Risk	Epanechnikov Kernel	99.725***

Panel B: Loan Spread - Intensive Margin - Matched Borrowers

		Full Allotment Period (Oct. 8, 2008 - 2010:Q2)			
		I	II	III	IV
	Matching Method	Nearest Neighbor Matching		Kernel Matching	
	ECB Market Liquidity				
(1)	Aggregate Central Bank Liquidity * High Bank Risk | High Bank Risk Prior Full Allotment	-39.895*	40.897	-166.558	-133.954
(2)	Aggregate Central Bank Liquidity * Low Bank Risk | Low Bank Risk Prior Full Allotment	-121.089**	-155.680**	-212.002**	-214.211**
	High Bank Risk	-10.182	-70.065	-16.043	-78.054
	Bank Control Variables	No	Yes	No	Yes
	Observations	264	264	358	358
	Wald Test of Interaction Terms	0.0677	0.0302	0.0825	0.0664
	R-squared	0.0995	0.1644	0.1005	0.1483

Table 10. Monetary Policy and Loan Maturity

The table reports regression results of the total sample and of borrowers on the intensive margin in the full allotment period. Intensive margin is defined as a borrower having received a loan from one bank risk category prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from the same bank risk category in the full allotment period. The table reports regressions of syndicated loan spreads on aggregate central bank liquidity, bank risk, loan maturity intervals and further control variables. Column III only includes loans on the intensive margin, that is loans from high risk banks conditional on the same borrower also having received loans from high risk banks prior to the full allotment period, and loans from low risk banks conditional on the same borrower also having received loans from low risk banks prior to the full allotment period. Aggregate Central Bank Liquidity is measured by the average over the quarter prior to loan origination of the adjusted liquidity in the banking sector. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. Loan are classified as short-term when maturity ≤ 1 year, medium-term when 1 year < maturity ≤ 5 years, and long-term when maturity > 5 years. All other variables are defined in Appendix A1. Bank and borrower accounting variables are used as stated in the annual report in the year prior to the transaction. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level. All models use heteroscedasticity-robust standard errors clustered at the firm-level.

	Full Allotment Period (Oct. 8, 2008 - 2010:Q2)		
			Intensive Margin
	I	II	III
ECB Market Liquidity			
Aggregate Central Bank Liquidity * Short-term Loan	-228.187**		
Aggregate Central Bank Liquidity * Medium-term Loan	-68.923		
Aggregate Central Bank Liquidity * Long-term Loan	318.403		
(1) Aggregate Central Bank Liquidity * High Bank Risk * Short-term Loan		-265.484**	-592.328***
(2) Aggregate Central Bank Liquidity * High Bank Risk * Medium-term Loan		-19.792	-49.226
(3) Aggregate Central Bank Liquidity * High Bank Risk * Long-term Loan		368.907	-45.516
(4) Aggregate Central Bank Liquidity * Low Bank Risk * Short-term Loan		-200.722*	-540.985***
(5) Aggregate Central Bank Liquidity * Low Bank Risk * Medium-term Loan		-206.797***	-277.036**
(6) Aggregate Central Bank Liquidity * Low Bank Risk * Long-term Loan		190.460	457.176
Control Variables			
Bank Risk * Loan Maturity Intervals	Yes	Yes	Yes
Borrower Accounting Variables	Yes	Yes	Yes
Bank Accounting Variables	Yes	Yes	Yes
Further Control Variables	Yes	Yes	Yes
Fixed Effects (FE) and Clustering			
Bank Risk * Time (year) FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Time (year) FE	Yes	Yes	Yes
Borrower Rating FE	Yes	Yes	Yes
Borrower Industry Code FE	Yes	Yes	Yes
Loan Type, Purpose, Currency FE	Yes	Yes	Yes
Clustering (Firm)	Yes	Yes	Yes
Wald Test of Interaction Terms [(1)=(4) / (2)=(5) / (3)=(6)]		0.5500 / 0.0281 / 0.4842	0.7416 / 0.0115 / 0.3148
Observations	623	623	272
R-squared	0.745	0.750	0.837

Table 11. Debt Capital Structure and Firm Characteristics: Intensive Margin

The table reports OLS regressions of changes in borrower variables of borrowers on the intensive margin in the full allotment period on bank risk and control variables. All variables are derived on the firm-level and measured in real terms with 2006 as the base year using the consumer price index (CPI) as published by the OECD. Panels A to C use data from S&P's Capital IQ, Panels D to I use data from Compustat. Asset growth is the ratio of total assets in t divided by the value of total assets in t-1, minus 1. Payouts are measured by total dividends, investment is measured by total invested capital, and employment is the number of employees in thousand. The panels show regression results of either pp.Δ (percentage point differences), or logΔ (log differences) or Δ (differences) from year t to t+1, t to t+2, and t to t+3, with t as the year when the loan is initiated in the full allotment period, on several control variables. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. High Bank Risk | only High Bank Risk Prior Full Allotment is defined as a borrower having received loans from only high risk banks prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from a high risk bank in the full allotment period. High Bank Risk | High and Low Bank Risk Prior Full Allotment is defined as a borrower having received loans from both low and high risk banks prior to the full allotment period and receiving a loan from a high risk bank in the full allotment period. All models include a borrower's log of total assets, leverage, current ratio, coverage, market to book ratio, and tangibility, and time (year) fixed effects (FE), borrower industry code FE, and borrower rating FE. All variables are defined in Appendix A1. Borrower accounting control variables are used as stated in the annual report in the year prior to the transaction. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the firm-level.

Panel A: Term Loans/ Total Debt	pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	-2.531**		-3.705**		0.346	
High Bank Risk | only High Bank Risk Prior Full Allotment		-3.275		-0.069		5.047
High Bank Risk | High and Low Bank Risk Prior Full Allotment		-2.453**		-4.005**		-0.066
Observations	212	212	213	213	211	211
R-squared	0.791	0.791	0.829	0.831	0.839	0.841

Panel B: Revolving Loans/ Total Debt	pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	1.736		0.885		1.718	
High Bank Risk | only High Bank Risk Prior Full Allotment		-2.612		-5.678		-10.149
High Bank Risk | High and Low Bank Risk Prior Full Allotment		2.266**		1.658*		3.116**
Observations	191	191	195	195	195	195
R-squared	0.866	0.874	0.856	0.872	0.791	0.833

Panel C: Notional Outstanding/ Total Debt	pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	1.654**		1.225*		1.269	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		2.492**		1.306		7.336**
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		1.540*		1.213*		0.439
Observations	250	250	248	248	248	248
R-squared	0.480	0.483	0.428	0.428	0.372	0.417

Panel D: Total Liabilities	logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	-0.007		0.001		-0.007	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-0.016		-0.016		0.023
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		-0.006		-0.006		-0.011
Observations	267	267	261	267	258	258
R-squared	0.399	0.399	0.515	0.399	0.685	0.686

Panel E: Payouts	logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	VII	VIII	IX	X	XI	XII
High Bank Risk	-0.370***		-0.206*		-0.334***	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-0.087		0.251		0.475
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		-0.401***		-0.241**		-0.370***
Observations	229	229	223	223	219	219
R-squared	0.515	0.530	0.629	0.659	0.651	0.691

Panel F: Capital Expenditures	logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	XIII	XIV	XV	XVI	XVII	XVIII
High Bank Risk	-0.144*		-0.079		-0.066	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-0.330		0.041		0.019
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		-0.112*		-0.099*		-0.079
Observations	267	267	261	261	258	258
R-squared	0.561	0.573	0.575	0.582	0.672	0.674

Panel G: Asset Growth	pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	-1.317		-0.021		1.448	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-19.283*		-11.552**		-10.077*
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		1.793		1.871		3.286
Observations	267	267	261	261	258	258
R-squared	0.472	0.504	0.609	0.637	0.682	0.702

Panel H: Investment	logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	0.003		-0.004		-0.013	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		0.006		-0.022		0.024
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		0.003		-0.001		-0.019
Observations	267	267	261	261	258	258
R-squared	0.381	0.381	0.565	0.565	0.677	0.679

Panel I: Employment	Δ (t; t+1)		Δ (t; t+2)		Δ (t; t+3)	
	I	II	III	IV	V	VI
High Bank Risk	-1.019		-2.107		-3.502	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		1.042		3.748		4.013
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		-1.408		-2.890		-4.473
Observations	249	249	243	243	240	240
R-squared	0.367	0.373	0.562	0.569	0.571	0.577

Appendix A1. Description of Variables

The table shows descriptions of virtually all variables used in the analyses together with their units of measurement. All financial variables are winsorized at the 1st and 99th percentile and measured in real terms with 2006 as the base year using the consumer price index (CPI) as published by the OECD.

Variable Name	Unit	Description
Aggregate ECB Market Liquidity		
Liquidity in Banking Sector	Log (€ billion)	Natural logarithm of the absolute amount of liquidity in the banking sector. It is calculated as the logarithm of the sum of banks' current account and deposit facility holdings with the ECB. The items used for the calculation are published by the ECB ex post on a daily basis in the "Data on daily liquidity conditions".
Adjusted Liquidity in Banking Sector	Log (€ billion)	Natural logarithm of the absolute amount of liquidity in the banking sector. It is calculated as the logarithm of the sum of banks' current account and deposit facility holdings with the ECB. The items used for the calculation are published by the ECB ex post on a daily basis in the "Data on daily liquidity conditions". The variable is centered around its mean value in 2006.
Excess Liquidity Ratio	%	Relative excess ECB liquidity in the banking sector. It is computed as the sum of banks' current account and deposit facility holdings with the ECB divided by the aggregated minimum reserve requirement imposed by the ECB for the specific reserve maintenance period, minus 1. The items used for the calculation are published by the ECB ex post on a daily basis in the "Data on daily liquidity conditions". The measure indicates the excess liquidity available in the banking sector above the "regular" level which is the minimum reserve requirement imposed by the ECB for the specific reserve maintenance period.
Liquidity Monetary Operations	Log (€ billion)	Natural logarithm of the absolute amount of liquidity provided by the ECB by means of open market operations and the marginal lending facility. The items used for the calculation are published by the ECB ex post on a daily basis in the "Data on daily liquidity conditions". The regular open market operations consist of the main refinancing operations and the longer-term refinancing operations. These items have been complemented in our observation period by a covered bond purchase program announced on March 7, 2009 and introduced on July 2, 2009, and by the liquidity absorbing provision of foreign currency to Eurosystem counterparties via FX swaps in June 2009, which in the period before were contained in the autonomous factors.
Bank Risk Variables		
Bank Risk	Integer	Credit default swap spread in bps on the bank's senior unsecured debt with 5 year maturity.
High Bank Risk	Dummy	Dummy variable, derived from an iterative procedure. First, we use Moody's ratings and derive the lowest CDS spread of all banks rated A1 or worse in each week. Second, all banks with a CDS spread higher than this threshold are classified as high risk banks. Third, in each week we compute the ratio of the average spread of all banks above and below the threshold. If this ratio has a value of 2 or larger we stick to this classification. If the ratio is smaller than 2, we derive a second threshold, using decreasing iterative steps of 0.5bps starting from the first threshold, below which banks are classified as low risk banks such that the ratio of the average weekly spread of all banks above and below the threshold is at least 2.
Deposit Transaction Variables		
ECB Deposit Facility Rate	%	Interest rate at which banks can deposit funds overnight at the ECB deposit facility. In theory, it constitutes the lower bound interest rate for the interbank money market.
Deposit Spread	bps	Spread between the deposit rate and the ECB deposit facility rate.
log(Notional Deposit Amount)	Log (€)	Natural logarithm of the notional € deposit amount of the transaction.
Duration	days	The duration of the deposit transaction which ranges from overnight up to one week, i.e. 7 days.

Bank Competition	Integer	The number of valid bank bids per requested deposit transaction. Only quotes not canceled until the end of the bidding process are considered as valid. Only one valid quote per bank in each transaction is considered. Banks cannot observe other bank's bids. Higher values indicate more market competition.
Number of outstanding Deposit transactions of the Firm	Integer	Outstanding number of deposit transactions of the firm on the platform (not matured yet), excluding the current transaction. The maximum maturity of deposits considered for this variable is one week.
Bank Accounting Variables		
log(Total Assets)	Log (€ million)	Natural logarithm of the bank's total assets in €-million as reported on the balance sheet.
Leverage		Ratio of total liabilities to total assets as reported on the balance sheet.
Off-Balance-Sheet Exposure	%	Ratio of off-balance-sheet items divided by the sum of total assets and off-balance-sheet items. The amount of off-balance-sheet items is used from Bankscope. It is calculated as the sum of managed securitized assets reported off-balance sheet, other off-balance sheet exposure to securitizations, guarantees, acceptances and documentary credits reported off-balance sheet, committed credit lines, and other contingent liabilities.
Return on Assets	%	Return on assets as calculated by Bankscope.
Total Asset Growth	%	Annual asset growth as calculated by Bankscope based on annual balance sheet data.
Net Interest Margin	%	Net interest margin as calculated by Bankscope.
Cost/Income Ratio	%	Ratio of administrative costs to income excluding increase of risk provisions as calculated by Bankscope.
Net Loans/Customer Deposits	%	Ratio of net loans to customer deposits as calculated by Bankscope.
Non-performing Loans/Total Loans	%	Ratio of non-performing loans to gross loans as calculated by Bankscope.
Net Derivative Exposure / Total Assets	%	Ratio of the difference between derivative assets and derivative liabilities to total assets.
Liquid Assets/Short-Term Funding	%	Ratio of liquid assets to short-term funding as calculated by Bankscope.
Total Deposits/Total Assets	%	Ratio of total deposits and short-term funding to total assets based on annual balance sheet data.
Borrower Variables		
log(Total Assets)	Log (€ million)	Natural logarithm of the firm's total assets in €-million as reported on the balance sheet.
Leverage	%	Ratio of total liabilities to total assets as reported on the balance sheet.
Current ratio	%	Ratio of current assets to current liabilities as reported on the balance sheet.
Coverage	%	Ratio of EBITDA to interest expenses as reported in the income statement.
Market to Book	%	Ratio of the sum of book value of liabilities and market value of equity to book value of total assets. The date are collected from Compustat for firms available in Compustat North America. For firms only available in Compustat Global we use the market to book ratio as reported by Datastream.
Tangibility	%	Ratio of tangible assets (property, plant and equipment) to total assets as reported on the balance sheet.
Log(Number of Loans of Borrower)	Integer	Natural logarithm of the number of loans (packages) of the borrower in LPC Dealscan from 1982 to the start of the loan.
Borrower IPO (years)	Integer	Years since the IPO of the borrower.
Credit Rating		
Investment Grade Rating	Dummy	Dummy variable equal to one, if the borrower's S&P long-term issuer rating is BBB- or better.
Non-Investment Grade Rating	Dummy	Dummy variable equal to one, if the borrower's S&P long-term issuer rating is BB+ or worse.
Not Rated	Dummy	Dummy variable equal to one if the borrower has no S&P long-term issuer rating.
Syndicated Loan Variables		
All in Spread Drawn	bps	Coupon spread over LIBOR plus one time fees on the drawn portion of the loan as stated in Dealscan

log(Facility Size)	log (€ million)	Natural logarithm of the loan facility amount in year 2006 € million.
log(Maturity in Months)	log (Integer)	Natural logarithm of the maturity of the loan in months
Secured	Dummy	Dummy variable equal to one if the loan is secured.
Performance Pricing	Dummy	Dummy variable equal to one if the loan contains a performance pricing grid.
Loan Type		
Term Loan		Dummy variable if the loan is defined as type "Term Loan" in Dealscan.
Revolver/Line >= 1 Yr.		Dummy variable if the loan is defined as type "Revolver/Line >= 1 Yr." in Dealscan.
364-Day Facility		Dummy variable if the loan is defined as type "364-Day Facility" in Dealscan.
Bridge Loan		Dummy variable if the loan is defined as type "Bridge Loan" in Dealscan.
Revolver/Line < 1 Yr.		Dummy variable if the loan is defined as type "Revolver/Line < 1 Yr." in Dealscan.
Loan Purpose		
Corporate purposes		Dummy variable if the loan is defined to have the primary purpose "Corp. purposes" in Dealscan.
M&A related		Dummy variable if the loan is defined to have a M&A-related primary purpose in Dealscan (e.g., LBO, MBO, SBO, Takeover).
Debt Repayment		Dummy variable if the loan is defined to have the primary purpose "Debt Repay." in Dealscan.
Working Capital		Dummy variable if the loan is defined to have the primary purpose "Work. cap." in Dealscan.
Other		Dummy variable if the loan is defined to have a different primary purpose in Dealscan than those above.
Time Indicator Variables		
Crisis until Full Allotment	Dummy	Dummy variable which is one from August 8, 2007 until October 7, 2008.
Full Allotment Period	Dummy	Dummy variable which is one from October 8, 2008 until the end of our observation period June 30, 2010. On October 8, 2008 the ECB announced that it will allot the full amount banks request via the refinancing operations at a fixed rate given sufficient adequate collateral, in contrast to the prior competitive tender with limited allotment.
Further control variables		
3 Month EURIBOR-EONIA Swap Spread	bps	Spread between the 3 month EURIBOR and the 3 month EONIA swap. It is an indicator for the risk in the market excluding interest rate change risk and interest rate expectations.
End of Reserve Maintenance Period	Dummy	Dummy variable which is one on the last day of the ECB's reserve maintenance period.

NOT FOR PUBLICATION

Does Lack of Financial Stability Impair the Transmission of Monetary Policy?

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Appendix A2. Liquidity in the Eurosystem and monetary policy implementation

The ECB is the only institution which has the ability to create Euro liquidity (also known as "base money").[1] It can do so by buying assets in exchange for Euro currency or by lending Euro liquidity to banks and other institutions. In a fiat money, floating exchange rate world all liquidity will eventually (after having flown through the economy) end up as either physical bank notes or as bank reserves and deposits in the Eurosystem held at the ECB.[2] The balance sheet of the ECB reflects this system. The asset side shows the creation of money by means of different operations, the liability side provides an overview of the allocation of liquidity in the Eurosystem.

Assets		Liabilities	
Autonomous liquidity factors		**Autonomous liquidity factors**	
Net foreign assets	387.1	Banknotes in circulation	285.8
		Government deposits	57.2
		Other autonomous factors (net)	92.1
			435.1
Autonomous factors are not under direct control of the ECB		**Current account holdings** covering the minimum reserve system	134.9
Monetary policy instruments		**Monetary policy instruments**	
Main refinancing operations	123		
Longer-term refinancing operations	60		
Marginal Lending facility	0	Deposit facility	0.1
Main lever to control overall liquidity		Liquidity in the Banking Sector	
	570.1		**570.1**

Graph: Simplified ECB balance sheet as of March 1, 2002; Source: ECB.

The ECB creates a structural demand for liquidity by banks by imposing a minimum reserve requirement for each bank. To meet this reserve requirement, a bank has to hold on average sufficient funds over one month in a current account at the ECB. The imposed reserve requirement is remunerated at the interest rate of the main refinancing operations while excess reserves do not yield any interest rate. Accordingly, each bank has an incentive to hold on average exactly the imposed reserve requirement (given positive interest rates for the ECB deposit facility). If a bank

[1] The Monetary Policy of the ECB, published in 2011, p. 59
[2] FT Alphaville on July 3, 2012 – The Base Money Confusion, Author: Izabella Kaminska

has excess reserves it can hold these overnight in the ECB deposit facility. The interest rate is however much lower than the interest rate of the main refinancing operations and provides (in theory) a lower boundary for banks to deposit funds in general.

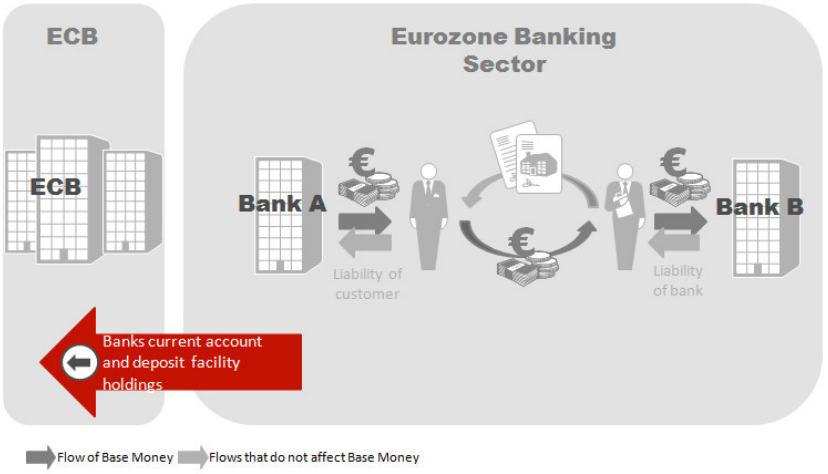
The funds required to meet the reserve requirement are provided by the ECB via the monetary policy instruments on the asset side such as the main refinancing operations (MROs), long-term refinancing operations (LTROs), and the marginal lending facility. In regular market periods, the MRO and LTRO are fixed amounts, previously determined by the ECB, which are allocated to the winning banks after a competitive bidding process. The MRO have a maturity of one week and the LTRO a maturity of three months (additional LTROs have been conducted since the crisis with maturities of up to three years). Furthermore, the ECB provides banks with overnight liquidity via the marginal lending facility at an interest rate much higher than the MRO or the LTRO interest rate. Accordingly, borrowing funds from the ECB via the marginal lending facility is very expensive and provides (in theory) an upper boundary for banks to obtain funds. With these operations the ECB ensures in regular market periods that banks are able to meet their reserve requirements while at the same time ensuring that liquidity is scarce enough to establish the targeted policy interest rate in the money market.

The only unknown for the ECB to establish the targeted policy interest rate are the autonomous factors such as banknotes in circulation, government or national central bank deposits directly held with the ECB, or foreign assets and liabilities (for example with other central banks). The ECB has to forecast the development of these.

The ECB intends to provide that amount of liquidity to banks via the refinancing operations which allows all banks to exactly hold their reserve requirement. Due to the competitive allocation mechanism funds are not optimally allocated to the individual banks immediately after allotment. Remember that borrowing at the marginal lending facility is prohibitively high while depositing at the marginal deposit facility pays only a very low (since June 11, 2014 even a negative) interest rate. Accordingly in regular time periods, the interbank market ensures an adequate allocation of central bank liquidity among banks such that each bank is able to hold its reserve requirement. If this interbank market does not function, banks might on aggregate obtain more funds via the refinancing operations than necessary to individually ensure that they are able to comply with their reserve requirement. Given that the autonomous factors do not change substantially, it should imply that banks deposit funds at the marginal deposit facility. Accordingly, holdings in the marginal deposit facility on average only reflect excess liquidity for banks and are not related to a possible credit crunch in the economy (a very common misperception).

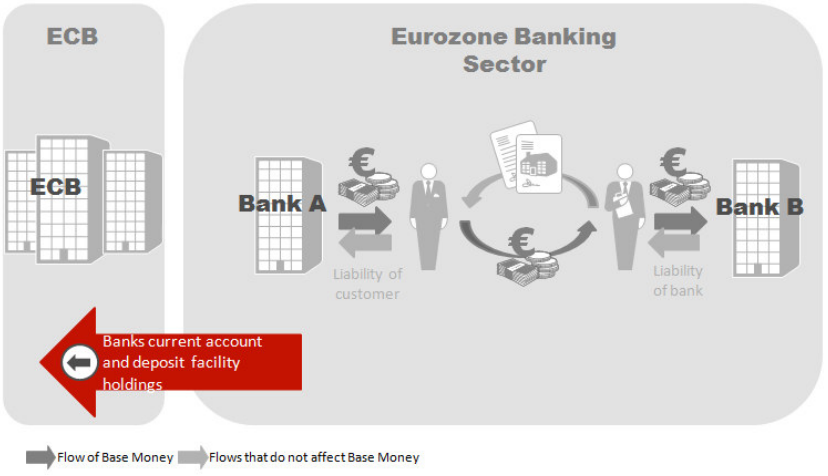
In the following, we provide examples which show that only the ECB has the ability to create Euro liquidity and that funds issued by the ECB will eventually return to an account held with the ECB if they are not held as banknotes.

Example 1: Bank liquidity is provided and deposited at the ECB or another bank



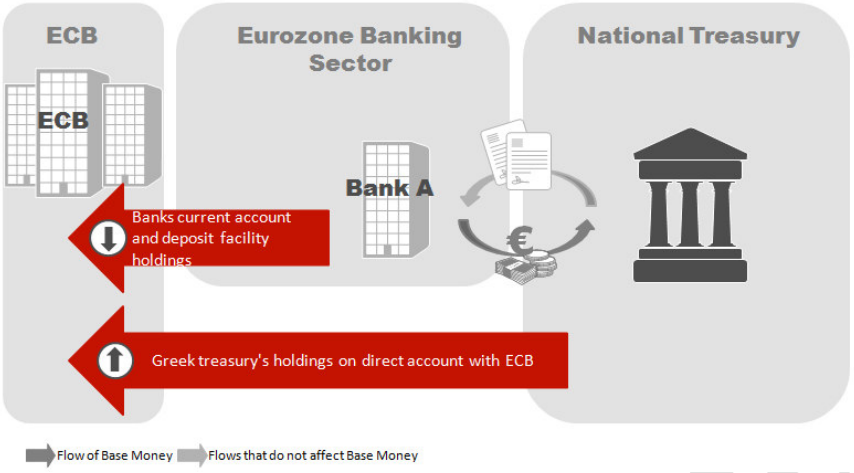
Bank A obtains liquidity via the refinancing operations from the ECB against collateral. It can deposit these funds at its account with the ECB to fulfill its reserve requirements or at the marginal deposit facility. It can also deposit the funds in the account of another bank which then has the same options as bank A. The aggregate holdings on the accounts with the ECB increase by the amount issued by the ECB via the refinancing operations.

Example 2: Bank A grants a loan to a firm which buys real estate



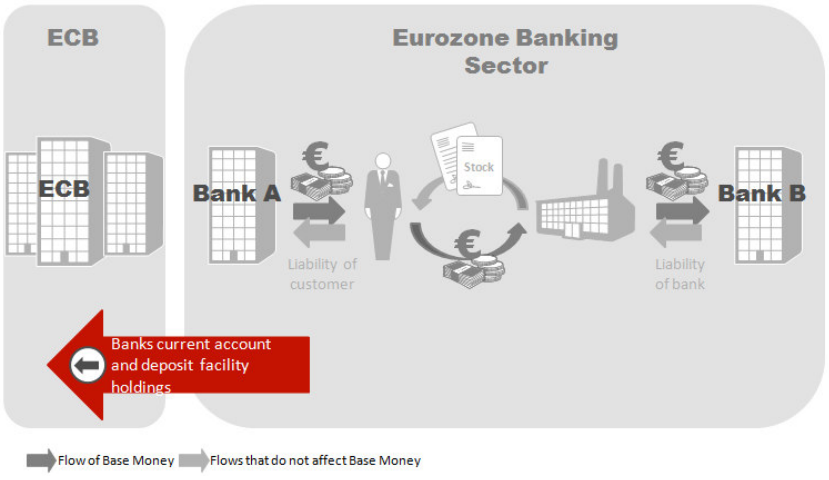
Bank A grants a loan to a firm which buys real estate from another firm which has an account at another bank. This implies that the liquidity holdings of bank A decrease by the amount transmitted to bank B. The liquidity of bank B increases by the exact same amount and accordingly the total liquidity in the banking sector as well as the aggregate holdings with the ECB remain constant. The only possibility to withdraw liquidity from the banking sector is if the money would be kept in cash. This would impact the autonomous factors to be forecasted by the ECB.

Example 3: Bank A buys government bonds in the primary market



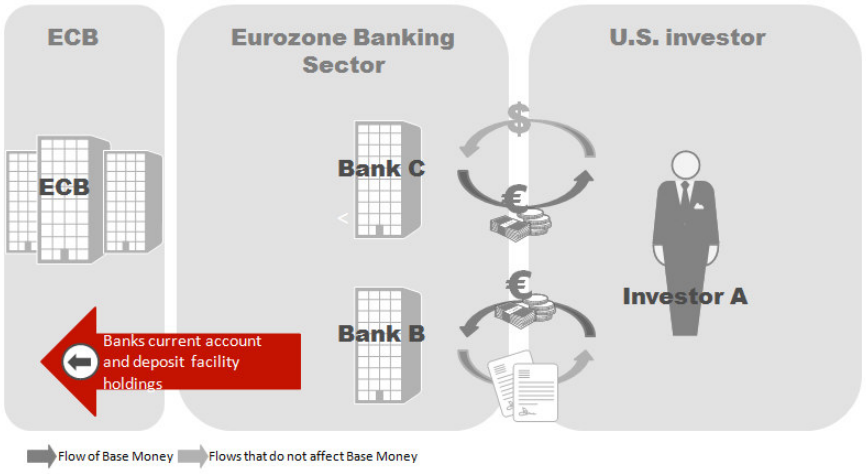
A government issues new debt and receives money from bank A against issuing claims. The government can deposit this money at a bank or buy other assets and transfer the purchase price to another bank. This increases liquidity by the same amount as it is reduced by the money bank A pays for the bonds which the latter might withdraw from its ECB account or from the account at another bank whose ECB account balance reduces. There might be a temporary reduction of liquidity in the banking sector when the government deposits the bond proceeds directly in its account at the ECB (if it has one) which should however not last very long because it is very costly.

Example 4: Investor A buys stocks of Firm B in the primary market



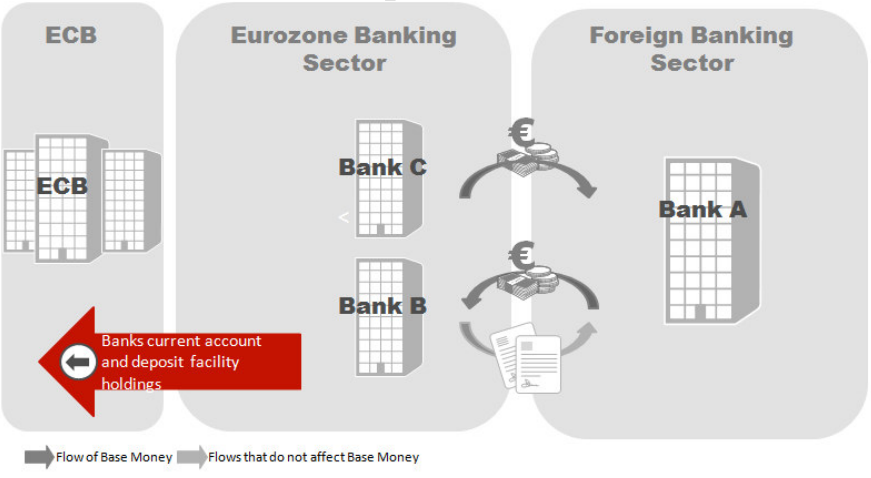
The liquidity holdings of bank A decrease by the amount the customer withdraws funds from her account. At the same time the liquidity holdings of bank B increase by the amount the issuing firm receives and transfers it to its account. The total liquidity in the banking sector as well as the aggregate holdings with the ECB remain constant.

Example 5: US investor A buys stocks of Eurozone bank B in the primary market



US investor A exchanges US$ into Euros at bank C and buys the stock of bank B. Bank B deposits these funds at the ECB or another bank. Accordingly, the (Euro) funds of bank C decrease by the same amount as they increase for bank B. The total liquidity in the banking sector as well as the aggregate holdings with the ECB remain unchanged.

Example 6: US Bank A buys shares of Eurozone Bank B



If bank A has an account at a bank of the Eurosystem the money is again only transferred to another bank in the Eurosystem and liquidity in the banking sector as well as the aggregate holdings with the ECB do not change. The only possibility to change the amount of aggregate central bank liquidity is if US bank A holds its €-funds in cash. This changes the autonomous factors which are forecasted by the ECB. However, when these funds are transferred back to a bank in the Eurosystem due to for example a purchase of €-assets the liquidity in the banking system increases by the same amount again.

Table 11 long version. Debt Capital Structure and Firm Characteristics: Intensive Margin

The table reports OLS regressions of changes in borrower variables of intensive margin borrowers in the full allotment period on bank risk and control variables. All variables are derived on the firm-level and measured in real terms with 2006 as the base year using the consumer price index (CPI) as published by the OECD. Panels A to C use data from S&P's Capital IQ, Panels D to I use data from Compustat. Asset growth is the ratio of total assets in t divided by the value of total assets in t-1, minus 1. Payouts are measured by total dividends, investment is measured by total invested capital, and employment is the number of employees in thousand. The panels show regression results of either pp.Δ (percentage point differences), or logΔ (log differences) or Δ (differences) from year t to t+1, t to t+2, and t to t+3, and t-3 to t, t-2 to t, and t-1 to t with t as the year when the loan is initiated in the full allotment period, on several control variables. High Bank Risk is a dummy variable defined using banks' CDS spreads and explained in detail in Appendix A1. High Bank Risk | only High Bank Risk Prior Full Allotment is defined as a borrower having received loans from only high risk banks prior to the full allotment period, that is from January 2006 until October 7, 2008, and receiving a loan from a high risk bank in the full allotment period. High Bank Risk | High and Low Bank Risk Prior Full Allotment is defined as a borrower having received loans from both low and high risk banks prior to the full allotment period and receiving a loan from a high risk bank in the full allotment period. All models include a borrower's log of total assets, leverage, current ratio, coverage, market to book ratio, and tangibility, and time (year) fixed effects (FE), borrower industry code FE, and borrower rating FE. All variables are defined in Appendix A1. Borrower accounting control variables are used as stated in the annual report in the year prior to the transaction. The statistical significance of results is indicated by * = 10% level, ** = 5% level and *** = 1% level using heteroscedasticity-robust standard errors clustered at the firm-level.

Panel A: Term Loans/ Total Debt	pp.Δ (t-3; t)		pp.Δ (t-2; t)		pp.Δ (t-1; t)		pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	-2.018		-0.144		-3.951**		-2.531**		-3.705**		0.346	
High Bank Risk | only High Bank Risk Prior Full Allotment		3.995		1.493		-8.332		-3.275		-0.069		5.047
High Bank Risk | High and Low Bank Risk Prior Full Allotment		-2.206		-0.200		-3.599**		-2.453**		-4.005**		-0.066
Observations	205	205	208	208	225	225	212	212	213	213	211	211
R-squared	0.875	0.878	0.802	0.802	0.695	0.699	0.791	0.791	0.829	0.831	0.839	0.841

Panel B: Revolving Loans/ Total Debt	pp.Δ (t-3; t)		pp.Δ (t-2; t)		pp.Δ (t-1; t)		pp.Δ (t; t+1)		pp.Δ (t; t+2)		ppt.Δ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	1.520		1.250		0.274		1.736		0.885		1.718	
High Bank Risk | only High Bank Risk Prior Full Allotment		6.048		0.976		-2.327		-2.612		-5.678		-10.149
High Bank Risk | High and Low Bank Risk Prior Full Allotment		1.411		1.268		0.492		2.266**		1.658*		3.116**
Observations	179	179	176	176	186	186	191	191	195	195	195	195
R-squared	0.825	0.833	0.834	0.834	0.762	0.765	0.866	0.874	0.856	0.872	0.791	0.833

Panel C: Notional Outstanding/ Total Debt	pp.Δ (t-3; t)		pp.Δ (t-2; t)		pp.Δ (t-1; t)		pp.Δ (t; t+1)		pp.Δ (t; t+2)		pp.Δ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	0.245		0.580		0.684		1.654**		1.225*		1.269	
High Bank Risk | only High Bank Risk Prior Full Allotment		-0.172		-1.139		1.042		2.492**		1.306		7.336**
High Bank Risk | High and Low Bank Risk Prior Full Allotment		0.305		0.829		0.633		1.540*		1.213*		0.439
Observations	256	256	256	256	256	256	250	250	248	248	248	248
R-squared	0.276	0.278	0.533	0.552	0.501	0.503	0.480	0.483	0.428	0.428	0.372	0.417

Panel D: Total Liabilities	logΔ (t-3; t)		logΔ (t-2; t)		logΔ (t-1; t)		logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	0.063		-0.018		0.041		-0.007		0.001		-0.007	
High Bank Risk | only High Bank Risk Prior Full Allotment		-0.126		-0.251		-0.112**		-0.016		-0.016		0.023
High Bank Risk | High and Low Bank Risk Prior Full Allotment		0.102		0.031		0.073		-0.006		-0.006		-0.011
Observations	270	270	270	270	270	270	267	267	261	267	258	258
R-squared	0.618	0.638	0.637	0.677	0.544	0.579	0.399	0.399	0.515	0.399	0.685	0.686

Panel E: Payouts	logΔ (t-3; t)		logΔ (t-2; t)		logΔ (t-1; t)		logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	-0.124		-0.153		-0.066		-0.370***		-0.206*		-0.334***	
High Bank Risk | only High Bank Risk Prior Full Allotment		0.141		0.270		0.141		-0.087		0.251		0.475
High Bank Risk | High and Low Bank Risk Prior Full Allotment		-0.151		-0.196		-0.089		-0.401***		-0.241**		-0.370***
Observations	226	226	226	226	231	231	229	229	223	223	219	219
R-squared	0.691	0.701	0.736	0.761	0.747	0.756	0.515	0.530	0.629	0.659	0.651	0.691

Panel F: Capital Expenditures	logΔ (t-3; t)		logΔ (t-2; t)		logΔ (t-1; t)		logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	-0.009		0.022		0.000		-0.144*		-0.079		-0.066	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-0.406		-0.283		-0.247*		-0.330		0.041		0.019
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		0.074		0.085		0.052		-0.112*		-0.099*		-0.079
Observations	270	270	270	270	270	270	267	267	261	261	258	258
R-squared	0.576	0.614	0.453	0.489	0.386	0.420	0.561	0.573	0.575	0.582	0.672	0.674

Panel G: Asset Growth	pp.Δ (t-3; t)		pp.Δ (t-2; t)		pp.Δ (t-1; t)		pp.Δ (t; t+1)		pp.Δ (t; t+2)		pp.Δ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	6.756		-5.282		1.516		-1.317		-0.021		1.448	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-17.349		-24.706		-8.241		-19.283*		-11.552**		-10.077*
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		11.761		-1.249		3.542		1.793		1.871		3.286
Observations	270	270	270	270	270	270	267	267	261	261	258	258
R-squared	0.486	0.546	0.541	0.598	0.573	0.585	0.472	0.504	0.609	0.637	0.682	0.702

Panel H: Investment	logΔ (t-3; t)		logΔ (t-2; t)		logΔ (t-1; t)		logΔ (t; t+1)		logΔ (t; t+2)		logΔ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	0.084		0.015		0.010		0.003		-0.004		-0.013	
High Bank Risk ǀ only High Bank Risk Prior Full Allotment		-0.037		-0.193		-0.149*		0.006		-0.022		0.024
High Bank Risk ǀ High and Low Bank Risk Prior Full Allotment		0.107		0.056		0.044		0.003		-0.001		-0.019
Observations	268	268	267	267	264	264	267	267	261	261	258	258
R-squared	0.420	0.432	0.500	0.556	0.462	0.505	0.381	0.381	0.565	0.565	0.677	0.679

Panel I: Employment	Δ (t-3; t)		Δ (t-2; t)		Δ (t-1; t)		Δ (t; t+1)		Δ (t; t+2)		Δ (t; t+3)	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
High Bank Risk	-2.878		-3.160		-4.545*		-1.019		-2.107		-3.502	
High Bank Risk | only High Bank Risk Prior Full Allotment		-0.807		-2.475		-1.318		1.042		3.748		4.013
High Bank Risk | High and Low Bank Risk Prior Full Allotment		-3.333		-3.326		-5.278*		-1.408		-2.890		-4.473
Observations	251	251	244	244	252	252	249	249	243	243	240	240
R-squared	0.751	0.752	0.810	0.810	0.719	0.723	0.367	0.373	0.562	0.569	0.571	0.577