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EUROSISTEMA

Temi di discussione

(Working Papers)

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Number 1238

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ISSN 1594-7939 (print)
ISSN 2281-3950 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

WHAT DO ALMOST 20 YEARS OF MICRO DATA AND TWO CRISES SAY ABOUT THE RELATIONSHIP BETWEEN CENTRAL BANK AND INTERBANK MARKET LIQUIDITY? EVIDENCE FROM ITALY

by Massimiliano Affinito*

Abstract

This paper studies the mutual interplay between central bank (CB) liquidity provisions and interbank market (IM) liquidity exchanges, exploring whether the relationship changes during IM impairments and CB massive liquidity injections in the global and sovereign crises. The analysis uses a dataset containing seventeen years of monthly bank-by-bank and counterparty-by-counterparty data from 1998 to 2015 in Italy. The results show the existence of complementarity. Banks receiving CB liquidity redistribute more to other banks. When CB liquidity increases exponentially during the crises, some healthy banks specialize in interbank lending. The complementarity helps to offset euro-area fragmentation via domestic interbank relationships and to adjust the collateral and maturity profiles of banks' liquidity.

JEL Classification: G21, E52, C30.
Keywords: liquidity, financial and sovereign crises, central bank intervention, interbank.

Contents

* Bank of Italy, DG Economics, Statistics and Research.

1. Introduction[1]

In normal times central bank (CB) liquidity is typically provided as demanded, usually not much demanded, by the banking system in order to avoid interest rate volatility, while the liquidity exchanged in a well-functioning interbank market (IM) overcomes the asynchronous nature of loan and deposit creation across banks. The situation radically changed in the recent crises. Both in the global financial crisis and in the euro-area sovereign debt crisis, IMs experienced considerable impairments and CBs, including the ECB and the Federal Reserve, introduced a wide range of measures to improve liquidity amount and flow, covering conventional strong reductions in policy rates, unconventional massive liquidity injections into the system, changes in the standard operational frameworks and the creation of more unusual forms of special liquidity schemes. The attention to liquidity and liquidity markets is substantially grown and so the need for a better understanding of the effects of CBs' mighty liquidity provisions. This paper contributes analysing jointly and at a granular data level the relationship between CB provision of liquidity and the IM liquidity circulation in Italy, with the goal of exploring whether, to what extent and how the uptake of CB liquidity spurs, inhibits or does not affect at all the liquidity exchange in the IMs, and further whether the relationship changes over time, in normal times and in the crises, during regular or massive liquidity injections.[2]

The empirical results show that both in normal times and in the crises the relationship between CB and IM liquidity is complementary: banks that rely more on CB liquidity lend more to other banks and CB liquidity injections speed up interbank lending. The outcome is even stronger when CB liquidity increases exponentially during the euro-area sovereign crisis, meaning that in situations of funding constraints, particularly faced in the period by Italian banks in international wholesale markets, CB liquidity alleviates the inability to borrow and facilitates the flow of interbank liquidity. Reasons behind the complementarity relationship arise when I split the interbank exposures according to the IM segment, which shows that CB liquidity injections allow banks to balance the cross-border liquidity reduction caused by the euro-area fragmentation (through domestic interbank relationships) and to adjust their collateral and maturity profiles (through the alternation of secured versus unsecured and overnight versus longer-term exposures).

[1] I would like to thank Giorgio Albareto, Celso Brunetti, Alain Coen, Riccardo De Bonis, Stefano Federico, Giuseppe Ferrero, Laurence Lescourret, Ruslán Gómez Nesterkín, Mario Pietrunti, Alberto Franco Pozzolo, Alessandro Secchi, Enrico Sette, Luigi Federico Signorini, the participants at the seminar held at the Bank of Italy and two anonymous referees for their helpful comments. The opinions expressed are only mine and do not necessarily reflect those of the Bank of Italy.

[2] In the paper I consider all liquidity injected by CB through banks (both through open market operations with banks or direct loans to the banking system), which is the typical way to inject liquidity in the system in the euro-area. Institutional backgrounds are detailed in Section 2.

The outcomes of the paper are relevant because an adequate amount of liquidity in the system and an adequate liquidity circulation through the banking system are both crucial for the correct functioning of the economy. IMs are crucial for both banks and CBs: they are the first channels through which monetary policy is implemented, provide benchmark rates for all financial assets, allow efficient allocation of funds and risk sharing between banks, assure peer monitoring and market discipline. If liquidity is not channelled, CBs' monetary policy transmission mechanisms may be ineffective, the intermediation to households and firms may stagnate, the orderliness of the payment system is impaired. Until the global financial crisis, most macroeconomic models did not take into account that monetary policy is implemented through the banking system and IMs and the macroeconomic effects of monetary policy and its implementation through IMs were analysed independently. In the aftermath of the crisis, numerous calls have been made for the development of macroeconomic models with an explicit role for banks and then for IMs. A recent literature has shown that, when IMs do not function smoothly, the monetary policy is less effective (e.g., Bianchi and Bigio, 2013; Piazzesi and Schnider, 2017; Arce et al., 2017) and the economic activity and welfare decline (e.g., Bruche and Suarez, 2010; Gertler et al., 2016; Altavilla et al., 2018; De Fiore et al., 2019). IM impairments in fact force banks to de-leverage or to increase their holdings of liquid assets leading to a fall in lending. CBs may mitigate this decline by increasing the size of their balance sheets; however the alleviation is only temporary (through the channel of the funding side of banks) unless IM liquidity flow reacts positively to the liquidity provided by the CB. This is indeed the case in my results.

From a theoretical point of view the relationship between CB and IM liquidity is *a priori* uncertain. On the one hand, when CBs inject new liquidity, the portfolios of banks become more liquid and a part of risky assets are removed off banks' balance sheets (both directly, if the CB buys the assets in return for cash, and indirectly, if the assets are pledged as collateral for borrowing). In turn this strengthens banks' balance sheets, improves collateral values and lowers funding constraints so helping loosen credit restrictions and support general and IM intermediation (complementarity relationship between CB and IM liquidity). On the other hand, when CBs introduce new liquidity, especially through large injections, they may end up by intermediating between banks and bypassing the IM altogether (substitutability relationship). The former relations and predictions, which imply a complementary role between CB and IM, belong to a large part of the literature (e.g., Freixas et al., 2000; Allen and Carletti, 2008; Sundaresan and Wang, 2009; Freixas et al., 2011; Diamond and Rajan, 2011; Afonso et al., 2011; Acharya et al., 2012; Affinito, 2013; Bindseil, 2014; Hoerova and Monnet, 2016). The latter opposite predictions, which postulate a crowding out effect of CB interventions on IM liquidity, have gained space in the literature in

particular during the crises (e.g., Allen et al., 2009; Bruche and Suarez, 2010; Brunetti et al., 2011; de Haan and van den End, 2013; Gale and Yorulmazer, 2013; Heider et al., 2015). This paper contributes to this literature trying to shed light on the two opposite views.

My empirical analysis is carried out on the liquidity provided by the ECB to each bank operating in Italy. The analysis of the ECB suits well my purposes because the typical way to carry on monetary policy and to inject liquidity in the system in the euro-area is the direct lending to banks, both in normal times and in the crises, at least until my sample period, which ends in 2015 when the ECB launches the (temporary) QE program. The Italian banking system is an interesting case for three reasons. First, it is a leading euro-area banking system and, given Italy's bank-based economy, the interbank and bank credit markets are vital to the financing of the private sector. Second, in Italy during the two crises, and in particular in the sovereign crisis, banks experienced both a deep reduction in international wholesale IM funding (due to the euro-area fragmentation and the distrust of international investors towards the country) and a wide recourse to CB liquidity (around 20 % of the total amount injected by the ECB), which makes Italy an excellent testing ground for exploring the relationship between CB and IMs. Third, Italy has high quality granular data, with all relationships of each bank towards the CB and every single (domestic and foreign) IM counterparty, while a similar comprehensive micro-database does not exist for the euro-area as a whole (indeed a similar dataset exists only in few countries around the world). My dataset contains seventeen years of monthly bank-by-bank and counterparty-by-counterparty data from 1998 to 2015 along with a large set of bank-level characteristics.

The opportunity of using this unique and comprehensive micro dataset is a substantial advantage of the paper. The literature shows that analysing micro data matters. First, individual banks' behaviour contributes to determine both the effectiveness of monetary policy and the regular functioning of the system.[3] Second, compared to macro data, using micro data on bank-by-bank behaviour allows me to detect exactly the banks that obtain CB's liquidity and to analyse what they do with it throughout all liquidity market, including over-the-counter components, and to analyse the effects of CB liquidity provided to each bank on its IM gross and net positions. Third, and remarkably, using micro data on each bank's position towards each IM counterparty is a necessary ingredient for the correct identification of the relationship between CB and IM liquidity since it allows me to use a within IM counterparty estimation to disentangle the effects of interbank lending supply and demand. In line with the most recent literature on the transmission of shocks to banks (Khwaja and Mian, 2008; Paravisini, 2008; Schnabl, 2012), empirical identification relies on comparing the IM behaviour towards *the same IM counterparty* by at least two banks that are

[3] See Haldane, 2009; Acharya et al., 2011; Ashcraft et al., 2011; Castiglionesi and Wagner, 2013; Yellen, 2013; Memmel and Sachs, 2013; León et al., 2016.

differently exposed to CB liquidity. As far as I know, this is the first paper to apply this methodology to the IM. Yet the issue it addresses is in the IM even more substantial than in the firm-bank relationships, where the approach is extensively used. In the IM it is crucial to control for the behaviour of counterparties (absorbing all counterparty heterogeneity through time-varying IM counterparty bank fixed effects) exactly because they are banks and therefore their decisions contribute to define the CB and IM interaction and the effect of CB liquidity on IM.

The paper is also related to the literature on the effects of unconventional monetary policy on bank lending to the private sector during the crisis.[4] The transmission channel is similar: the CB liquidity injections, thanks to a positive funding shock, can restore bank credit supply to the economy. However, compared to these studies, my focus is on an earlier step of the monetary policy transmission mechanism: the relationship and the causal effect between CB liquidity and IM lending. Despite its relevance the issue is surprisingly less fathomed by the literature. Probably, the absence of micro data on lending and counterparty banks contributes to explain this disregard because hampers to control for unobserved time-varying IM counterparty-level effects.

My econometric analysis uses a simultaneous-equations model to examine the impact of CB on IM liquidity because this relationship is simultaneous and mutual (the IM may react to the provision of liquidity by the CB, and the CB liquidity may move in response to IM conditions) and the simultaneous-equations model endogenizes for both CB and IM liquidity, jointly and at the same time. I also compare the simultaneous-equation results with single-equation OLS estimations for both CB and IM liquidity. The results provide similar outcomes; however, the complementarity relationship results stronger in the simultaneous-equations system confirming that CB liquidity and IMs are jointly dependent.

The last part of the paper investigates the key players of IM and CB liquidity. The literature has long since recognized that liquidity markets are not made of homogenous banks (as modelled by Allen and Gale, 2000), but of key and minor players. Since my analysis shows that CB liquidity is redistributed in the IM, even in the crises, it implies that different types of banks exist: banks that demand and redistribute the CB liquidity and banks that do not demand the CB liquidity but use the IM liquidity. Therefore identifying bank types and key players in CB and IM liquidity completes the analysis. The results show that the activity of liquidity redistribution throughout the IM is concentrated in a group of sound, well capitalized banks, with abundant retail fundraising and few customer loans, which specialize in interbank lending and become liquidity spreaders of CB

[4] Among others, Bhattarai and Neely (2016); Chakraborty et al. (2016); and Rodnyansky and Darmouni (2017) for U.S. policies; Acharya et al. (2016); Acharya et al. (2019) and Peydró et al. (2017) for European policies; and still Chodorow-Reich (2014); Andrade et al. (2015); Goldstein et al. (2016); Darmouni and Rodnyansky (2016); Daetz et al. (2016); Alves et al. (2016); Kandrac and Schlusche (2017); Carpinelli and Crosignani (2017).

liquidity. These banks could be identified as "money center banks", that is, intermediaries helping the CB implement monetary policy (Stigum and Crescenzi, 2007). For example, money center banks were common in the pre-crisis US IM, where the FED typically acted with a small group of money market primary dealers. The long time dimension of my dataset allows me to document that the role of money center banks grows in Italy exactly when the CB injections increase exponentially.

The rest of the paper is organized as follows. Section 2 describes some institutional aspects of the ECB monetary policy framework and the euro-area IMs, also providing some comparisons with the US market. Section 3 presents the data. Section 4 summarizes the main features of the empirical methodology. Sections 5 and 6 report the results. Section 7 concludes. The Appendix summarizes the statistical diagnostics and the robustness checks of the econometric analysis.

2. Institutional background

In all systems CB liquidity is mostly provided through the banking system and the IM. This holds even more true in the euro-area, where, compared to the FED and the US market, the role of banks in the financial system is more prominent, the IM is even more crucial, the Eurosystem operations are much more directed at the banking system, both in normal times and during the crises, and the number of banks participating in CB operations is much higher.

CBs usually have an ultimate objective (price stability or full employment), an intermediate objective (the short term interest rate), a more or less explicit operational target (the IM overnight interest rate), and several operational instruments: typically, open market operations, standing facilities and reserve requirements. The CBs' first tool are the open market operations (OMOs), which are defined as CB transactions with banks and other counterparties at the CBs' initiative to inject (or absorb) liquidity against collateral and with an haircut applied to the collateral.[5] OMOs may be basically distinguished in two types: purchase or sales of assets (usually debt securities) and direct collateralized loans to the banking system. The Federal Reserve uses OMOs that typically are conducted in the open market and are directed to a limited number of banks and other intermediaries. The Eurosystem typically uses OMOs conducted through auctions with banks (refinancing). In both systems, OMOs normally take place in the form of reverse transactions. Eurosystem OMOs include four categories of operation: main refinancing, longer-term refinancing, fine tuning and structural operations.[6]

[5] To be counterparties of monetary policy operations, typically banks have to meet some requirements.

[6] During the crisis, the FED also operated the Term Auction Facility (TAF), which provided credit to banks through an auction mechanism. In the euro-area, prior to the crisis, main refinancing operations were the most important in that they were used to signal the stance of monetary policy each week. Longer-term refinancing operations were

The CBs' second tool are the standing facilities. The standing facilities is the provision of direct lending to banks through CB operations at the initiative of banks, which CBs commit to carry out under certain conditions, and however against collateral and with an haircut applied to the collateral. The Federal Reserve standing facility is the discount window, which also provides a source of funding both for individual banks and for the banking system as a whole.[7] The Eurosystem standing facilities include two types of operations, both with an overnight maturity: the marginal lending facility and the deposit facility. The two facilities allow the ECB to tune the so called IM interest rate "corridor", which is used to avoid excessive variability in interbank interest rates.[8]

The CBs' third tool are the reserve requirements, which are a certain minimum level of deposits to be hold by all banks on their deposit accounts with the CB, according to the quantity and nature of the bank's customer deposits. A maintenance refinancing period determines the period over which this average is calculated. The main function of the minimum reserve requirements is to create a structural liquidity shortage in the banking system, which allows the ECB to control and stabilize IM rates.

Given an appropriately managed supply of aggregate liquidity, the distribution of liquidity among banks occurs through trades in the IM, which therefore plays a key role both in banks' liquidity management and for the implementation of monetary policy. This is the case in the US, where the overnight IM is known as the federal funds market ("fed funds") and the actual weighted average rate at which banks lend overnight is known as the fed funds rate. The FED uses an explicit operational target on IM rates announcing the so called fed funds target rate.[9] In the euro-area, although the Eurosystem does not have an explicit operational target on IM rates, the role of IM is

characterized by a maturity of 3 months, while during the crises the ECB recurred to LTROs more frequently and with a longer maturity. Fine-tuning operations are usually held on the last day of a reserve maintenance period.

[7] There are three types of discount window credit in the US: primary credit (for banks in sound conditions), secondary credit (banks not eligible for primary credit), and seasonal credit (for small banks with significant seasonal swings). The rate paid by banks for primary credit is lower than the rate paid for secondary or seasonal funding. At the Eurosystem, a comparable monetary policy tool to provide liquidity to banks facing temporary tensions at a higher-than-normal price is the emergency liquidity assistance (ELA). ELA is the exceptional provision of CB liquidity to an individual bank, which occurs when a bank cannot borrow from other banks or from the CB through normal facilities. Therefore, the FED discount window also includes the function carried out in the euro-area through the ELA. This explains why in the US the use of discount window by banks has more often had a stigma effect, that is a reputation for revealing banks' grave liquidity problems (see for example Bindseil, 2014; Garcia-de-Andoain et al., 2016). In the euro-area a key characteristic of ELA is that its responsibility lies with the national CBs of the Eurosystem and it is not analysed in this paper.

[8] The term "corridor" comes from the fact that the interbank rate is expected to be bounded above by the marginal lending facility rate and below by the deposit rate. In fact, normally, banks would prefer to obtain liquidity from the lending facility rather than from the market if the market rate were above the CB's lending rate, and symmetrically would prefer to deposit reserves at the CB's deposit facility rather than lend them in the market if the market rate were lower than the CB's deposit rate. Since 2008 the Federal also has introduced a corridor system and is paying interest rates on excess reserve balances.

[9] The fed funds market is an over-the-counter market and transactions are typically uncollateralized. Alternative to the fed funds market, some transactions have longer maturities and banks can also use the repo market.

even more pervasive because it is a bank-dominated system. IM transactions may be distinguished according to: the kind of market where they occur (regulated or over-the-counter transactions); the presence of collateral (unsecured and secured exposures); the (domestic or foreign) residence of counterparties; the bilateral or multilateral nature of transactions (that is, either traditional transactions between pairs of banks or through third parties, the so called Central Clearing Counterparties or CCPs).[10] Further details on IM structure are provided in the next Section 3, where I describe my dataset, which covers and breaks down all types of IM segments.

Very often, in particular prior to the crises, macroeconomic textbooks described monetary policy implementation placing a heavy emphasis on OMOs. Actually, in normal times it is not the quantity of money but the terms on which it is available that influence interest rates. Indeed, CBs can move rates simply by announcing their intentions. Therefore in normal times the main function of OMOs is not to set interest rates but to adjust the supply of liquidity so as to accommodate the banking system's demand for liquidity and to keep the overnight interbank rate (and then the chain of rates) stable around the target, avoiding volatility.[11] During the crises instead CBs increased massively liquidity injections, and so their balance sheet size, by undertaking several unconventional monetary policy measures. An important difference across CBs has been the relative emphasis given to bank versus non-bank markets. The FED has focused heavily on non-bank credit markets as well as on operations involving private sector securities. The ECB kept emphasizing banking system liquidity and then the relationship between CB and IM liquidity. Only in 2015 the Eurosystem started its QE program of securities' purchase, in any case a provisional program that supported and did not replace the direct loans to banks. .

Until 2015, when my sample time ends, Eurosystem unconventional measures included basically the following features. (i) The fixed rate, full allotment tender procedure used in the auctions with the banks. This meant that, while during normal times the ECB allotted only the amount of liquidity needed to cover the (estimated) structural liquidity deficit of the banking system, in the crises banks were allowed to obtain all liquidity they wished for only subject to adequate collateral provision. (ii) The related extension of the eligible collateral accepted in all Eurosystem operations, which made much easier the only real condition to obtain CB liquidity. (iii)

[10] Traditional transactions occur between pairs of banks and are therefore *bilateral*. Transactions through CCPs are multilateral (typically anonymized and collateralized) interbank transactions. Exposures via CCPs are structured as follows: i) the borrowing bank enters into a repurchase agreement with the CCP, borrowing the required amount and providing collateral; ii) the lending bank enters into a reverse repo with the CCP; iii) the CCP acts as the direct counterparty to the seller and the buyer, thus assuming the risk of borrower default. CCPs mediate the lending operations between more banks with the purpose of mitigating counterparty credit risk. For more details, see Affinito and Piazza (2018).

[11] Guthrie and Wright, 2000; Disyatat, 2008; Borio and Disyatat, 2009; McLeay et al., 2014; Bindseil, 2014; Jacab and Kumhof, 2015.

The extension in the amount and maturity of liquidity provided through longer-term refinancing operations (LTROs).[12]

3. The data

My first key variable – CB liquidity − is the ratio at bank level between the total liquidity provided by the CB to each bank in each period (alternatively gross or net of amounts re-deposited at the CB) and total assets. The total liquidity comprises all kinds of exposures, including loans granted through the non-standard measures taken by the Eurosystem during the crises. Indeed, the chance of using data on the *total* liquidity provided by the CB to each bank is a strength of the paper. For example, the empirical literature on banks' behaviour in CBs' auctions utilizes data on the CB liquidity obtained by each bank on single operations or types of operation or auction, which in my analysis would mislead the interchangeable role of CB liquidities. In the Eurosystem view, even in normal times, the types of operation are unimportant for the effectiveness of the monetary policy exactly because they are interchangeable (ECB, 2009 and 2011). For example, if one bank's bidding strategy fails or if the Eurosystem mistakenly injects too little liquidity by market operations, the bank can make up the difference by accessing the standing facilities. Even more, this is true during the crises when banks asking for CB liquidity can benefit from the fixed rate, full allotment tender procedure, which permits unlimited access to CB liquidity subject to adequate collateral.[13] The analysis is run on all liquidity provided by the Eurosystem through the Bank of Italy to all banks operating in Italy, domestic and foreign. The sample covers all banks operating in Italy, including banks never directly accessing CB liquidity, to avoid sample selection biases.

My second key variables are the IM exposures of each bank towards each IM counterparty. My data cover all IM exposures, including over-the-counter transactions and all types of IM segments (this is another advantage compared to the literature, which typically can use data on specific segments and excluding over-the-counter exposures). In addition to the study of the Total IM, I deepen my analysis splitting the Total exposures into different IM segments and investigating each segment separately. Specifically, I use three kinds of IM breakdowns. The first breakdown relies on the residence of counterparties (Domestic versus Foreign) to investigate the relationship between CB and both domestic and cross-border liquidity. The second breakdown is based on the seniority of exposures and detects two segments (Secured versus Unsecured exposures) to explore

[12] For more details, see Cecioni *et al.* (2011); Eser *et al.* (2012); ECB (2012), Affinito and Pozzolo (2017). In the case of the USA, it would have included the Term Auction Facility (TAF), the Term Securities Lending Facility (TSLF), the Term Asset-Backed Facility (TALF) and the Large-Scale Asset Purchases (L-SAP).

[13] In any case, in Italy CB liquidity comes almost entirely from main refinancing operations before the crisis and longer-term operations during the crises.

the use of collateral in IM transactions, which was stressed in the crises.[14] The third breakdown is based on the maturity of exposures and distinguishes two segments (Overnight versus Longer-Term) to explore the maturity of IM transactions, which also was affected by the crisis.

For each segment, I analyse separately the gross lending side (Credits), the gross borrowing side (Debts), and the Net Position (Credits minus Debts) of each bank. In fact, the IM is a two-sided market and the behaviour of a bank cannot be seized by only, say, Credits regardless of Debts, or vice-versa, because both are crucial in order to define the bank's conduct. Summing up, I use data on 4 IM breakdowns (Total; Domestic versus Foreign; Secured versus Unsecured; Overnight versus Longer-term) and for everyone I analyse the three positions (Credits, Debts and Net-Position): therefore, I analyse the IM though 12 variables. Of course, results and implications for the relationship between CB and IM liquidity are different for the three positions. In the next Section I also delve into the issue describing my strategy. I use quantitative measures of both CB and IM positions because in the crises the relevance lies in the amount of liquidity.[15]

The main source of my bank-by-bank and counterparty-by-counterparty data are the Bank of Italy's prudential supervisory reports. The Bank of Italy collects information on gross bilateral interbank exposures of each bank towards each interbank counterparty and the identity of every counterparty, domestic and foreign. The number $i = 1, 2, \dots, N_t$ of banks in the dataset varies in each period t reflecting the changes in the Italian banking system. The number of counterparties $j_{i,t} = 1, 2, \dots, C_{i,t}$ varies across banks and over time.[16] My variables are computed aggregating at banking group or independent bank level monthly bank-by-bank data. The aggregation at group level is preferable insofar as a group comprising various banks may decide to resort to CB and IM liquidity through one, several or all of them, and in any case these transactions are likely to be decided by the parent bank, and to fit into a group-specific scheme. Therefore, in my final dataset I analyse the relationship of each banking group (or independent bank) towards the CB and each other banking group (or independent bank).[17]

My sample period runs from June 1998 to May 2015: 17 years of month data; $t = 1, 2, \dots, T_i$, where $T_i = 204$ months when the bank i exists form the beginning. I use end-of-month stocks because, apart from information on auctions, which could replicate the frequency of the auctions themselves, the data are not available on a more frequent basis. The total number of observations N_t

[14] CCP exposures are all fully secured, while bilateral exposures may be secured or unsecured.
[15] From an estimation perspective, all the effects of interest rate developments are captured by the bank, IM counterparty and month dummies.
[16] The individual foreign counterparties are not available for all the sample period; however, even in those cases, I can utilize the country of origin.
[17] Data are cleaned-up to remove intra-group exposures. In order to separate the intra-group exposures, I used information on the identity of each counterparty and its group of affiliation. For the banks that changed group during my sample period, I traced the current group of affiliation in each *t*.

$\times T_i \times C_{i,t}$ is equal to 845,315 for the Net-Position, and it is lower for Credits (553,930) and for Debts (562,966) because of the one-position banks. To explore the impact of the crises on the relationship between CB and IM liquidity, I also split the entire sample period into three sub-periods. Although I experiment with alternative dates as a check, my basic estimations define the three spans as follows: normal times is the period from June 1998 to July 2007 (T is equal to 110); the global financial crisis is the period from August 2007 to July 2011 (T = 48); the sovereign debt crisis is the period from August 2011 to May 2015 (T = 46).

Figures 1 and 2 show that both the share of banks that are net-borrowers from the CB and the share of CB liquidity in banks' total assets grow during the two crises, in particular in the sovereign debt crisis after the two large 3-years LTROs conducted by the Eurosystem from the end of 2011. Figure 2 also shows that IM Net-Position of the Italian banking system is structurally negative. Figure 3 shows that the annual growth rates of CB liquidity peak twice: during the global financial crisis and then during the sovereign crisis. In the meantime, those of the IM gross positions first decrease and then bounce back.

Table 1 reports the summary statistics of the key variables. Table 2 shows the correlations. CB liquidity tends to be correlated positively with interbank Debts and Credits and negatively with Net Positions. In addition to data on CB and IM liquidity, my analysis utilizes a long list of bank specific covariates, again drawn from the Bank of Italy's prudential supervisory reports. The scope of these regressors is detailed in the next Section.

4. Empirical strategy

The paper aims at exploring at bank-counterparty level and on a long horizon the relation between CB and IM liquidity. As mentioned in Introduction, the relation is typically supposed to be jointly dependent. In fact the casual nexus may move in both directions. In some moments it may be the IM to react to the provision of liquidity by the CB, while in other moments it is the CB liquidity to move in response to IM conditions. Likewise, in some moments a bank treasurer may decide first the CB liquidity demand and then the IM conduct, while in other moments she may decide first the IM conduct and then the CB liquidity demand. The twofold causal nexus may be quite contemporaneous or almost, depending for example on CB changing policies or each bank's evolving liquidity needs, surpluses and opportunities. Therefore the most proper way to estimate such a two-way relationship is through a simultaneous-equation approach.[18]

[18] References include Davidson and MacKinnon (1993); Greene (2008); for a recent application Brick and Palia (2007).

(1) Simultaneous-equations system

In formal terms, the analysis uses the following complete system of simultaneous equations:

$$\begin{cases} cb_{i,t} = \alpha'_1\, im_{i,j,t} + \beta'_1\, M^R{}_{i,t-1} + \varphi'_1\, M1^I{}_{i,t-1} + \gamma'_1\, b_i + \delta'_1\, p_t + \theta'_1\, c_j + \varepsilon_{1i,t} & (1) \\ im_{i,j,t} = \alpha'_2\, cb_{i,t} + \beta'_2\, M^R{}_{i,t-1} + \varphi'_2\, M2^I{}_{i,t-1} + \gamma'_2\, b_i + \delta'_2\, p_t + \theta'_2\, c_j + \varepsilon_{2i,t} & (2) \end{cases}$$

where $cb_{i,t}$ is the liquidity provided by the CB to the bank i in the period t; $im_{i,j,t}$ is the IM position (Debts, Credits or Net-Position) of the same bank i in the same period t towards each single IM counterparty j. The variables $cb_{i,t}$ and $im_{i,j,t}$ are contemporaneous dependent variables, respectively in equation (1) and (2), and at the same time are endogenous explanatory variables in the other equation. The two equations are estimated as a simultaneous-equations system in my basic regressions and, to provide a comparison, they are also estimated through two single-equations OLS regressions. $M^R{}_{i,t-1}$ is a matrix of bank-level exogenous regressors (detailed below), common for each dependent variable. $M1^I{}_{i,t-1}$ and $M2^I{}_{i,t-1}$ are two distinct matrixes (specific for each endogenous variable) of bank-level instruments, which satisfy rank and order conditions to identify the system.[19] b_i, p_t and c_j are respectively bank, period and IM counterparty fixed effects, which control for bank-level and counterparty-level unobservable characteristics and take into account macroeconomic trends and all unobservable time-varying variables. α_1, α_2, β_1, β_2, φ_1, φ_2, γ_1, γ_2, δ_1, δ_2, θ_1, θ_2, are vectors of coefficients; $\varepsilon_{1i,t}$ and $\varepsilon_{2i,t}$ are identically and independently distributed idiosyncratic errors.

Equation (1), where banks' liquidity borrowing from CB (that is, the liquidity provided by CB to each bank) is the dependent variable, investigates the relation that moves from IM to CB liquidity. The equation resembles the literature on banks' behaviour in CB auctions, which estimates banks' participation in CB liquidity auctions as the dependent variable on the left hand side and bank characteristics as the determinists on the right hand side.[20] Equation (1) answers the general question of the characteristics (determinants) of banks that ask for CB liquidity. In my case, the crucial determinant is the IM position of each bank and α_1 is the coefficient of interest. The estimation verifies whether CB liquidity depends on banks' IM position and how banks that are

[19] The regressors in the matrixes $M^R{}_{i,t-1}$, $M1^I{}_{i,t-1}$ and $M2^I{}_{i,t-1}$ are lagged to avoid endogeneity in estimating $im_{i,j,t}$ and $cb_{i,t}$, and to replicate the publication delay needed for mutual assessment by banks.

[20] E.g. Peristiani (1998); Breitung and Nautz (2001); Nyborg *et al.* (2002); Furfine (2003); Linzert *et al.* (2007); Craig and Fecht (2007); Bindseil *et al.* (2009); Armantier *et al.* (2011).

seeking CB liquidity behave in the IM: in particular whether they use CB liquidity as an alternative funding source (substitute role) or to redistribute it (complementary role).

Equation (2) reverses the experiment. The equation explores the relation that moves from CB liquidity to the IM and analyses banks' characteristics as determinants of IM positions. This second estimation is the core of my analysis because the CB liquidity is estimated as the determinant/driver of IM positions and the coefficient of interest α_2 explicitly addresses the question of whether CB liquidity spurs (and then complements) interbank liquidity or on the contrary whether it does not affect or even inhibit IM liquidity.

(2) Expected signs

As mentioned, I analyse the three possible IM positions: gross Debts, gross Credits and Net-Position. The analysis of the three positions aims at providing a complete picture of CB and IM relations. Of course, the interpretation of the possible signs of α_1 and α_2 changes in the three positions, while it is basically the same in the two equations. Table 3 summarizes the potential findings.[21]

First, when $im_{i,j,t}$ is the Net-Position, if the coefficients of interest α_1 and α_2 are positive, this may indicate that banks that are asking for CB liquidity redistribute it in the IM (i.e., Credits > Debts) and CB liquidity provisions eases IM lending. This may be viewed as a sign of a complementary role in the sense that the liquidity redistributed in the IM and the liquidity provided by CB grow together in the same bank. However, if the effect on Net-Position is driven only by Debts' reduction, then Net-Position increase might be a sign of replacement (substitute role). Conversely, if α_1 and α_2 are both negative. Therefore, since the Net-Position may be driven by Debts, Credits or both, the analysis of gross positions is decisive.

Second, when $im_{i,j,t}$ are the IM Debts, if the signs of α_1 and α_2 were negative, there would be evidence that banks that are demanding CB liquidity use it as an alternative funding source (α_1) and that CB liquidity provision causes IM funding reductions (α_2). Therefore the outcome would be coherent with a substitute relationship between CB and IM liquidity. The opposite if α_1 and α_2 were positive. It is worth highlighting that, in the case of Debts, the expected sign of α_1 and α_2 appears less uncertain in the sense that the expected sign is negative insofar as it is plausible that the same bank borrowing from the CB should register (on average) less liquidity needs against the other banks and then should borrow less in the IM.

Instead, finally, when $im_{i,j,t}$ are the IM Credits, the result is *a-priori* more uncertain. In this case, if the coefficients α_1 and α_2 were negative they could provide an indication in favour of a

[21] The signs of α_1 and α_2 may be *a priori* different, which would suggest more complex relationships between CB and IM liquidity. However, we will see soon, *ex-post* this is not the case.

substitute role (that is, less need of using interbank lending); while if the coefficients were positive they would indicate clearly that banks asking for CB liquidity tend to redistribute it in the IM (α_1) and that CB injections benefit IM exchanges (α_2), therefore I could conclude clearly in favour of a complementarity relationship.

(3) Estimation method

As mentioned since the beginning, I apply for the first time to the IM, and then to bank-toward-bank relationships, the same methodology applied by Khwaja and Mian (2008) and many others since then, to bank-toward-firm relationships. In other words, the simultaneous-equations system is run at (*i, j, t*) bank-counterparty-time level, which allows to capture demand for interbank lending through the inclusion of interbank counterparties fixed effects. Thanks to the granularity of my data, the effect of CB liquidity provided to the single bank on bank IM lending is identified using within-counterparty variation, that is, comparing the IM behaviour towards *the same IM counterparty* in the same period across *banks with different levels* of CB liquidity. IM counterparty (borrowing bank) fixed effects absorb all demand side factors to study the pure response of lending-bank to CB liquidity provision. Further, compared to the literature on bank-toward-firm relationships, here the presence of counterparty fixed effects allows to control alternatively for demand or supply effects, since IM is a two-sided market. Specifically, when I analyse IM Credits, the presence of counterparty fixed effects (which in the case of Credits are borrowing banks) allows me to control for demand effects, while analysing Debts, the presence of counterparty fixed effects (which in the case of Debts are lending banks) allows me to control for supply effects.[22] The three kinds of fixed effects, bank-counterparty-time, may be variously combined. In particular, interacting counterparty and time fixed effects $p_t \times c_j$ allows to control for both observable and unobservable interbank counterparty heterogeneity, crucially capturing interbank counterparty demand (or supply) for interbank lending at time *t*. Moreover, respect to Khwaja and Mian (2008), interacting bank and counterparty fixed effects $b_i \times c_j$ allows to absorb any bank-counterparty time-invariant characteristics (including any time-invariant bank characteristic) and therefore to control for the (potentially) confounding factors at the bank-counterparty level, such as the strength of the IM customer lending relationships.

Accordingly, to obtain heteroskedasticity-robust standard errors and to control for possible autocorrelations across the same banking group and the same counterparty, standard errors are double clustered both at bank and counterparty level. Double-clustering allows for residual correlation within banks, given that treatment variables vary at the bank level, as well as within IM

[22] In the rest of the paper, I refer to these controls as control for counterparty effects or, in analogy with the literature on firm-bank relationship, simply as a control for demand effects.

counterparties, given that IM behaviour towards the same counterparty may be correlated across banks (for counterparties with many such relationships and not fully absorbed by counterparty fixed effects).

(4) Explanatory variables

The analysis includes the exam of individual bank characteristics as determinants of positions in both CB and IM liquidity, also to isolate the effect of CB liquidity on bank IM credit supply. To this purpose, equations (1) and (2) contain in the matrix $M^{R}_{i,t-1}$ a set of explanatory variables. Table 4 lists these covariates, their computations and summary statistics. All regressors are natural logarithms, ratios or dummy variables. The variable Retail Fundraising takes into account whether banks with more deposits and bonds from their retail customers take less CB liquidity and/or redistribute more in the IM; the variable Retail Loans controls for the liquidity intermediated onward to the economy (in addition to or in place of lending to banks). Three variables measure banks' health (Capital, ROE, Bad Loans) and are used to verify whether banks borrowing in the two wholesale liquidity markets are sounder, and whether sounder banks borrow from CB or IMs. Three variables (Portfolio of domestic or foreign Government Debt Securities and Bank Bonds) take into account whether and to what extent the availability of collateral influences borrowing from CB and IMs. The other control variables are: Size (log of banks' total assets), which constitutes a standard control to capture the effect of bank size on individual choices; and Domestic Intra-Group exposures (i.e. domestic transactions among banks belonging to the same group), which are treated separately from the other interbank exposures as they capture the internal capital market of banking groups and do not constitute a real IM.

(5) Regression model

In the system of equations (1) and (2) CB and IM liquidities are the dependent variables in an equation and the endogenous explanatory variable in the other. In such a case the OLS estimates are inconsistent because the endogenous variables are correlated with the disturbances. Moreover, OLS estimates are inefficient because do not make use of the cross-equation correlations of the disturbances. In such a case, the three stage least squares (3SLS) model allows the joint estimation of a system of equations as it uses an instrumental variable (IV) approach to produce consistent estimates and generalized least squares to account for correlation structure in the disturbances across the equations.[23] Being an IV model, estimates are consistent provided that the instruments in the matrixes of instruments $M_1{}^{I}_{i,t-1}$ and $M_2{}^{I}_{i,t-1}$ are valid. The instruments need to satisfy the usual

[23] The 3SLS estimator is as asymptotically efficient as the full information maximum likelihood estimator: both are IV estimators; the 3SLS is far easier to compute. See Davidson and MacKinnon (1993) and Greene (2008).

two requirements. First, they have to be relevant: that is, the instruments need to be coherent with the findings of the literature and, conditional on the other covariates, they have to induce significant changes in the instrumented variable (i.e. strong versus weak instrument). Second, they do not have to produce independent effects on the other dependent variable (that is, the instruments cannot be correlated with the error term in the explanatory equation: the so called exclusion restriction). In practice it is never trivial to find fully convincing instruments as any instrument may be liable to criticisms. In this light, I alternate different instruments (both based upon the literature and tested using the Sargan-Hansen-Wooldridge test, which establishes that instruments are valid and the system of equations is well-identified) and present broad diagnostics and several checks on their quality in the regression tables and in the Appendix.

(6) Instruments

Of course, the instrumental variables change in the matrixes $M_1^I{}_{i,t-1}$ and $M_2^I{}_{i,t-1}$ (Table 4). In the matrix $M_2^I{}_{i,t-1}$ of equation (2), where the endogenous variable is $im_{i,j,t}$, I use as instruments a pair of variables on banks' credit rating. The variable "Rating", which is coded so as to take values from 1 to 10, from best to worst, plus 11 to designate unrated banks; and the variable "Banks without Rating", which is a dummy that takes the value of 1 for banks with no rating and 0 otherwise. The two variables always have to be considered simultaneously: on the one hand, this allows not to lose observations on non-rated banks; and, on the other hand, allows not to interpret the missing rating as worse than the actually worst rating (this is just the purpose of the *ad hoc* dummy, which constantly controls for non-rated banks: see Angelini et al., 2011). As for instruments' requirements, an unanimous literature (e.g. Morgan, 2002; Ashcraft, 2006; Angelini et al., 2011; Affinito, 2012) both documents the relevance of rating scores for interbank positions and corroborates the compliance with the exclusion restriction. Indeed, the exclusion restriction requires that the composite signalling power of credit scores does not affect *directly* the liquidity provided by the CB and demanded to the CB by banks, but *through the channel* of their effect on the willingness (even only expected) of other banks to exchange liquidity with the bank *i*, which is indeed what seems to happen.

In the matrix $M_1^I{}_{i,t-1}$ of equation (1), where the endogenous variable is $cb_{i,t}$, I experiment with either the pair of variables 'GDP gap and inflation rates' (in line with the objective of CBs, which refer the use of monetary policy instruments to changes in inflation and output) or as an alternative the pair of variables 'official rates and CB's total assets' (in line with the recent empirical literature that uses the two variables as proxies of conventional and unconventional monetary policy stance). The two pairs of macro-instruments are both *relevant* for monetary policy

decisions and *exogenous* for individual behaviours of single banks. As for the first pair of macro-instruments, the fact that CBs' objective function includes output (or employment) and inflation has been always assumed by the literature, incorporated explicitly into CBs' charter legislations or self-declared systems of rules and conducts all around the world and constantly reasserted by CBs during the crisis exactly to justify the recourse to unconventional measures.[24] This means that, irrespective of the monetary policy implementation framework, which varies before and during the crises, CBs alter their instrument setting (including specifically the amount of liquidity and the way it is provided) in response first of all to price and output developments.[25] As for the second pair of macro-instruments (official rates and CB's total assets) it suffices to remind how the monetary policy works: monetary policy stance (which is proxied by the two macro-instruments according to the literature[26]) affects (relevance) directly the implemented monetary instrument (i.e., the amount of CB liquidity) and indirectly (exclusion restriction) the IM positions.

The other side of the macro-instruments is that their use would be incompatible with the presence of the time fixed effects p_t. Therefore, in order to preserve the control for macroeconomic trends, either I remove time fixed effects but replace them with a number of control macro-variables, or I keep time fixed effects by defining macro-variable instruments at bank level using as weights the ratios of total assets of each bank to the euro-area banking system's total assets. When I weigh the macro-variable instruments at bank level, the market share of each bank contributes to characterize the instrumental variables; however, this contribution is marginal and exogenous insofar the market share is referred to the entire euro-area.[27]

(7) The impact of the two crises

As mentioned, my long sample period is divided into three spans (normal times, global financial crisis and sovereign debt crisis) in order to verify whether and to what extent the determinants of liquidity markets change over time, not only in the comparison to normal times, but also across the two phases of the crisis (which is remarkable for Italy since the sovereign debt crisis

[24] See for example Kydland and Prescott (1977); Barro and Gordon (1983); Cuchierman (1992); Peerson and Tabellini (1994); Clarida *et al.* (2000); FED (2008); Walsh (2010); ECB (2011, 2012); Bernanke (2015); Draghi (2019). In this respect, the only difference between the ECB and the FED is that in the euro-area the objective of economic development is subordinated to price stability.

[25] Indeed, even during the ECB full allotment, when the CB liquidity is provided in the amount requested by banks under the only condition of available collateral, the increasing quantity of CB liquidity is not decided by banks, and then independent of GDP and inflation, because (as remarked by the ECB) it derives obviously from the decision itself of the full allotment, which is of course a CB decision, taken first of all looking at GDP and inflation developments. Furthermore, even when the full allotment was already operating, the ECB further increased the CB liquidity launching the two huge 3-years LTROs, again with contingent and specific objectives, but with the usual, statutory, ultimate goal of influencing economic and price developments.

[26] See for example Krippner (2013); Boeckx et al. (2014); Gambacorta et al. (2014).

[27] Statistical diagnostics on the quality of the instruments in both cases are reported in the Appendix.

impacted much more and involved particularly Italian banks in the ECB liquidity injections). Accordingly, the two equations include interaction-terms between each regressor and time-dummies capturing each phase. Estimations of interaction-terms are carried out through a single empirical model instead of splitting the sample period because this eases efficiency gains and coefficients' comparison across periods.

5. Bank determinants of CB and IM liquidity

To establish a benchmark with which to evaluate simultaneous-equations results, Tables 5 and 6 report the two separate single-equation OLS estimates, respectively for equation (1) and (2). In all specifications of Table 5 the dependent variable is the CB liquidity to each bank and the three IM positions (Net-Position, Credits and Debts) towards each IM counterparty are alternatively used as the key regressors and are treated as *exogenous* as all other covariates. In Table 6 the three IM positions are alternatively used as dependent variables and the CB liquidity to each bank is estimated as the *exogenous* key regressor. Although in Tables 5 and 6 the two equations are estimated separately, regressions still contain the three possible fixed effects (bank b_i, time p_t and IM counterparty c_j), which various combinations explain the four specifications for each variable. Single-equation OLS results of equation (1) in Table 5 suggest that Net-Position (positively) and Debts (negatively) affect with statistical significance CB liquidity provision to each bank, while the coefficients of the regressor Credits are very small and statistically insignificant. When the exercise is reversed in Table 6, single-equation OLS results of equation (2) suggest that CB liquidity has a statistically significant impact on all IM positions: positive for Net-Position and Credits and negative for Debts. The two separate single-equation estimates also confirm the strength of instrumental variables, for both equations.

I next investigate the effects of treating CB and IM liquidity as jointly determined. Results of the simultaneous-equations system are reported in Tables 7-12. The pair of Tables 7 and 10 report results of the simultaneous-equations system when $im_{i,j,t}$ is the IM Net-Position; the pair of Tables 8 and 11 when $im_{i,j,t}$ are IM Credits; and Tables 9 and 12 when $im_{i,j,t}$ are Debts. When joint dependence is controlled for through 3SLS IV estimations, the signs of coefficients remain stable compared to the OLS estimations, but their magnitude (and also their statistical significance in equation (1) in the case of Credits) is larger, revealing an underlying downward bias in the OLS estimations and confirming that CB and IM liquidities are jointly determined. To assess the strength and validity of instrumental variables, in addition to the analysis reported in the Appendix, the Tables report for each specification the Kleibergen-Paap *F* statistic test (in order to assess the non-

weakness of instruments) and the Sargan-Hansen-Wooldridge test (in order to test their validity).[28] The choice of instruments is largely corroborated.

Although estimated simultaneously, for exposition purposes, first I comment on all CB liquidity determinants (Tables 7-9) and then on all IM liquidity determinants (Tables 10-12). Tables report results for the total period and the time spans. For each phase, the four specifications variously combining the set of fixed effects are presented. Tables report both coefficients and marginal effects.

5.1 Bank determinants of CB liquidity provision

As argued in Section 4, the simultaneous-equations system estimates of equation (1) answers the question whether CB liquidity depends on banks' IM position and how banks that are seeking CB liquidity behave in the IM.[29] Results show that CB liquidity is obtained by banks that present a positive IM Net-Position (Table 7); with more IM Credits (Table 8), that is, banks obtaining CB liquidity are those that grant more liquidity to other banks; and less IM Debts (Table 9), that is, banks obtaining CB liquidity are those that demand less liquidity from other banks. The relationship between CB and IM appears therefore to be substitute with regard to Debts (who borrows form CB does not borrow also from IM), whereas it is clearly complementary with regard to Credits (who borrows from CB lend to other banks). The first (substitute) effect was rather expected for Debts, while the second (complementary) effect on Credits is more meaningful because *a-priori* one might guess that banks obtaining CB liquidity could be those that use it for their needs, while on the contrary are found to be those that (also) redistribute the CB liquidity. In other words, banks asking for CB liquidity are on average interbank lenders (or liquidity redistributors).

For all the three IM positions coefficients' magnitude grows during the two crises, in particular during the sovereign crisis (exactly when banks' demand for CB liquidity rises) suggesting that the IM is more reactive when CB liquidity is injected more intensely. The complementary (redistributive) relationship between CB and IM liquidity prevails also when it is measured in quantitative terms by the marginal effects: passing from the 25th to the 75th percentile

[28] The two tests verify, respectively, the strength and the validity of instruments. First, the Kleibergen-Paap test verifies the null hypothesis that the set of instruments is weak. If the test statistic exceeds the critical value, it can be concluded that instruments are not weak. It is an *F* statistic of the simultaneous equation. For the 2SLS IV estimator Stock et al. (2002) suggest that the *F* statistic should exceed 10 for inference to be reliable. Second, the Sargan-Hansen-Wooldridge test verifies the exclusion restriction. The use of more instruments in the same equation is exactly the condition to run the test. Strictly speaking, the Sargan test applies in the 2SLS estimator; the Hansen's *J* test in the GMM estimator; and the Wooldridge's score test when the model is estimated by heteroskedasticity-robust standard errors. In any case, all the tests verify the null hypothesis that the instruments are valid instruments, that is, uncorrelated with the error term, and a rejection would cast doubts on the validity of the instruments.

[29] The pairs of variables "Debts and Net Position" and "Credit and Net Position" are never estimated in the same specification because of evident problems of collinearity. On the other hand, the two variables Debts and Credits can be included in the same specification, but this requires more instruments. See details in the Appendix.

of IM Credits (Debts), the CB liquidity rises (decreases) by around 18 (6) percentage points in proportion to total assets.[30]

5.2. Determinants of IM liquidity

Tables 10-12 show simultaneous-equations results of equation (2), respectively for IM Net-Position, Credits and Debts. Symmetrically to the results of equation (1), the sign of CB liquidity is always significantly negative as a determinant of IM Debts, which means that those banks that borrow more from CB borrow significantly less from the market (substitute relationship), while it is always statistically positive as a determinant of Net-Position and Credits, which means that banks obtaining more CB liquidity on average redistribute the liquidity more strongly (complementarity). In other words, while reducing the liquidity needs of borrowing banks, the CB provision of liquidity spurs interbank lending. Again, the substitutability relationship with Debts was *ex-ante* expected (because who obtains direct liquidity form CB has less funding needs from other banks), while the complementarity relationship with Credits is more relevant because CB liquidity could be used to finance other balance sheet items, while is found to speed (also) IM lending. In quantitative terms measured by the marginal effects, the prevailing outcome is again the complementary effect: passing from the 25th to the 75th percentile of CB liquidity to each bank, IM Credits (Debts) grow (decreases) by around 11 (8) percentage points in proportion to total assets. Even in equation (2) coefficients' magnitude increases in particular in the sovereign crisis.[31]

In order to shed light on the reasons behind the complementarity relationship between CB and IM liquidity and in particular behind the uplift of interbank lending induced by CB injections, I also estimate the simultaneous-equations for the single segments in which the Total IM may be broken-down. Results of equation (2) are reported breaking-down the Total IM in Domestic versus Foreign exposures (Table 13); Secured versus Unsecured exposures (Table 14) and Overnight versus Longer-term exposures (Table 15).[32]

[30] Tables 7-9 also show results of the other determinants of CB liquidity. The variable Retail Loans is positive, significantly during the crisis, which signals that banks getting resources from the CB are those with a higher incidence of loans not only to other banks but also to the economy. However, it is worth stressing, in the case of retail loans the control is not at counterparty-level. The variable Retail Fundraising is always negative and has a large economic impact: banks with large-scale deposits and retail bonds have less need for liquidity and thus do not demand CB liquidity, even in the crises. The variables concerning the kinds of collateral show that the availability of collateral of any type eases the recourse to CB liquidity. Banks' Size tends to be positive confirming that larger banks have a greater direct recourse to CB liquidity (Ashcraft *et al.*, 2008; Fecht *et al.*, 2011).

[31] As in the case of CB liquidity, estimations also show the other determinants of liquidity positions (Tables 10-12). Interestingly results indicate that banks with more retail funds borrow less and lend more in the IM; symmetrically banks with more Retail Loans borrow more and lend less in the IM. The covariates on banks' securities holdings (Portfolio of Government Debt Securities, domestic and foreign, and Bank Bonds) confirm that their availability facilitates IM exposures.

[32] In this case simultaneous-equations results of equation (1) are not reported because substantially analogous. However, they are available upon request. In the Domestic versus Foreign breakdown exposures through CCPs are excluded

The breakdown between Domestic and Foreign exposures (Table 13) shows the overall results are confirmed for the Domestic segment, while they are not for the Foreign market, in particular just for Credits. Therefore, banks borrowing from the CB tend to redistribute more domestically than abroad. This suggests that, exactly when cross-border wholesale funding became more constrained because of the euro-area fragmentation (IMF, 2013, de Andoain et al., 2014; Abbassi et al., 2014), the CB liquidity turns out to have encouraged the replacement of the reduced cross-border interbank lending with a rise in domestic interbank lending. The outcome suggests that the complementarity with CB liquidity may be used to create or reinforce domestic relationships among banks and therefore it is consistent with the literature on the existence of customer relationships in IMs (Rochet and Tirole, 1996; Furfine, 2001; Cocco et al.2009; Affinito, 2012).

The breakdown between Secured and Unsecured transactions (Table 14) allows to find out that, while reducing all interbank Debts and improving all Net-Positions, CB liquidity impels mainly interbank Unsecured Credits in the global financial crisis and interbank Secured Credits in the sovereign crisis. This is probably because the sovereign debt crisis affected Italy more heavily and exacerbated the need of Italian banks to protect themselves from bank counterparties' credit risk. Moreover, during the second crisis, in a global trend making collateral an ever scarcer resource (Levels and Capel, 2012; Williamson, 2016; Affinito et al., 2019), the CB liquidity helps banks to use the IM as a tool to adjust their collateral availability and profile and therefore as a way to mitigate the negative impact of asset scarcity. In this sense, CB policies have a beneficial role (also) because enable exchanges, which involve collateral, when collateral and their exchanges are scarce (Carlson et al., 2016; Caballero and Farhi, 2017; Arce et al., 2017).

The breakdown between Overnight and Longer-term maturities (Table 15) indicates that, while reducing again all interbank Debts and improving all Net-Positions, CB liquidity spurs interbank Overnight Credits in the global financial crisis and Longer-term Credits in the sovereign crisis. This suggests that the longer maturity of CB liquidity operations in the period had a direct impact on the following maturity of the liquidity exchanged among banks. Combining the findings of the previous and the present breakdown, CB liquidity appears to prompt Unsecured Credits with a short maturity in the first crisis, and Secured Credits with a longer maturity in the second crisis. In other words, banks seem to be willing to lend at longer maturities provided that loans are secured confirming that CB liquidity may be used with IM exchanges to adjust maturity and collateral profiles.

because the ultimate counterparty of IM transactions via CCPs can be a domestic or a non-domestic bank and then these exposures are not purely domestic or foreign.

6. Bank types and money center banks

The analysis has shown that in Italy CB liquidity, even more when it is enormously fed up, contrary to the conjectures on the crowding out effect, is redistributed in the interbank system. In this respect, different types of banks are likely to exist: banks that demand and redistribute the CB liquidity, banks that do not demand the CB liquidity but only use the IM liquidity, and so on. As reminded in Introduction, the literature has long since recognized that liquidity markets are not made of homogenous banks, but of key and minor players. Therefore identifying bank types and key CB and IM liquidity players is a natural extension of my analysis.

Table 16 identifies six possible types of bank on the basis of their potential behaviour in the two wholesale liquidity markets: the primary (CB) and secondary (IM) market.[33] The possible behaviour vis-à-vis the CB is measured by the net position with the CB on the rows, while the possible conduct in the overall IM is measured by the *overall* Total IM Net-Position on the columns.[34] For example, "secondary liquidity users" (first cell of the matrix) are banks that present a negative Total IM Net-Position and do not borrow from the CB (or even present a positive net-deposit with the CB). "Secondary liquidity redistributors" are banks that again do not borrow from the CB, but have a positive Total IM Net-Position (thus they are likely to redistribute the IM or retail liquidity). "Liquidity eagers" are banks that borrow at the same time from the CB and the IM. "Primary liquidity redistributors" are banks that are net-borrowers with the CB while present a positive Net-Position in the Total Interbank Market. As for column, Table 16 groups banks according to their IM Net-Position. "IM liquidity users" are a sum of secondary liquidity users and liquidity eagers, that is, they are IM net-borrowing banks. Likewise, "IM liquidity redistributors" are IM net-lending banks. As for row, Table 16 groups banks according to their relationship with the CB, whether or not they use the CB liquidity.

Table 17 shows the percentage shares of these different types of bank and their development over time in Italy, in terms both of number of banks and total assets.[35] The table confirms that banks asking for CB liquidity grow in the crises: in normal times "CB liquidity users" account for only 3 per cent in terms of banks' number and 44 per cent in terms of banks' total assets, while in the sovereign debt crisis account for 21 per cent for banks and 86 per cent for total assets. Confirming the previous analysis, the IM is more reactive when the CB liquidity increases: "IM liquidity redistributors" decrease in terms of number of banks but increase in terms of total assets. What

[33] In analogy with the other financial markets, CB provision of liquidity to banks may be viewed as the primary liquidity market, where liquidity is issued for the first time, while IM may be viewed as the secondary wholesale liquidity market, where the liquidity obtained in the primary market is reallocated among banks.
[34] The *overall* position is computed as a sum of all IM positions towards all counterparties.
[35] The two middle cells (i.e., "wholesale liquidity uninterested" and "only primary liquidity users") are not reported because of very low figures. However, they are included in the total of rows and columns.

emerges again is the complementary role between CB and IMs. Indeed the IM liquidity redistribution of CB liquidity strengthens in the crises as “primary liquidity redistributors” become the most of IM liquidity redistributors. In fact, “secondary liquidity redistributors” decrease during the crises, both in terms of number of banks (from around 70 to around 25 per cent) and in terms of total assets (from 17 to 3 per cent), while “primary liquidity redistributors” (banks borrowing from the CB to redistribute in the IM) rise from less than 1 to more than 8 per cent in terms of number of banks, and from 4 to 23 per cent in terms of total assets. At the same time, liquidity users do not appear to substitute the IM liquidity with the CB liquidity. In fact “primary liquidity users” (banks only borrowing from CB) maintain negligible (unreported) figures, while “liquidity eagers” (the banks that are net-borrowers simultaneously from the CB and IMs) increase from 2 to 11 per cent in terms of number of banks and from 40 to 63 per cent in terms of total assets.

Therefore, in normal times the banks that redistribute liquidity in the IM are mainly the “secondary liquidity redistributors”, that is, banks that do not redistribute the primary liquidity just injected by the CB but redistribute the liquidity already existing in the system, drawn from the retail customers or the IM itself. Instead, in the crises the banks that redistribute liquidity in the IM are “primary liquidity redistributors”, that is during the crises several banks take the role of borrowing from the CB and redistributing to other banks. Figure 4 shows that in terms of total assets the composition of bank types of the Italian IM was more homogeneous in normal times, while tends to polarize in the sovereign crisis in two types of banks: liquidity eagers and primary liquidity redistributors. Compared to normal times, the increase of primary liquidity redistributors is much more substantial.

Table 18 shows in percentage terms the transition matrix of the bank types across the different phases of my analysis. The 60 per cent of banks that are primary liquidity redistributors during the sovereign crisis were on average secondary liquidity redistributors in normal times and therefore they already had a vocation for liquidity redistributing. Instead, the 27 per cent were secondary liquidity users or liquidity eagers and thus did not have any inclination to redistribute and appear to assume the role as a new opportunity.

Primary liquidity redistributors may be likened to those intermediaries that are often indicated in the literature with the term “money center banks”. This term is generally associated with large banks dominating wholesale activity in money markets thereby helping the CB implement monetary policy (Stigum and Crescenzi, 2007). For example, money center banks were common in the pre-crisis US IM, where the FED typically acted with a small group of money market primary dealers. The literature documents a core-periphery structure in the IMs, where a very strict core of money center banks play an essential role in holding together the periphery banks

into a single IM.[36] The data on CB liquidity to each bank within the issue of the relationship between CB liquidity and IM reallocation and the long time dimension of my dataset allows me to document that the role of money center banks grows exactly when the CB injections increase exponentially.

A further step is to verify whether the bank types follow systematic patterns, that is whether bank-specific features help explain the joint behaviour towards CB and IM liquidity. In this light Table 19 presents the results of two random effects probit estimations for two bank types (the twos prevailing in the last phase: primary liquidity redistributors and liquidity eagers). These regressions are estimated at bank-time level instead than at bank-counterparty-time level.[37] In the first estimation of Table 19 the dependent variable is a binary variable equal to 1 if bank *i* is found to be a primary liquidity redistributor in the period *t* and 0 otherwise; and in the second estimation if bank *i* is a liquidity eager. The odds of a bank to be a primary liquidity redistributor grow significantly whenever the CB increases the liquidity injections, in any phase. Interestingly, the huge liquidity injections in the sovereign crisis do not affect the chance of being a liquidity eager. For both types of banks, the odds rise in size: earlier works on the US IM suggested instead that small banks tend to turn over surplus funds to large banks.[38] More interestingly, the results indicate that the primary liquidity redistributors turn out to be systematically sound banks, more capitalized and with more funds from retail customers, while liquidity eagers tend to raise less retail funds, and thus need more wholesale liquidity. Primary liquidity redistributors grant less loans to retail customers, probably just because they tend to specialize in the IM, while liquidity eagers present more liquidity needs as they lend more to retail customers. The more a bank is equipped with collateral, the less it is likely to be a primary liquidity redistributor and the more to be a liquidity eager. These outcomes may simply indicate again that the banks that invest more in interbank lending put less resources in other assets, or they may be a confirmation that banks need more collateral to be CB and IM net-borrowers.

7. Conclusions

Since the outbreak of the crisis, liquidity and liquidity markets have been at the center of academic and policy debate. In several systems around the world IMs faced worrying impairments

[36] See Soramäki et al. (2007); Bech and Atalay (2010); Craig and von Peter (2014); in't Veld and van Lelyveld (2014); Fricke and Lux (2015); León et al. (2016)

[37] In other worlds, here what is explored is the *overall* position of each bank. For this reason, the number of observations is much smaller than in the previous econometric exercises. Moreover, in this case the issue of joint dependence does not matter because the dependent variable is a combination of the two liquidities and the estimation aims at identifying only clear conditional correlations rather than casual nexuses.

[38] See Ho and Saunders (1985); Allen and Saunders (1986); Bech and Atalay (2010).

and many CBs introduced a wide range of measures to increase liquidity amount and flow. The literature on unconventional monetary policy has concentrated on the (ultimate) effects of CB liquidity on credit developments, while has widely disregarded the earlier IM step, despite the fact that the coexistence of IMs with CB liquidity provision is a common goal of CBs and banks as they allow liquidity insurance and risk sharing between banks, assure peer monitoring and market discipline, play a key role in the transmission of monetary policy and provide benchmark rates for the pricing of financial assets throughout the economy. Furthermore, the most recent literature points out the relevance of IMs for the growth of economic activity and the welfare. It is therefore crucial to improve the knowledge on how the two liquidities react and interact each other. This paper contributes to the purpose with the advantage of using an unique micro database containing seventeen years of monthly micro bank-by-bank and counterparty-by-counterparty data, which cross two crises. The analysis allows for both the possible causal directions of the mutual relationship between CB and IM liquidity through a simultaneous-equations system and controls for demand and supply effects exploiting within counterparty variation by comparing the IM behaviour towards the same IM counterparty by banks with different exposures to CB liquidity.

The results show that in Italy CB and IM liquidities do have a complementary role, even in the crises. I find that the complementarity relationship does not change when CB and IMs are assumed exogenous and non-simultaneous. However, once the two liquidities are endogenized in a simultaneous-equations system, the relationship is stronger showing robust evidence for jointness. The CB's liquidity influences the IM redistribution and circulates among banks. CB larger liquidity provisions amplify IM reactivity as banks obtaining CB liquidity do not limit to use it for their needs but redistribute it to other banks speeding up interbank lending. Banks exploit CB liquidity to offset and adjust domestic and cross-border interbank exposures, secured and unsecured transactions, short-term and longer-term interbank lending. More, in normal times the banks that redistribute liquidity in the IM tend to channel the liquidity already existing in the system drawn from the retail customers or the IM itself, while in the crises when CB liquidity is provided abundantly, some banks take on a pivotal role in liquidity management as borrowers from the CB and redistributors to other banks. Redistributing banks tend to be healthy, specialized in interbank activity and with smaller portfolios of collateral, which are instead concentrated in the net borrowing banks. Future research could try to understand also another aspect of the relationship between CB and IM liquidities: whether there is an impact of CB injections on banks' positions in the intricate web of IM networks.

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Figure 1. Percentage shares of the number of banks' borrowing and depositing with the CB

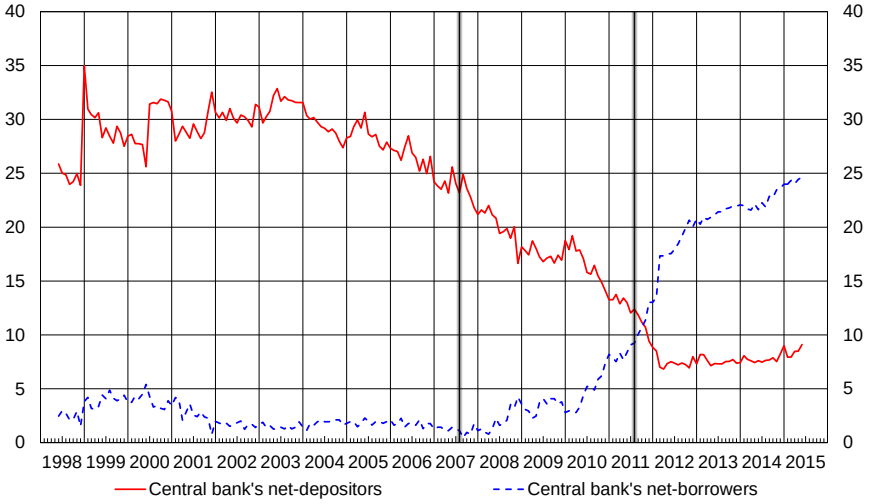


Figure 2. CB and IM liquidity in Italy 1998-2015

(percentage shares of banks' total assets)

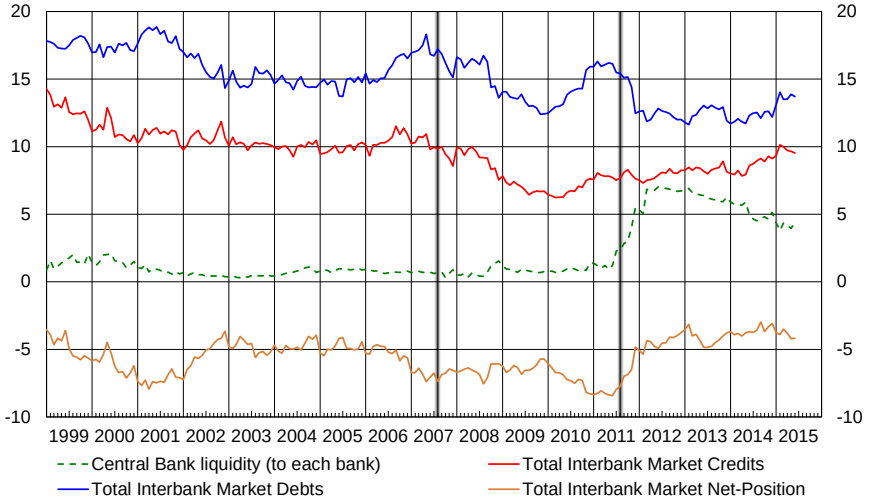
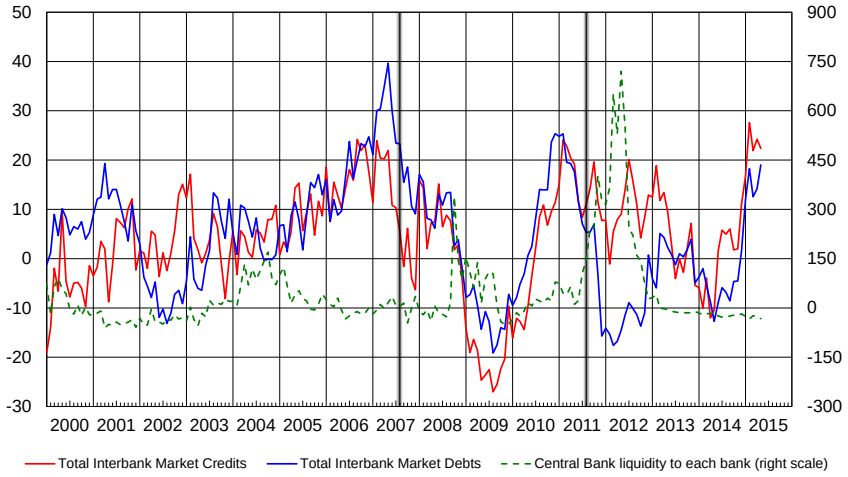


Figure 3. CB and IM liquidity developments in Italy 2000-2015

(12-month percentage changes)



My sample period runs from June 1998 to May 2015. Normal times is defined as the period from June 1998 to July 2007; the global financial crisis is defined as the period from August 2007 to July 2011; the euro-area sovereign debt crisis is defined as the period from August 2011 onwards. Grey vertical lines indicate the starting dates for the global financial crisis and the sovereign debt crisis.

Table 1. Summary statistics of the key variables

Key variables (scaled by total assets)				Obs	Mean	Sd. Dev.	Min	Max
Central Bank liquidity (provided to each bank)				845,315	0.006	0.064	0.000	0.162
Total Interbank Market			*Net*	845,315	0.003	0.046	-1.000	0.143
			Credits	553,930	0.010	0.036	0.000	0.171
			Debts	562,966	0.007	0.040	0.000	0.226
Interbank Market segments	Residence of counterparties	Domestic	*Net*	436,942	0.007	0.054	-1.000	0.146
			Credits	275,552	0.013	0.039	0.000	0.152
			Debts	278,338	0.006	0.042	0.000	0.121
		Foreign	*Net*	289,873	-0.014	0.077	-0.134	0.030
			Credits	159,878	0.003	0.034	0.000	0.066
			Debts	166,128	0.017	0.080	0.000	0.225
	Seniority	Unsecured	*Net*	821,340	0.000	0.079	-1.000	0.136
			Credits	534,725	0.012	0.047	0.000	0.175
			Debts	542,187	0.012	0.076	0.000	0.206
		Secured	*Net*	803,152	-0.007	0.050	-1.000	0.039
			Credits	489,574	0.003	0.019	0.000	0.063
			Debts	501,928	0.010	0.049	0.000	0.140
	Maturity	Overnight	*Net*	753,572	0.003	0.063	-1.000	0.139
			Credits	492,256	0.012	0.045	0.000	0.169
			Debts	488,273	0.008	0.057	0.000	0.152
		Longer-term	*Net*	251,386	-0.010	0.065	-1.000	0.049
			Credits	145,629	0.004	0.021	0.000	0.068
			Debts	161,026	0.014	0.064	0.000	0.176
Domestic Infra-Group			*Debts or Credits*	845,315	0.025	0.051	0.000	0.390

Table 2. Relations among key variables

		Central Bank liquidity (to each bank)	Total Interbank Market			Domestic			Foreign			Unsecured			Secured			Overnight			Longer-term			Domestic Infra-Group
			Net	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	*Net*	*Credits*	*Debts*	
Central Bank liquidity (to each bank)		**1**																						
Total Interbank Market	*Net*	-0.0080*	**1**																					
	Credits	0.0618*	**0.4445***	**1**																				
	Debts	0.0511*	**-0.7881***	**0.2011***	**1**																			
Domestic	*Net*	-0.0212*	0.6136*	0.5356*	-0.3029*	**1**																		
	Credits	0.0186*	0.4801*	0.7665*	0.0017	**0.7240***	**1**																	
	Debts	0.0514*	-0.3524*	0.0795*	0.4400*	**-0.6394***	**0.0674***	**1**																
Foreign	*Net*	-0.0102*	0.0227*	0.0012	-0.0239*	0.0212*	0.0213*	-0.007	**1**															
	Credits	0.0271*	-0.0179*	0.0080*	0.0250*	-0.0222*	-0.0328*	-0.005	**-0.2844***	**1**														
	Debts	0.0213*	-0.0256*	0.0032	0.0302*	-0.0268*	-0.0323*	0.0027	**-0.8697***	**0.7206***	**1**													
Unsecured	*Net*	-9E-04	0.9809*	0.4169*	-0.7857*	0.5826*	0.4543*	-0.3362*	0.0278*	-0.0198*	-0.0303*	**1**												
	Credits	0.0281*	0.4321*	0.9584*	0.1862*	0.5239*	0.7286*	0.0544*	0.0152*	-0.0117*	-0.0170*	**0.4397***	**1**											
	Debts	0.0197*	-0.7863*	0.1809*	0.9837*	-0.2893*	-0.0128*	0.4042*	-0.0204*	0.0139*	0.0219*	**-0.8022***	**0.1836***	**1**										
Secured	*Net*	-0.0362*	0.2190*	0.1900*	-0.1088*	0.2281*	0.1841*	-0.1247*	-0.0229*	0.0075*	0.0205*	0.0250*	0.0153*	-0.0172*	**1**									
	Credits	0.1241*	0.1272*	0.3362*	0.0919*	0.1456*	0.2776*	0.0989*	-0.0456*	0.0665*	0.0672*	0.0078*	0.0535*	0.0270*	**0.6145***	**1**								
	Debts	0.1780*	-0.1199*	0.1420*	0.2286*	-0.1106*	0.0852*	0.2550*	-0.0226*	0.0635*	0.0491*	-0.0210*	0.0403*	0.0497*	**-0.5109***	**0.3642***	**1**							
Overnight	*Net*	-0.0149*	0.8484*	0.4682*	-0.6056*	0.5184*	0.4891*	-0.2047*	0.0360*	-0.0294*	-0.0412*	0.8629*	0.4962*	-0.6145*	**0.0317***	**0.0007**	**-0.0367***	**1**						
	Credits	0.0059	0.4664*	0.9380*	0.1348*	0.5259*	0.7167*	0.0383*	0.0163*	-0.0147*	-0.0193*	0.4731*	0.9787*	0.1329*	0.0239*	0.0524*	0.0289*	**0.5468***	**1**					
	Debts	0.0224*	-0.6049*	0.2342*	0.8220*	-0.1685*	0.0251*	0.2718*	-0.0286*	0.0221*	0.0321*	-0.6163*	0.2353*	0.8310*	-0.0173*	0.0429*	0.0671*	**-0.7154***	**0.1938***	**1**				
Longer-term	*Net*	0.0075*	0.6028*	0.1295*	-0.5698*	0.3720*	0.1646*	-0.3546*	-0.0116*	0.0107*	0.0139*	0.5449*	0.0651*	-0.5531*	0.3642*	0.2383*	-0.1703*	0.0890*	0.0533*	-0.0598*	**1**			
	Credits	0.1628*	0.0593*	0.4273*	0.2288*	0.1680*	0.3335*	0.1289*	-0.0388*	0.0614*	0.0597*	-0.0358*	0.2016*	0.1732*	0.4840*	0.8298*	0.3329*	-0.0807*	0.0875*	0.1676*	**0.2332***	**1**		
	Debts	0.0602*	-0.5850*	0.0468*	0.6716*	-0.3063*	-0.0277*	0.4123*	-0.004	0.0148*	0.0108*	-0.5661*	0.0180*	0.6316*	-0.1670*	0.1043*	0.3108*	-0.1236*	-0.0175*	0.1302*	**-0.9145***	**0.1803***	**1**	
Domestic Infra-Group	*Debts or Credits*	0.0570*	-0.0230*	-0.0200*	0.0114*	-0.0411*	-0.0555*	-0.002	-0.4471*	0.3516*	0.5045*	-0.0237*	-0.0460*	-0.005	0.0004	0.0821*	0.0890*	-0.0400*	-0.0526*	0.003	0.0170*	0.0798*	0.0161*	**1**

* denotes statistical significance at 10 % level.

Table 3. Possible signs and meanings of the relationship between CB and IM liquidities

		Interbank Market		
		Net-Position (Credits-Debts)	Debts	Credits
Central Bank liquidity (to each bank)	α > 0	*ambiguous (maybe complemenatry)*	*complementary*	*complementary*
	α < 0	*ambiguous (maybe substitute)*	*substitute*	*substitute*

Table 4. Summary statistics of explanatory and instrumental variables

Matrix	Name	Definition	Obs	Mean	Sd. Dev.	Min	Max
Matrix $M^R_{i,t}$: banks' characteristics/ regressors	Size	Log (Total assets)	845,315	8.240	2.506	1.609	13.666
	Reatil Loans	Total performing (non-securitized) loans to the domestic private sector / Total assets	845,315	0.496	0.194	0.000	0.972
	Retail Fundraising	(Total deposits and bonds) / Total assets	845,315	0.560	0.220	0.000	0.954
	Bad Loans	Total non-performing (non-securitized) loans (private sector) / Total performing (non-securitized) loans (private sector)	845,315	0.056	0.064	0.000	1.000
	ROE	Net profits / (Capital and reserves)	845,315	0.073	0.069	0.000	1.000
	Capital	Regulatory capital / Total risk weighted assets	845,315	0.094	0.044	0.000	0.920
	Portfolio of domestic Government Debt Securities	Holdings of Italian Government bonds / Total assets	845,315	0.124	0.109	0.000	0.865
	Portfolio of euro countries' Government Debt Securities	Holdings of other Euro-area countries' Government bonds / Total assets	845,315	0.002	0.009	0.000	0.623
	Portfolio of Bank Bonds	Holdings of their own bonds and of other banks' bonds / Total assets	845,315	0.039	0.042	0.000	0.625
Matrix $M_1{}^I_{i,t-1}$: instruments for Central Bank liquidity	Lagged CB liquidity (to each bank)		see Table 1				
	Eurosystem total assets	(weighted for banks' total assets)	845,315	251.9	2018.6	0.053	66784
	ECB official rates	(weighted for banks' total assets)	845,315	0.00	0.0	0.000	0.09
	Euro-area GDP gap	(weighted for banks' total assets)	845,315	0.00	0.0	-0.020	0.01
	Euro area inflation rates	(weighted for banks' total assets)	845,315	0.000	0.002	-0.012	0.077
Matrix $M_2{}^I_{i,t-1}$: instruments for Interbank Market positions	Lagged IM positions		see Table 1				
	Rating	Rating agency scores	845,315	8.609	3.135	2.000	11.000
	Banks without rating (0-1)	Banks without rating (0-1)	845,315	0.616	0.486	0.000	1.000

Table 5. Single-equation OLS regressions of equation (1): determinants of CB liquidity

Dependent variable $cb_{i,t}$: ratio of CB liquidity provided to the bank on its total assets. Four identical specifications are adopted for each IM position. Specification (1) includes b_i and p_t fixed effects; Specification (2) includes the three b_i, p_t and c_j fixed effects; Specification (3) includes b_i and the interaction counterparty-time $p_t \times c_j$, which controls for both observable and unobservable counterparty heterogeneity capturing interbank counterparty demand (or supply) for interbank lending at time t; Specification (4) includes the interaction $p_t \times c_j$ and the interaction $b_i \times c_j$, which absorbs any bank-counterparty time-invariant characteristic, including any time-invariant bank characteristic. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

		Total period											
Exogenous key regressor:		**Net-Position** (as a regressor)				**Credits** (as a regressor)				**Debts** (as a regressor)			
Specifications:		**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Total Interbank Market	*Net*	0.0004*** *0.000*	0.0004*** *0.000*	0.0004*** *0.000*	0.0003*** *0.000*								
	Credits					0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*				
	Debts									-0.0004** *0.000*	-0.0004** *0.000*	-0.0003* *0.000*	-0.0004** *0.000*
Domestic Infra-Group	*Debts or Credits*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0003** *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0003** *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0003** *0.000*
Size		0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*
Reatil Loans		0.0002** *0.000*	0.0002** *0.000*	0.0002** *0.000*	0.0002** *0.000*	0.0002** *0.000*	0.0002** *0.000*	0.000 *0.000*	0.000 *0.000*	0.0002*** *0.000*	0.0002*** *0.000*	0.000 *0.000*	0.000 *0.000*
Reatil Fundraising		-0.0003*** *0.000*	-0.0003*** *0.000*	-0.0001*** *0.000*	-0.0001** *0.000*	-0.0003*** *0.000*	-0.0003*** *0.000*	-0.0001*** *0.000*	-0.0001** *0.000*	-0.0003*** *0.000*	-0.0003*** *0.000*	-0.0001*** *0.000*	-0.0001** *0.000*
Bad Loans		0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0002* *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0002* *0.000*	0.000 *0.000*
ROE		0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0003** *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0003** *0.000*
Capital		0.001 *0.001*	0.001 *0.001*	0.001 *0.001*	0.001 *0.001*	0.001* *0.001*	0.001* *0.001*	0.001 *0.001*	0.001 *0.001*	0.001* *0.001*	0.001* *0.001*	0.001 *0.001*	0.001 *0.001*
Portfolio of domestic Gov't Debt Securities		0.0004* *0.000*	0.0004* *0.000*	0.0005* *0.000*	0.000 *0.000*	0.0004* *0.000*	0.0004* *0.000*	0.0005** *0.000*	0.000 *0.000*	0.0004* *0.000*	0.0004* *0.000*	0.0005** *0.000*	0.000 *0.000*
Portfolio of Gov't Debt Securities of oether euro-area countries		0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	-0.001 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*
Portfolio of Bank Bonds		0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*
Inflation		-0.111*** *0.008*	-0.105*** *0.007*	-0.201*** *0.020*	-0.018** *0.009*	-0.141*** *0.008*	-0.135*** *0.007*	-0.204*** *0.020*	-0.028*** *0.009*	-0.111*** *0.008*	-0.135*** *0.007*	-0.204*** *0.020*	-0.018** *0.009*
GDP gap		0.172*** *0.013*	0.194*** *0.025*	0.394*** *0.025*	0.098*** *0.014*	0.195*** *0.013*	0.195*** *0.014*	0.454*** *0.025*	0.099*** *0.014*	0.172*** *0.013*	0.194*** *0.025*	0.394*** *0.025*	0.098*** *0.014*
Number of observations		845,315	845,307	790,014	786,546	553,930	553,919	502,241	497,909	562,966	562,959	501,750	497,860
Adj R-squared		0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Bank FEs		yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs		yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty FEs		no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FEs × Time FEs		no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FEs		no	no	no	yes	no	no	no	yes	no	no	no	yes

Table 6. Single-equation OLS regressions of equation (2): determinants of IM liquidity

Dependent variable $im_{i,t}$: total IM positions: alternatively, Net-Position, Credits and Debts. For the description of Specifications, see note to Table 5. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

	Total IM											
Dependent variable:	**Total period**											
	Net-Position				**Credits**				**Debts**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Central Bank liquidity (to each bank)	0.009*** *0.003*	0.009*** *0.003*	0.010*** *0.003*	0.010*** *0.004*	0.004*** *0.001*	0.004*** *0.001*	0.003*** *0.001*	0.004** *0.002*	-0.005** *0.002*	-0.005** *0.002*	-0.007*** *0.003*	-0.007** *0.003*
Domestic Infra-Group *Debts or Credits*	-0.0096*** *0.001*	-0.0105*** *0.001*	-0.0181*** *0.002*	-0.0224*** *0.002*	-0.0280*** *0.001*	-0.0284*** *0.001*	-0.0313*** *0.001*	-0.0350*** *0.001*	-0.0184*** *0.001*	-0.0180*** *0.001*	-0.0132*** *0.002*	-0.0125*** *0.002*
Size	-0.0077*** *0.000*	-0.0076*** *0.000*	-0.0070*** *0.000*	-0.0076*** *0.000*	-0.0067*** *0.000*	-0.0065*** *0.000*	-0.0063*** *0.000*	-0.0067*** *0.000*	0.0010*** *0.000*	0.0011*** *0.000*	0.0007** *0.000*	0.0009** *0.000*
Retail Loans	-0.0645*** *0.001*	-0.0654*** *0.001*	-0.0769*** *0.002*	-0.0853*** *0.002*	-0.0605*** *0.002*	-0.0609*** *0.002*	-0.0678*** *0.002*	-0.0726*** *0.002*	0.0040*** *0.002*	0.0046*** *0.002*	0.0091*** *0.002*	0.0126*** *0.002*
Retail Fundraising	0.0684*** *0.001*	0.0676*** *0.001*	0.0671*** *0.002*	0.0670*** *0.002*	0.0190*** *0.001*	0.0186*** *0.001*	0.0200*** *0.001*	0.0212*** *0.001*	-0.0494*** *0.001*	-0.0491*** *0.001*	-0.0471*** *0.001*	-0.0458*** *0.002*
Bad Loans	0.0127*** *0.003*	0.0123*** *0.003*	0.0138*** *0.003*	0.0163*** *0.003*	0.0102*** *0.002*	0.0099*** *0.002*	0.0097*** *0.002*	0.0090*** *0.003*	-0.003 *0.003*	-0.002 *0.003*	-0.004 *0.003*	-0.007** *0.003*
ROE	-0.006*** *0.001*	-0.005*** *0.001*	-0.005*** *0.001*	-0.004*** *0.002*	0.001 *0.001*	0.002 *0.001*	0.001 *0.001*	-0.001 *0.001*	0.007*** *0.002*	0.007*** *0.002*	0.006*** *0.002*	0.004** *0.002*
Capital	0.0533*** *0.007*	0.0516*** *0.007*	0.0536*** *0.007*	0.0538*** *0.009*	0.0425*** *0.006*	0.0408*** *0.006*	0.0441*** *0.007*	0.0421*** *0.007*	-0.0108* *0.006*	-0.0108* *0.006*	-0.010 *0.007*	-0.012 *0.008*
Portfolio of domestic Gov't Debt Securities	-0.068*** *0.001*	-0.069*** *0.001*	-0.081*** *0.002*	-0.090*** *0.002*	-0.051*** *0.001*	-0.052*** *0.001*	-0.059*** *0.001*	-0.065*** *0.002*	0.016*** *0.001*	0.017*** *0.001*	0.022*** *0.001*	0.025*** *0.002*
Portfolio of euro Gov't Debt Securities	-0.102*** *0.016*	-0.104*** *0.016*	-0.112*** *0.017*	-0.115*** *0.019*	-0.083*** *0.007*	-0.083*** *0.007*	-0.089*** *0.008*	-0.093*** *0.009*	0.020 *0.015*	0.021 *0.015*	0.023 *0.016*	0.022 *0.017*
Portfolio of Bank Bonds	-0.009*** *0.002*	-0.009*** *0.002*	-0.023*** *0.002*	-0.035*** *0.002*	-0.016*** *0.005*	-0.016*** *0.005*	-0.022*** *0.007*	-0.025*** *0.009*	-0.007 *0.005*	-0.007 *0.005*	0.002 *0.007*	0.010 *0.009*
Rating	0.0005*** *0.000*	0.0004*** *0.000*	0.0006*** *0.000*	0.0006*** *0.000*	0.0004*** *0.000*	0.0004*** *0.000*	0.0003*** *0.000*	0.0003*** *0.000*	-0.0009*** *0.000*	-0.0009*** *0.000*	-0.0008*** *0.000*	-0.0007*** *0.000*
Banks without Rating	0.018*** *0.001*	0.017*** *0.001*	0.018*** *0.001*	0.017*** *0.001*	0.009*** *0.000*	0.009*** *0.000*	0.010*** *0.001*	0.010*** *0.001*	0.008*** *0.000*	0.008*** *0.000*	0.008*** *0.001*	0.007*** *0.001*
Number of observations	845,315	845,307	790,014	786,546	553,930	553,919	502,241	497,909	562,966	562,959	501,750	497,860
Adj R-squared	0.18	0.19	0.22	0.27	0.23	0.25	0.27	0.31	0.14	0.14	0.17	0.21
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes

Table 7. Simultaneous-equation system estimations of equation (1): determinants of CB liquidity (to each bank) when the simultaneous endogenous variable is IM Net-Position

Equation (1) – Simultaneous system 3SLS IV estimations. Dependent variable $cb_{i,t}$: ratio of CB liquidity provided to the bank on its total assets. The Table 7 couples with Table 10, where the simultaneous endogenous variable is $im_{i,t}$ as IM Net-Position. Regarding the time spans, the Table reports and compares the overall coefficients obtained interacting all regressors with the two crisis dummies within a single empirical estimation (the omitted case is normal times). For the description of Specifications see note to Table 5. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. The marginal effects quantify the estimated economic impact of each regressor on the dependent variable 'CB liquidity (to each bank)', other things being equal. The estimated effect of each determinant is computed as the change in the percentage share of the total loans from CB to total assets between the 25th to the 75th percentile of each variable.

	Total period				**Normal times**				**Global financial crisis**				**Sovereign debt crisis**				*Marginal effects Total period Spec. 4*
Specifications:	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Total Interbank Market *Net*	0.050*** *0.017*	0.050*** *0.017*	0.051*** *0.017*	0.068*** *0.019*	0.069*** *0.023*	0.069*** *0.023*	0.034 *0.023*	0.010 *0.021*	0.095*** *0.029*	0.081*** *0.029*	0.124*** *0.029*	0.124*** *0.029*	0.657*** *0.197*	0.624*** *0.169*	0.400** *0.169*	0.403** *0.169*	22.3
Domestic Infra-Group *Debts or Credits*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.0007*** *0.000*	-0.0011* *0.001*	-0.0012* *0.001*	-0.001 *0.001*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.005*** *0.001*	-0.005*** *0.001*	-0.003*** *0.001*	-0.005*** *0.001*	2.1
Size	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.001*	14.6
Reatil Loans	0.0007*** *0.000*	0.0007*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.001 *0.001*	0.002 *0.001*	0.001 *0.002*	0.000 *0.003*	0.0006*** *0.000*	0.0006*** *0.000*	0.0007*** *0.000*	0.0006*** *0.001*	0.010*** *0.003*	0.010*** *0.003*	0.008*** *0.003*	0.008*** *0.003*	19.5
Reatil Fundraising	-0.0006*** *0.000*	-0.0006*** *0.000*	-0.0009*** *0.000*	-0.00110*** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0004** *0.000*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-21.2
Bad Loans	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.001 *0.002*	-0.001 *0.002*	-0.002 *0.002*	-0.002 *0.002*	ns
ROE	0.000 *0.000*	-0.0002* *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.001 *0.002*	0.001 *0.002*	0.000 *0.001*	0.001 *0.001*	ns
Capital	0.0015** *0.001*	0.0015** *0.001*	0.0018** *0.001*	0.0024** *0.001*	0.001 *0.001*	0.001 *0.001*	0.001 *0.002*	0.000 *0.002*	0.0017* *0.001*	0.0017* *0.001*	0.0019** *0.001*	0.0016* *0.001*	0.018* *0.010*	0.018* *0.010*	0.015 *0.009*	0.017 *0.010*	2.1
Portfolio of domestic Gov't Debt Securities	0.000 *0.000*	0.000 *0.000*	0.0007* *0.000*	0.001** *0.000*	0.001 *0.001*	0.001 *0.001*	0.001 *0.002*	0.000 *0.003*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.012*** *0.003*	0.012*** *0.003*	0.009*** *0.003*	0.009*** *0.003*	9.1
Portfolio of Gov't Debt Securities of oether euro-area countries	0.0011* *0.001*	0.0012* *0.001*	0.002*** *0.001*	0.003*** *0.001*	0.002 *0.003*	0.002 *0.003*	0.001 *0.005*	0.002 *0.006*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*	0.000 *0.001*	0.0129*** *0.005*	0.0129*** *0.004*	0.009*** *0.004*	0.009*** *0.004*	3.2
Portfolio of Bank Bonds	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.002 *0.002*	0.002 *0.002*	0.001 *0.003*	0.001 *0.004*	0.000 *0.000*	0.000 *0.000*	0.0008** *0.000*	0.0009** *0.000*	0.005** *0.002*	0.005** *0.002*	0.002 *0.002*	0.001 *0.002*	1.1
Inflation	-0.138*** *0.008*	-0.156*** *0.007*	-0.201*** *0.019*	-0.025*** *0.009*	-0.005** *0.003*	-0.004** *0.002*	-0.005** *0.003*	-0.005** *0.003*	-0.018*** *0.005*	-0.016*** *0.005*	-0.007* *0.004*	-0.049*** *0.009*	-0.019** *0.009*	-0.019** *0.009*	-0.019* *0.011*	-0.029** *0.011*	
GDP gap	0.178*** *0.013*	0.192*** *0.025*	0.414*** *0.025*	0.099*** *0.013*	0.005* *0.002*	0.005* *0.002*	0.004* *0.002*	0.000* *0.000*	0.078** *0.027*	0.078*** *0.025*	0.064*** *0.021*	0.271*** *0.050*	0.392*** *0.070*	0.385*** *0.080*	0.416*** *0.090*	0.475*** *0.113*	
Number of observations	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	
Adj R-squared	0.27	0.27	0.26	0.27	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.27	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	76.18	58.26	42.48	28.76	35.52	25.36	21.20	15.23	77.43	55.23	38.96	24.68	72.15	62.89	44.99	24.26	
Sargan-Hansen-Wooldridge test	1.92	2.85	3.54	1.96	0.98	0.95	0.86	0.96	0.08	0.12	0.01	0.47	0.65	1.56	1.75	1.62	

Table 8. Simultaneous-equation system estimations of equation (1): determinants of CB liquidity (to each bank) when the simultaneous endogenous variable is IM Credits

The Table 8 couples with Table 11, where the simultaneous endogenous variable is $im_{i,t}$ as IM Credits. For the description of Specifications, see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. Regarding computation of marginal effects, see notes to Table7.

	Total period				**Normal times**				**Global financial crisis**				**Sovereign debt crisis**				*Marginal effects Total period Spec. 4*
Specifications:	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Total Interbank Market *Credits*	0.0165** *0.007*	0.0164** *0.007*	0.0203*** *0.004*	0.0149*** *0.005*	0.0164* *0.009*	0.0185** *0.009*	0.0132* *0.008*	0.0130* *0.007*	0.0131** *0.006*	0.0122* *0.007*	0.0121* *0.007*	0.0124** *0.006*	0.267*** *0.094*	0.266*** *0.095*	0.205** *0.081*	0.209** *0.085*	18.1
Domestic Infra-Group *Debts or Credits*	0.0005* *0.000*	0.0005* *0.000*	0.000 *0.000*	0.0007*** *0.000*	-0.0009** *0.000*	-0.0010** *0.000*	-0.001 *0.000*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.0098*** *0.002*	-0.0099*** *0.002*	-0.0081*** *0.002*	-0.0103*** *0.003*	2.2
Size	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.001*	14.8
Reatil Loans	0.0007*** *0.000*	0.0007*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.001 *0.001*	0.002 *0.001*	0.001 *0.002*	0.000 *0.003*	0.0006*** *0.000*	0.0006*** *0.000*	0.0007*** *0.000*	0.0006*** *0.001*	0.010*** *0.003*	0.010*** *0.003*	0.008*** *0.003*	0.008*** *0.003*	18.9
Reatil Fundraising	-0.0006*** *0.000*	-0.0006*** *0.000*	-0.0009*** *0.000*	-0.00110*** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0004** *0.000*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-20.5
Bad Loans	-0.0003** *0.000*	-0.0003** *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	ns
ROE	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	-0.003* *0.001*	-0.003* *0.001*	-0.002* *0.001*	-0.002 *0.001*	ns
Capital	0.000 *0.001*	0.000 *0.001*	0.001* *0.001*	0.002** *0.001*	0.001 *0.001*	0.001 *0.001*	0.001 *0.001*	0.000 *0.002*	0.002* *0.001*	0.002* *0.001*	0.002** *0.001*	0.001* *0.001*	0.002 *0.007*	0.002 *0.007*	0.003 *0.007*	0.004 *0.008*	2.2
Portfolio of domestic Gov't Debt Securities	0.001*** *0.000*	0.001*** *0.000*	0.000 *0.000*	0.000 *0.000*	0.001 *0.001*	0.001 *0.001*	0.000 *0.001*	0.000 *0.002*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.012*** *0.004*	0.014*** *0.004*	0.012*** *0.004*	0.013*** *0.004*	ns
Portfolio of Gov't Debt Securities of oether euro-area countries	0.001 *0.001*	0.001 *0.001*	0.001 *0.001*	0.002*** *0.001*	0.000 *0.001*	0.000 *0.002*	0.001 *0.002*	0.001 *0.003*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*	0.000 *0.001*	0.0109* *0.006*	0.0112* *0.006*	0.0100* *0.005*	0.0100* *0.006*	3.2
Portfolio of Bank Bonds	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*	0.000 *0.000*	0.000 *0.000*	0.0008** *0.000*	0.0008** *0.000*	0.007** *0.003*	0.007** *0.003*	0.004* *0.003*	0.005 *0.003*	ns
Inflation	-0.188*** *0.008*	-0.172*** *0.007*	-0.185*** *0.009*	-0.015* *0.009*	-0.005** *0.003*	-0.004** *0.002*	-0.005** *0.003*	-0.005** *0.003*	-0.018*** *0.005*	-0.016*** *0.005*	-0.007* *0.004*	-0.049*** *0.009*	-0.017** *0.008*	-0.017** *0.008*	-0.019* *0.011*	-0.029** *0.011*	
GDP gap	0.186*** *0.013*	0.198*** *0.025*	0.318*** *0.028*	0.095*** *0.018*	0.006*** *0.002*	0.006*** *0.002*	0.006*** *0.002*	0.004* *0.000*	0.085** *0.027*	0.088*** *0.025*	0.074*** *0.021*	0.252*** *0.050*	0.419*** *0.070*	0.378*** *0.080*	0.316*** *0.090*	0.352*** *0.113*	
Number of observations	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	
Adj R-squared	0.27	0.27	0.26	0.27	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.27	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	70.25	55.36	45.51	23.65	31.89	22.31	19.56	14.89	78.98	57.82	41.25	22.74	68.21	55.46	41.47	22.15	
Sargan-Hansen-Wooldridge test	2.18	3.01	2.98	2.31	1.26	1.98	0.77	2.96	0.85	0.88	1.01	0.84	1.63	2.05	3.24	3.69	

Table 9. Simultaneous-equation system estimations of equation (1): determinants of CB liquidity (to each bank) when the simultaneous endogenous variable is IM Debts

The Table 9 couples with Table 12, where the simultaneous endogenous variable is $im_{i,t}$ as IM Debts. For the description of Specifications, see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. Regarding computation of marginal effects, see notes to Table7.

	Total period				**Normal times**				**Global financial crisis**				**Sovereign debt crisis**				*Marginal effects Total period Spec. 4*
Specifications:	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Total Interbank Market *Debts*	-0.0316*** *0.011*	-0.0324*** *0.011*	-0.0355*** *0.013*	-0.0527*** *0.016*	-0.052 *0.082*	-0.058 *0.093*	-0.021 *0.039*	0.003 *0.103*	-0.086*** *0.025*	-0.068*** *0.024*	-0.116*** *0.027*	-0.116*** *0.026*	-0.383*** *0.130*	-0.363*** *0.123*	-0.196*** *0.075*	-0.201** *0.079*	-6.1
Domestic Infra-Group *Debts or Credits*	0.0006** *0.000*	0.0006** *0.000*	0.0005** *0.000*	0.000 *0.000*	-0.0005*** *0.000*	-0.0005*** *0.000*	-0.0005*** *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.003 *0.003*	0.003 *0.003*	0.002 *0.002*	0.002 *0.003*	ns
Size	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.001*	15.5
Reatil Loans	0.0007*** *0.000*	0.0007*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.001 *0.001*	0.002 *0.001*	0.001 *0.002*	0.000 *0.003*	0.0006*** *0.000*	0.0006*** *0.000*	0.0007*** *0.000*	0.0006*** *0.001*	0.010*** *0.003*	0.010*** *0.003*	0.008*** *0.003*	0.008*** *0.003*	19.0
Reatil Fundraising	-0.0006*** *0.000*	-0.0006*** *0.000*	-0.0009*** *0.000*	-0.00110*** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0005** *0.000*	-0.0004** *0.000*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-0.010*** *0.003*	-0.010*** *0.003*	-0.007*** *0.002*	-0.007*** *0.002*	-20.3
Bad Loans	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.001*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.001 *0.001*	-0.001 *0.006*	-0.001 *0.006*	-0.003 *0.003*	-0.003 *0.004*	ns
ROE	-0.0004*** *0.000*	-0.0004*** *0.000*	-0.0004*** *0.000*	0.000 *0.000*	0.0002* *0.000*	0.000 *0.000*	0.0002** *0.000*	0.0002*** *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.006 *0.004*	0.006 *0.004*	0.003 *0.003*	0.004 *0.003*	ns
Capital	0.0013* *0.001*	0.0014* *0.001*	0.001 *0.001*	0.0018* *0.001*	0.001 *0.001*	0.001 *0.001*	0.000 *0.001*	0.000 *0.001*	0.0018* *0.001*	0.0017* *0.001*	0.0017** *0.001*	0.0017* *0.001*	0.042** *0.018*	0.0408** *0.017*	0.0258** *0.013*	0.0293** *0.015*	2.2
Portfolio of domestic Gov't Debt Securities	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.0009** *0.000*	0.001 *0.001*	0.001 *0.001*	0.000 *0.000*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.000*	0.000 *0.001*	0.0104*** *0.003*	0.0098*** *0.003*	0.0057*** *0.002*	0.0060*** *0.002*	7.8
Portfolio of Gov't Debt Securities of oether euro-area countries	0.001 *0.001*	0.001 *0.001*	0.001 *0.001*	0.0021* *0.001*	0.004 *0.004*	0.004 *0.005*	0.003 *0.002*	0.001 *0.006*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.000 *0.001*	0.0157*** *0.006*	0.0153*** *0.006*	0.0093*** *0.003*	0.0088** *0.003*	3.2
Portfolio of Bank Bonds	0.000 *0.000*	0.000 *0.000*	0.000 *0.000*	0.000 *0.001*	0.003 *0.004*	0.004 *0.005*	0.002 *0.002*	0.001 *0.007*	0.000 *0.000*	0.000 *0.000*	0.0006** *0.000*	0.0008** *0.000*	0.002 *0.003*	0.002 *0.003*	0.001 *0.003*	0.002 *0.003*	ns
Inflation	-0.188*** *0.008*	-0.172*** *0.007*	-0.185*** *0.009*	-0.015* *0.009*	-0.005** *0.003*	-0.004** *0.002*	-0.005** *0.003*	-0.005** *0.003*	-0.021*** *0.005*	-0.016*** *0.005*	-0.007* *0.004*	-0.054*** *0.009*	-0.016** *0.008*	-0.016** *0.008*	-0.019* *0.011*	-0.032** *0.014*	
GDP gap	0.186*** *0.013*	0.198*** *0.025*	0.318*** *0.028*	0.095*** *0.018*	0.006*** *0.002*	0.006*** *0.002*	0.006*** *0.002*	0.004* *0.000*	0.085** *0.027*	0.078*** *0.025*	0.074*** *0.021*	0.252*** *0.050*	0.419*** *0.070*	0.378*** *0.080*	0.316*** *0.090*	0.352*** *0.113*	
Number of observations	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	
Adj R-squared	0.27	0.27	0.26	0.27	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.27	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	66.25	57.85	38.15	22.59	31.56	24.24	23.87	19.20	74.23	51.76	34.28	22.19	65.46	55.23	41.21	22.56	
Sargan-Hansen-Wooldridge test	2.92	1.73	2.81	3.19	2.08	1.51	0.68	0.63	0.48	0.73	0.52	0.84	1.56	1.48	2.55	2.21	

Table 10. Simultaneous-equation system estimations of equation (2): determinants of IM liquidity – Net-Position

The Table 10 couples with Table 7, where the simultaneous endogenous variable is $cb_{i,t}$, the ratio of CB liquidity provided to the bank on its total assets. For the description of Specifications see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. Regarding computation of marginal effects, see notes to Table7.

	Total IM																
Dependent variable:	**Net-Position**																
	Total period				Normal times				Global financial crisis				Sovereign debt crisis				*Marginal effects Total period Spec. 4*
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Central Bank liquidity (to each bank)	0.045*** *0.017*	0.044*** *0.017*	0.048*** *0.018*	0.049*** *0.017*	0.025*** *0.005*	0.025*** *0.005*	0.025*** *0.006*	0.026*** *0.006*	0.059*** *0.015*	0.058*** *0.015*	0.042*** *0.014*	0.040*** *0.015*	0.134*** *0.018*	0.135*** *0.017*	0.136*** *0.019*	0.132*** *0.019*	19.4
Domestic Infra-Group *Debts or Credits*	-0.009 *0.017*	-0.010 *0.016*	-0.018 *0.014*	-0.0237** *0.011*	-0.0274*** *0.009*	-0.0272*** *0.009*	-0.0189* *0.010*	-0.0252*** *0.010*	0.019 *0.017*	0.018 *0.017*	0.003 *0.017*	-0.008 *0.017*	-0.011 *0.017*	-0.012 *0.017*	-0.030 *0.026*	-0.036 *0.028*	-1.9
Size	-0.0079*** *0.002*	-0.0078*** *0.002*	-0.0070*** *0.002*	-0.00752** *0.002*	-0.003 *0.002*	-0.003 *0.002*	-0.003 *0.002*	-0.003 *0.002*	-0.0122** *0.006*	-0.0119** *0.006*	-0.0121** *0.006*	-0.0145** *0.006*	-0.0123*** *0.005*	-0.0124*** *0.005*	-0.0137*** *0.004*	-0.0142*** *0.004*	-11.3
Retail Loans	-0.0648*** *0.010*	-0.0657*** *0.010*	-0.0769*** *0.009*	-0.0859*** *0.010*	-0.0646*** *0.012*	-0.0650*** *0.012*	-0.0750*** *0.010*	-0.0838*** *0.011*	-0.0766*** *0.020*	-0.0772*** *0.019*	-0.0929*** *0.020*	-0.102*** *0.023*	-0.0616*** *0.021*	-0.0628*** *0.021*	-0.0715*** *0.016*	-0.0739*** *0.016*	-7.5
Retail Fundraising	0.0689*** *0.008*	0.0683*** *0.008*	0.0680*** *0.008*	0.0660*** *0.008*	0.0362*** *0.009*	0.0365*** *0.009*	0.0442*** *0.009*	0.0424*** *0.007*	0.0714*** *0.016*	0.0713*** *0.016*	0.0713*** *0.017*	0.0691*** *0.015*	0.0686*** *0.013*	0.0682*** *0.013*	0.0737*** *0.013*	0.0783*** *0.013*	17.4
Bad Loans	0.013 *0.011*	0.013 *0.011*	0.012 *0.012*	0.015 *0.010*	0.013 *0.008*	0.013 *0.008*	0.013 *0.008*	0.0146* *0.008*	0.0428** *0.018*	0.0421** *0.018*	0.0343** *0.017*	0.030 *0.019*	0.009 *0.017*	0.009 *0.017*	0.005 *0.017*	0.012 *0.015*	ns
ROE	-0.005 *0.006*	-0.005 *0.006*	-0.005 *0.006*	-0.004 *0.005*	-0.002 *0.003*	-0.002 *0.003*	-0.003 *0.003*	-0.004 *0.003*	0.007 *0.011*	0.007 *0.011*	0.006 *0.011*	0.002 *0.009*	0.0238*** *0.006*	0.0239*** *0.006*	0.0269*** *0.006*	0.0254*** *0.005*	ns
Capital	0.0558*** *0.021*	0.0541*** *0.020*	0.0568*** *0.021*	0.0616*** *0.018*	0.0357** *0.018*	0.0361** *0.018*	0.0513*** *0.016*	0.0642*** *0.014*	0.0821** *0.034*	0.0814** *0.033*	0.0771** *0.033*	0.0730** *0.033*	0.047 *0.040*	0.045 *0.039*	0.038 *0.036*	0.024 *0.040*	3.1
Portfolio of domestic Gov't Debt Securities	-0.0673*** *0.011*	-0.0686*** *0.011*	-0.0816*** *0.010*	-0.0894*** *0.010*	-0.0658*** *0.009*	-0.0665*** *0.009*	-0.0736*** *0.009*	-0.0776*** *0.009*	-0.0910*** *0.015*	-0.0923*** *0.015*	-0.109*** *0.017*	-0.121*** *0.019*	-0.0850*** *0.022*	-0.0861*** *0.022*	-0.102*** *0.017*	-0.107*** *0.017*	-8.4
Portfolio of euro Gov't Debt Securities	-0.0920** *0.037*	-0.0926** *0.037*	-0.102*** *0.038*	-0.107*** *0.036*	-0.149*** *0.043*	-0.149*** *0.044*	-0.154*** *0.048*	-0.158*** *0.053*	-0.037 *0.042*	-0.039 *0.042*	-0.0637* *0.034*	-0.0678** *0.034*	-0.054 *0.037*	-0.057 *0.037*	-0.0605* *0.032*	-0.0633** *0.030*	-4.1
Portfolio of Bank Bonds	-0.009 *0.014*	-0.010 *0.015*	-0.0236* *0.013*	-0.0353*** *0.013*	-0.0920*** *0.018*	-0.0927*** *0.018*	-0.0911*** *0.017*	-0.0926*** *0.017*	-0.012 *0.034*	-0.013 *0.033*	-0.0459* *0.025*	-0.0578** *0.024*	-0.0613*** *0.012*	-0.0609*** *0.012*	-0.0651*** *0.012*	-0.0682*** *0.013*	-2.8
Rating	0.0013*** *0.000*	0.0014*** *0.000*	0.0013*** *0.000*	0.0012*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	0.0001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	0.003*** *0.000*	0.003*** *0.000*	0.003*** *0.000*	0.003*** *0.000*	2.9
Banks without Rating	0.001*** *0.001*	0.001*** *0.001*	0.004*** *0.001*	0.004*** *0.001*	0.011*** *0.002*	0.010*** *0.002*	0.008*** *0.002*	0.008*** *0.002*	0.015*** *0.001*	0.014*** *0.001*	0.014*** *0.002*	0.014*** *0.002*	-0.015 *0.001*	-0.014 *0.001*	-0.012 *0.002*	-0.012 *0.002*	4.8
Number of observations	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	
Adj R-squared	0.18	0.19	0.23	0.28	0.19	0.20	0.16	0.22	0.25	0.26	0.22	0.24	0.20	0.20	0.15	0.17	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	28.26	24.32	21.56	18.78	19.74	16.98	15.97	14.82	29.87	27.56	25.41	22.79	25.74	22.89	19.47	15.13	
Sargan-Hansen-Wooldridge test	0.85	1.96	2.58	2.42	1.54	2.74	2.46	3.65	0.58	2.46	1.78	2.39	0.98	1.45	3.74	4.15	

Table 11. Simultaneous-equation system estimations of equation (2): determinants of IM liquidity – Credits

The Table 11 couples with Table 8, where the simultaneous endogenous variable is $cb_{i,t}$, the ratio of CB liquidity provided to the bank on its total assets. For the description of Specifications see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. Regarding computation of marginal effects, see notes to Table7.

	Total IM																
Dependent variable:	**Credits**																
	Total period				Normal times				Global financial crisis				Sovereign debt crisis				*Marginal effects Total period Spec. 4*
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Central Bank liquidity (to each bank)	0.0284*** *0.001*	0.0281*** *0.001*	0.0298*** *0.002*	0.0295*** *0.003*	0.0222*** *0.006*	0.0221*** *0.006*	0.0214*** *0.008*	0.0223*** *0.008*	0.0189*** *0.002*	0.0181*** *0.002*	0.0039* *0.002*	0.00391* *0.002*	0.0404*** *0.005*	0.0404*** *0.005*	0.0342*** *0.006*	0.0287*** *0.007*	11.3
Domestic Infra-Group *Debts or Credits*	-0.0281*** *0.001*	-0.0288*** *0.001*	-0.0314*** *0.001*	-0.0346*** *0.001*	-0.0290*** *0.002*	-0.0295*** *0.002*	-0.0232*** *0.002*	-0.0252*** *0.002*	-0.0173*** *0.003*	-0.0188*** *0.003*	-0.0361*** *0.004*	-0.0436*** *0.004*	-0.0272*** *0.003*	-0.0281*** *0.003*	-0.0387*** *0.005*	-0.0444*** *0.005*	-1.8
Size	-0.0067*** *0.000*	-0.0064*** *0.000*	-0.0062*** *0.000*	-0.0066*** *0.000*	-0.0055*** *0.000*	-0.0054*** *0.000*	-0.0051*** *0.000*	-0.0057*** *0.000*	-0.003 *0.003*	-0.002 *0.003*	-0.002 *0.003*	-0.004 *0.003*	-0.0055*** *0.002*	-0.0054*** *0.002*	-0.0052*** *0.002*	-0.0051** *0.002*	-3.7
Retail Loans	-0.0604*** *0.002*	-0.0607*** *0.002*	-0.0676*** *0.002*	-0.0718*** *0.002*	-0.0514*** *0.002*	-0.0518*** *0.002*	-0.0593*** *0.002*	-0.0653*** *0.002*	-0.0603*** *0.004*	-0.0605*** *0.004*	-0.0740*** *0.005*	-0.0822*** *0.005*	-0.0606*** *0.004*	-0.0613*** *0.004*	-0.0669*** *0.004*	-0.0709*** *0.005*	-4.2
Retail Fundraising	0.0186*** *0.001*	0.0183*** *0.001*	0.0196*** *0.001*	0.0200*** *0.001*	0.0072*** *0.002*	0.0071*** *0.002*	0.0120*** *0.002*	0.0123*** *0.003*	0.0143*** *0.003*	0.0137*** *0.003*	0.0113*** *0.004*	0.0141*** *0.004*	0.0179*** *0.003*	0.0179*** *0.003*	0.0207*** *0.003*	0.0230*** *0.004*	8.6
Bad Loans	0.0102*** *0.002*	0.0100*** *0.002*	0.0098*** *0.002*	0.0097*** *0.003*	0.0082*** *0.003*	0.0081*** *0.003*	0.0088*** *0.003*	0.0099*** *0.003*	0.004 *0.008*	0.003 *0.008*	-0.004 *0.008*	-0.009 *0.009*	0.004 *0.008*	0.003 *0.008*	0.004 *0.009*	0.007 *0.010*	2.5
ROE	0.001 *0.001*	0.002 *0.001*	0.001 *0.001*	-0.001 *0.001*	-0.001 *0.001*	-0.001 *0.001*	-0.0027* *0.002*	-0.0036** *0.002*	0.0055* *0.003*	0.0054* *0.003*	0.003 *0.003*	0.001 *0.004*	-0.001 *0.004*	-0.001 *0.004*	-0.001 *0.004*	-0.001 *0.005*	ns
Capital	0.0468*** *0.006*	0.0452*** *0.006*	0.0500*** *0.007*	0.0515*** *0.008*	0.0532*** *0.008*	0.0523*** *0.008*	0.0629*** *0.009*	0.0660*** *0.010*	0.0712*** *0.026*	0.0706*** *0.026*	0.0707** *0.028*	0.0544* *0.030*	-0.0411** *0.018*	-0.0418** *0.018*	-0.0442** *0.019*	-0.0534*** *0.021*	1.4
Portfolio of domestic Gov't Debt Securities	-0.0512*** *0.001*	-0.0520*** *0.001*	-0.0594*** *0.001*	-0.0642*** *0.002*	-0.0554*** *0.003*	-0.0564*** *0.003*	-0.0626*** *0.003*	-0.0662*** *0.004*	-0.0713*** *0.004*	-0.0724*** *0.004*	-0.0859*** *0.005*	-0.0979*** *0.006*	-0.0555*** *0.003*	-0.0563*** *0.003*	-0.0629*** *0.004*	-0.0675*** *0.004*	-4.8
Portfolio of euro Gov't Debt Securities	-0.0831*** *0.007*	-0.0834*** *0.007*	-0.0900*** *0.007*	-0.0897*** *0.008*	-0.110*** *0.008*	-0.110*** *0.008*	-0.111*** *0.009*	-0.0988*** *0.010*	-0.100*** *0.024*	-0.101*** *0.024*	-0.126*** *0.025*	-0.127*** *0.025*	-0.024 *0.021*	-0.026 *0.021*	-0.029 *0.023*	-0.029 *0.023*	-3.6
Portfolio of Bank Bonds	-0.0161*** *0.006*	-0.0166*** *0.006*	-0.0219*** *0.007*	-0.0246*** *0.009*	-0.0404* *0.023*	-0.0410* *0.023*	-0.034 *0.027*	-0.025 *0.033*	-0.0140*** *0.003*	-0.0149*** *0.003*	-0.0410*** *0.004*	-0.0538*** *0.005*	-0.0455*** *0.005*	-0.0454*** *0.004*	-0.0470*** *0.005*	-0.0499*** *0.005*	-0.9
Rating	0.0005*** *0.000*	0.0005*** *0.000*	0.0004*** *0.000*	0.0004*** *0.000*	0.0005*** *0.000*	0.0005*** *0.000*	0.0005*** *0.000*	0.0005*** *0.000*	-0.002*** *0.000*	-0.002*** *0.000*	-0.002** *0.000*	-0.002** *0.000*	0.001*** *0.000*	0.002*** *0.000*	0.001*** *0.000*	0.002*** *0.000*	1.0
Banks without Rating	0.009*** *0.000*	0.009*** *0.000*	0.012*** *0.001*	0.012*** *0.001*	0.008*** *0.001*	0.007*** *0.002*	0.006*** *0.002*	0.006*** *0.002*	0.010*** *0.001*	0.009*** *0.001*	0.010*** *0.001*	0.011*** *0.001*	-0.009*** *0.001*	-0.008*** *0.002*	-0.007*** *0.002*	-0.007** *0.002*	0.8
Number of observations	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	
Adj R-squared	0.23	0.25	0.27	0.31	0.24	0.26	0.22	0.25	0.29	0.30	0.26	0.29	0.27	0.28	0.24	0.25	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	29.41	28.62	25.74	19.64	18.97	17.56	16.41	15.89	27.89	24.89	24.11	22.85	29.71	24.89	21.74	20.36	
Sargan-Hansen-Wooldridge test	1.85	1.85	2.54	1.98	1.45	0.85	2.59	1.85	0.97	3.64	2.95	2.47	2.54	1.86	2.96	2.85	

Table 12. Simultaneous-equation system estimations of equation (2): determinants of IM liquidity – Debts

The Table 12 couples with Table 9, where the simultaneous endogenous variable is $cb_{i,t}$, the ratio of CB liquidity provided to the bank on its total assets. For the description of Specifications see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level. Last column reports marginal effects of Specification 4 of the estimation on the total period. Regarding computation of marginal effects, see notes to Table7.

	Total IM																
Dependent variable:	**Debts**																
	Total period				Normal times				Global financial crisis				Sovereign debt crisis				*Marginal effects Total period Spec. 4*
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
Central Bank liquidity (to each bank)	-0.0166*** *0.001*	-0.0164*** *0.001*	-0.0185*** *0.002*	-0.0144*** *0.002*	-0.0037* *0.002*	-0.0037* *0.002*	-0.0040* *0.002*	-0.0042* *0.003*	-0.0400*** *0.003*	-0.0403*** *0.003*	-0.0390*** *0.004*	-0.0369*** *0.004*	-0.0938*** *0.004*	-0.0946*** *0.003*	-0.102*** *0.003*	-0.104*** *0.004*	-7.8
Domestic Infra-Group *Debts or Credits*	-0.0185*** *0.001*	-0.0181*** *0.001*	-0.0128*** *0.002*	-0.0111*** *0.002*	-0.001 *0.002*	-0.001 *0.002*	-0.003 *0.002*	-0.002 *0.003*	-0.0367*** *0.003*	-0.0375*** *0.003*	-0.0390*** *0.004*	-0.0333*** *0.004*	-0.0150*** *0.005*	-0.0156*** *0.005*	-0.0118** *0.006*	-0.0127** *0.006*	-1.1
Size	0.0010*** *0.000*	0.0011*** *0.000*	0.0007* *0.000*	0.0009* *0.000*	-0.0024*** *0.001*	-0.0024*** *0.001*	-0.0026*** *0.001*	-0.0025*** *0.001*	0.0079*** *0.002*	0.0081*** *0.002*	0.0086*** *0.002*	0.0096*** *0.002*	0.0056*** *0.002*	0.0057*** *0.002*	0.0078*** *0.002*	0.0083*** *0.003*	3.2
Retail Loans	0.0040*** *0.001*	0.0044*** *0.002*	0.0089*** *0.002*	0.0139*** *0.002*	0.0128*** *0.002*	0.0129*** *0.002*	0.0157*** *0.002*	0.0173*** *0.002*	0.0158*** *0.003*	0.0161*** *0.003*	0.0188*** *0.003*	0.0208*** *0.005*	-0.005 *0.005*	-0.004 *0.005*	-0.001 *0.006*	-0.001 *0.007*	2.6
Retail Fundraising	-0.0498*** *0.001*	-0.0494*** *0.001*	-0.0473*** *0.001*	-0.0462*** *0.002*	-0.0277*** *0.002*	-0.0279*** *0.002*	-0.0311*** *0.002*	-0.0323*** *0.003*	-0.0592*** *0.004*	-0.0597*** *0.004*	-0.0613*** *0.005*	-0.0550*** *0.004*	-0.0500*** *0.004*	-0.0497*** *0.004*	-0.0499*** *0.004*	-0.0533*** *0.005*	-11.8
Bad Loans	-0.002 *0.003*	-0.002 *0.003*	-0.002 *0.004*	-0.005 *0.004*	-0.004 *0.004*	-0.004 *0.004*	-0.004 *0.005*	-0.004 *0.005*	-0.0387*** *0.010*	-0.0385*** *0.010*	-0.0372*** *0.011*	-0.0325*** *0.011*	-0.004 *0.015*	-0.004 *0.015*	0.001 *0.017*	0.000 *0.017*	ns
ROE	0.0070*** *0.002*	0.0068*** *0.002*	0.0066*** *0.002*	0.0043** *0.002*	0.001 *0.001*	0.001 *0.001*	0.002 *0.002*	0.000 *0.002*	-0.003 *0.002*	-0.003 *0.002*	-0.003 *0.003*	0.000 *0.003*	-0.0216*** *0.007*	-0.0218*** *0.007*	-0.0251*** *0.008*	-0.0247*** *0.008*	1.1
Capital	-0.010 *0.006*	-0.010 *0.006*	-0.007 *0.007*	-0.010 *0.008*	0.015 *0.011*	0.014 *0.011*	0.011 *0.012*	0.011 *0.016*	-0.0233*** *0.009*	-0.0234*** *0.009*	-0.0200** *0.009*	-0.0203** *0.010*	-0.0763*** *0.018*	-0.0757*** *0.018*	-0.0672*** *0.020*	-0.0712*** *0.022*	ns
Portfolio of domestic Gov't Debt Securities	0.0164*** *0.001*	0.0166*** *0.001*	0.0221*** *0.001*	0.0264*** *0.002*	0.0106*** *0.002*	0.0104*** *0.002*	0.0116*** *0.002*	0.0120*** *0.003*	0.0221*** *0.002*	0.0221*** *0.002*	0.0250*** *0.002*	0.0243*** *0.003*	0.0288*** *0.003*	0.0286*** *0.003*	0.0359*** *0.004*	0.0368*** *0.004*	4.2
Portfolio of euro Gov't Debt Securities	0.017 *0.015*	0.018 *0.015*	0.020 *0.016*	0.024 *0.018*	0.045 *0.028*	0.0456* *0.028*	0.047 *0.030*	0.058 *0.037*	-0.0386*** *0.009*	-0.0386*** *0.009*	-0.0365*** *0.009*	-0.0239** *0.010*	0.0290** *0.012*	0.0294** *0.012*	0.0264** *0.012*	0.0241** *0.012*	ns
Portfolio of Bank Bonds	-0.007 *0.006*	-0.006 *0.006*	0.002 *0.007*	0.011 *0.010*	0.0525** *0.023*	0.0529** *0.023*	0.0581** *0.027*	0.0677** *0.033*	-0.001 *0.003*	-0.001 *0.003*	0.005 *0.004*	0.004 *0.005*	0.0176*** *0.005*	0.0177*** *0.005*	0.0202*** *0.006*	0.0186*** *0.006*	ns
Rating	-0.0008*** *0.000*	-0.0009*** *0.000*	-0.0009*** *0.000*	-0.0008*** *0.000*	0.0004* *0.000*	0.0005* *0.000*	0.0004* *0.000*	0.0004* *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-0.001*** *0.000*	-1.7
Banks without Rating	0.008*** *0.000*	0.008*** *0.000*	0.007*** *0.001*	0.006*** *0.001*	-0.003* *0.002*	-0.003* *0.002*	-0.002* *0.003*	-0.002* *0.004*	-0.003*** *0.001*	-0.003*** *0.001*	-0.004*** *0.001*	-0.004*** *0.001*	0.006*** *0.000*	0.006*** *0.000*	0.005*** *0.001*	0.005*** *0.001*	0.8
Number of observations	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	
Adj R-squared	0.14	0.14	0.17	0.21	0.13	0.13	0.08	0.15	0.17	0.17	0.13	0.16	0.19	0.20	0.14	0.16	
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	
Kleibergen-Paap F-statistic test	29.85	27.58	23.65	16.47	16.25	15.98	14.79	12.85	24.78	22.75	21.78	20.39	27.85	26.74	22.45	21.63	
Sargan-Hansen-Wooldridge test	2.45	2.74	1.49	2.47	0.87	1.58	3.56	2.74	0.88	1.58	1.98	3.52	1.14	2.54	1.46	3.85	

Table 13. Simultaneous-equation system estimations of equation (2): determinants of IM segment positions: Domestic versus Foreign

Simultaneous estimates of equation (1) of Table 13 are not reported. For the description of Specifications, see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

	Total IM												**Domestic**												**Foreign**											
Dependent variable:	**Net-Position**												**Net-Position**												**Net-Position**											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.025 *** *0.005*	0.025 *** *0.005*	0.025 *** *0.006*	0.026 *** *0.006*	0.059 *** *0.015*	0.058 *** *0.015*	0.042 *** *0.014*	0.040 *** *0.015*	0.134 *** *0.018*	0.135 *** *0.017*	0.136 *** *0.019*	0.132 *** *0.019*	0.066*** *0.004*	0.065*** *0.004*	0.063** *0.005*	0.058** *0.005*	0.065*** *0.003*	0.064*** *0.003*	0.044*** *0.003*	0.037*** *0.004*	0.106*** *0.007*	0.105*** *0.007*	0.119*** *0.010*	0.116*** *0.010*	0.035** *0.015*	0.035** *0.015*	0.035** *0.015*	0.035** *0.015*	0.032** *0.016*	0.032** *0.016*	0.032** *0.016*	0.032** *0.016*	0.041* *0.022*	0.041* *0.022*	0.041* *0.022*	0.041* *0.022*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	436,942	436,939	393,666	391,718	436,942	436,939	393,666	391,718	436,942	436,939	393,666	391,718	289,873	289,868	277,848	276,328	289,873	289,868	277,848	276,328	289,873	289,868	277,848	276,328
Adj R-squared	0.19	0.20	0.16	0.22	0.25	0.26	0.22	0.24	0.20	0.20	0.15	0.17	0.31	0.32	0.34	0.39	0.44	0.44	0.47	0.53	0.31	0.31	0.34	0.40	0.47	0.47	0.47	0.47	0.35	0.35	0.35	0.35	0.28	0.28	0.28	0.28
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes
Dependent variable:	**Credits**												**Credits**												**Credits**											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.022 *** *0.006*	0.022 *** *0.006*	0.021 *** *0.008*	0.022 *** *0.008*	0.019 *** *0.002*	0.018 *** *0.002*	0.004 * *0.002*	0.004 * *0.002*	0.040 * *0.005*	0.040 * *0.005*	0.034 *** *0.006*	0.029 *** *0.007*	0.043*** *0.003*	0.041*** *0.003*	0.037*** *0.004*	0.031*** *0.005*	0.030*** *0.002*	0.030*** *0.002*	0.012*** *0.002*	0.007*** *0.002*	0.018** *0.007*	0.016** *0.007*	0.027*** *0.010*	0.026*** *0.009*	0.017 *0.016*	0.017 *0.016*	0.017 *0.016*	0.017 *0.016*	0.009 *0.015*	0.009 *0.015*	0.009 *0.015*	0.009 *0.015*	-0.010 *0.010*	-0.010 *0.010*	-0.010 *0.010*	-0.010 *0.010*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	275,552	275,544	230,495	227,002	275,552	275,544	230,495	227,002	275,552	275,544	230,495	227,002	159,878	159,875	153,246	152,407	159,878	159,875	153,246	152,407	159,878	159,875	153,246	152,407
Adj R-squared	0.24	0.26	0.22	0.25	0.29	0.30	0.26	0.29	0.27	0.28	0.24	0.25	0.45	0.46	0.49	0.53	0.55	0.55	0.57	0.61	0.46	0.47	0.49	0.53	0.19	0.19	0.19	0.19	0.41	0.41	0.41	0.41	0.25	0.25	0.25	0.25
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes
Dependent variable:	**Debts**												**Debts**												**Debts**											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	-0.004 *** *0.007*	-0.004 *** *0.007*	-0.004 *** *0.008*	-0.004 *** *0.009*	-0.040 *** *0.003*	-0.040 *** *0.003*	-0.039 *** *0.004*	-0.037 *** *0.004*	-0.094 *** *0.004*	-0.095 *** *0.004*	-0.102 *** *0.004*	-0.104 *** *0.005*	-0.023*** *0.004*	-0.023*** *0.004*	-0.026*** *0.006*	-0.027*** *0.007*	-0.034*** *0.002*	-0.034*** *0.002*	-0.033*** *0.003*	-0.030*** *0.003*	-0.090*** *0.002*	-0.089*** *0.002*	-0.092*** *0.003*	-0.090*** *0.003*	-0.018 *0.011*	-0.018 *0.011*	-0.018 *0.011*	-0.018 *0.011*	-0.023 *0.018*	-0.023 *0.018*	-0.023 *0.018*	-0.023 *0.018*	-0.050* *0.027*	-0.050* *0.027*	-0.050* *0.027*	-0.050* *0.027*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	278,338	278,334	235,258	232,397	278,338	278,334	235,258	232,397	278,338	278,334	235,258	232,397	166,128	166,125	147,992	146,963	166,128	166,125	147,992	146,963	166,128	166,125	147,992	146,963
Adj R-squared	0.13	0.13	0.08	0.15	0.17	0.17	0.13	0.16	0.19	0.20	0.14	0.16	0.13	0.13	0.15	0.19	0.24	0.24	0.27	0.35	0.37	0.39	0.41	0.46	0.48	0.48	0.48	0.48	0.20	0.20	0.20	0.20	0.33	0.33	0.33	0.33
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty FEs	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FEs × Time FEs	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FEs	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes

Table 14. Simultaneous-equation system estimations of equation (2): determinants of IM segment positions: Secured vs Unsecured segments

Simultaneous estimates of equation (1) of Table 14 are not reported. For the description of Specifications, see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

	Total IM												Secured												Unsecured											
Dependent variable:	Net-Position												Net-Position												Net-Position											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.025 *** *0.005*	0.025 *** *0.005*	0.025 *** *0.006*	0.026 *** *0.006*	0.059 *** *0.015*	0.058 *** *0.015*	0.042 *** *0.014*	0.040 *** *0.015*	0.134 *** *0.018*	0.135 *** *0.017*	0.136 *** *0.019*	0.132 *** *0.019*	0.018 *** *0.004*	0.018 *** *0.003*	0.016 *** *0.003*	0.017 *** *0.003*	0.015 *** *0.001*	0.015 *** *0.001*	0.011 *** *0.002*	0.009 *** *0.002*	0.024 *** *0.005*	0.024 *** *0.005*	0.036 *** *0.007*	0.040 *** *0.008*	0.065 *** *0.004*	0.064 *** *0.004*	0.063 *** *0.005*	0.055 *** *0.005*	0.059 *** *0.003*	0.059 *** *0.003*	0.045 *** *0.004*	0.033 *** *0.005*	0.093 *** *0.006*	0.092 *** *0.006*	0.097 *** *0.007*	0.103 *** *0.008*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	803,152	802,733	748,933	695,623	803,152	802,733	748,933	695,623	803,152	802,733	748,933	695,623	821,340	820,912	766,292	762,877	821,340	820,912	766,292	762,877	821,340	820,912	766,292	762,877
Adj R-squared	0.19	0.20	0.16	0.22	0.25	0.26	0.22	0.24	0.20	0.20	0.15	0.17	0.05	0.05	0.02	0.03	0.12	0.12	0.09	0.09	0.08	0.08	0.04	0.07	0.32	0.32	0.28	0.34	0.36	0.36	0.32	0.35	0.31	0.31	0.26	0.30
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes
Dependent variable:	Credits												Credits												Credits											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.022 *** *0.006*	0.022 *** *0.006*	0.021 *** *0.008*	0.022 *** *0.008*	0.019 *** *0.002*	0.018 *** *0.002*	0.004 * *0.002*	0.004 * *0.002*	0.040 * *0.005*	0.040 * *0.005*	0.034 *** *0.006*	0.029 *** *0.007*	0.009 *** *0.002*	0.010 *** *0.002*	0.010 *** *0.002*	0.010 *** *0.002*	0.002 *** *0.001*	0.002 *** *0.001*	0.000 *0.001*	0.001 *0.001*	0.012 ** *0.005*	0.012 ** *0.005*	0.016 ** *0.006*	0.017 ** *0.007*	0.030 *** *0.005*	0.029 *** *0.005*	0.024 *** *0.007*	0.020 *** *0.008*	0.030 *** *0.003*	0.029 *** *0.003*	0.012 *** *0.003*	0.006 * *0.004*	0.002 *0.005*	0.002 *0.005*	0.011 *0.007*	0.016 ** *0.007*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	489,574	489,231	442,082	395,940	489,574	489,231	442,082	395,940	489,574	489,231	442,082	395,940	534,725	534,350	483,192	478,913	534,725	534,350	483,192	478,913	534,725	534,350	483,192	478,913
Adj R-squared	0.24	0.26	0.22	0.25	0.29	0.30	0.26	0.29	0.27	0.28	0.24	0.25	0.12	0.12	0.08	0.09	0.18	0.18	0.15	0.14	0.13	0.13	0.06	0.06	0.40	0.40	0.38	0.41	0.45	0.45	0.42	0.45	0.41	0.41	0.37	0.39
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes
Dependent variable:	Debts												Debts												Debts											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	-0.004 *** *0.007*	-0.004 *** *0.007*	-0.004 *** *0.008*	-0.004 *** *0.009*	-0.040 *** *0.003*	-0.040 *** *0.003*	-0.039 *** *0.004*	-0.037 *** *0.004*	-0.094 *** *0.004*	-0.095 *** *0.004*	-0.102 *** *0.004*	-0.104 *** *0.005*	-0.009 *** *0.003*	-0.009 *** *0.003*	-0.007 *** *0.003*	-0.006 ** *0.003*	-0.013 *** *0.001*	-0.013 *** *0.001*	-0.011 *** *0.002*	-0.008 *** *0.002*	-0.012 *** *0.002*	-0.012 *** *0.002*	-0.020 *** *0.002*	-0.022 *** *0.002*	-0.035 *** *0.006*	-0.035 *** *0.006*	-0.040 *** *0.008*	-0.035 *** *0.009*	-0.029 *** *0.003*	-0.029 *** *0.003*	-0.033 *** *0.004*	-0.026 *** *0.004*	-0.091 *** *0.003*	-0.090 *** *0.003*	-0.086 *** *0.004*	-0.087 *** *0.004*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	501,928	501,860	445,278	391,922	501,928	501,860	445,278	391,922	501,928	501,860	445,278	391,922	542,187	542,114	481,058	477,219	542,187	542,114	481,058	477,219	542,187	542,114	481,058	477,219
Adj R-squared	0.13	0.13	0.08	0.15	0.17	0.17	0.13	0.16	0.19	0.20	0.14	0.16	0.06	0.06	0.04	0.08	0.08	0.08	0.05	0.07	0.07	0.07	0.04	0.07	0.19	0.18	0.13	0.20	0.23	0.23	0.18	0.21	0.34	0.35	0.29	0.34
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes

Table 15. Simultaneous-equation system estimations of equation (2): determinants of IM segment positions: Overnight vs Longer-Term segments

Simultaneous estimates of equation (1) of Table 15 are not reported. For the description of Specifications see notes to Table 5; for the description of time spans, see notes to Table 7. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

	Total IM												Overnight												Longer-term											
Dependent variable:	Net-Position												Net-Position												Net-Position											
	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.025 *** *0.005*	0.025 *** *0.005*	0.025 *** *0.006*	0.026 *** *0.006*	0.059 *** *0.015*	0.058 *** *0.015*	0.042 *** *0.014*	0.040 *** *0.015*	0.134 *** *0.018*	0.135 *** *0.017*	0.136 *** *0.019*	0.132 *** *0.019*	0.052 *** *0.003*	0.052 *** *0.003*	0.047 *** *0.004*	0.045 *** *0.004*	0.050 *** *0.003*	0.049 *** *0.003*	0.032 *** *0.004*	0.022 *** *0.004*	0.040 *** *0.005*	0.040 *** *0.006*	0.054 *** *0.007*	0.067 *** *0.007*	0.030 *** *0.004*	0.030 *** *0.004*	0.032 *** *0.004*	0.028 *** *0.004*	0.023 *** *0.002*	0.023 *** *0.002*	0.021 *** *0.003*	0.021 *** *0.003*	0.066 ** *0.005*	0.067 *** *0.005*	0.071 ** *0.007*	0.074 *** *0.008*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	845,315	845,307	790,014	786,546	753,572	753,164	695,393	691,903	753,572	753,164	695,393	691,903	753,572	753,164	695,393	691,903	251,386	251,353	211,435	206,179	251,386	251,353	211,435	206,179	251,386	251,353	211,435	206,179
Adj R-squared	0.19	0.20	0.16	0.22	0.25	0.26	0.22	0.24	0.20	0.20	0.15	0.17	0.31	0.31	0.31	0.36	0.40	0.40	0.36	0.39	0.28	0.28	0.22	0.25	0.15	0.15	0.11	0.12	0.13	0.12	0.07	0.09	0.15	0.15	0.10	0.13
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes

	Credits												Credits												Credits											
Dependent variable:	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	0.022 *** *0.006*	0.022 *** *0.006*	0.021 *** *0.008*	0.022 *** *0.008*	0.019 *** *0.002*	0.018 *** *0.002*	0.004 * *0.002*	0.004 * *0.002*	0.040 * *0.005*	0.040 * *0.005*	0.034 *** *0.006*	0.029 *** *0.007*	0.028 *** *0.005*	0.028 *** *0.005*	0.022 *** *0.006*	0.016 ** *0.007*	0.030 *** *0.002*	0.030 *** *0.002*	0.011 *** *0.003*	0.006 * *0.003*	-0.004 *0.005*	-0.003 *0.005*	0.002 *0.007*	0.015 ** *0.007*	0.015 *** *0.002*	0.015 *** *0.002*	0.015 *** *0.002*	0.016 *** *0.002*	0.001 *0.001*	0.001 *0.001*	0.000 *0.001*	0.001 *0.001*	0.012 ** *0.005*	0.012 ** *0.005*	0.016 ** *0.007*	0.019 ** *0.008*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	553,930	553,919	502,241	497,909	492,256	491,899	441,199	436,771	492,256	491,899	441,199	436,771	492,256	491,899	441,199	436,771	145,629	145,584	113,871	108,405	145,629	145,584	113,871	108,405	145,629	145,584	113,871	108,405
Adj R-squared	0.24	0.26	0.22	0.25	0.29	0.30	0.26	0.29	0.27	0.28	0.24	0.25	0.41	0.41	0.38	0.41	0.46	0.46	0.43	0.45	0.41	0.41	0.36	0.39	0.11	0.11	0.09	0.09	0.16	0.16	0.12	0.18	0.13	0.13	0.07	0.09
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes

	Debts												Debts												Debts											
Dependent variable:	Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis				Normal times				Global financial crisis				Sovereign debt crisis			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Central Bank liquidity (to each bank)	-0.004 *** *0.007*	-0.004 *** *0.007*	-0.004 *** *0.008*	-0.004 *** *0.009*	-0.040 *** *0.003*	-0.040 *** *0.003*	-0.039 *** *0.004*	-0.037 *** *0.004*	-0.094 *** *0.004*	-0.095 *** *0.004*	-0.102 *** *0.004*	-0.104 *** *0.005*	-0.024 *** *0.006*	-0.024 *** *0.006*	-0.025 *** *0.007*	-0.029 *** *0.008*	-0.019 *** *0.002*	-0.019 *** *0.002*	-0.021 *** *0.003*	-0.016 *** *0.003*	-0.044 *** *0.002*	-0.043 *** *0.002*	-0.052 *** *0.003*	-0.052 *** *0.003*	-0.015 *** *0.004*	-0.015 *** *0.004*	-0.016 *** *0.004*	-0.012 *** *0.004*	-0.022 *** *0.002*	-0.022 *** *0.002*	-0.021 *** *0.003*	-0.020 *** *0.003*	-0.054 ** *0.003*	-0.055 *** *0.003*	-0.055 ** *0.003*	-0.056 *** *0.003*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	562,966	562,959	501,750	497,860	488,273	488,197	425,614	421,678	488,273	488,197	425,614	421,678	488,273	488,197	425,614	421,678	161,026	160,984	128,901	123,249	161,026	160,984	128,901	123,249	161,026	160,984	128,901	123,249
Adj R-squared	0.13	0.13	0.08	0.15	0.17	0.17	0.13	0.16	0.19	0.20	0.14	0.16	0.12	0.12	0.11	0.15	0.22	0.22	0.17	0.20	0.28	0.28	0.23	0.26	0.18	0.18	0.14	0.15	0.13	0.13	0.08	0.10	0.15	0.15	0.11	0.13
Bank FEs	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no
Time FEs	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no
Counterparty Fes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no
Counterparty FE × Time FE	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Bank FEs × Counterparty FE	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	yes

Table 16. Bank types detected on the basis of their possible behaviour vis-à-vis CB and IM

The table identifies and names six possible types of banks, detected on the basis of their possible behaviour in the two wholesale liquidity markets (measured by the Net-Position in the Total Interbank Market and the total Liquidity net-borrowed form CB). For example, "secondary liquidity users" are identified as banks that present a negative Net-Position in the Total Interbank Market while do not borrow from CB (or even present a positive net-deposit to it). Likewise, "primary liquidity redistributors" are defined as banks that are net-borrowers of the CB while present a positive Net-Position in the Total Interbank Market.

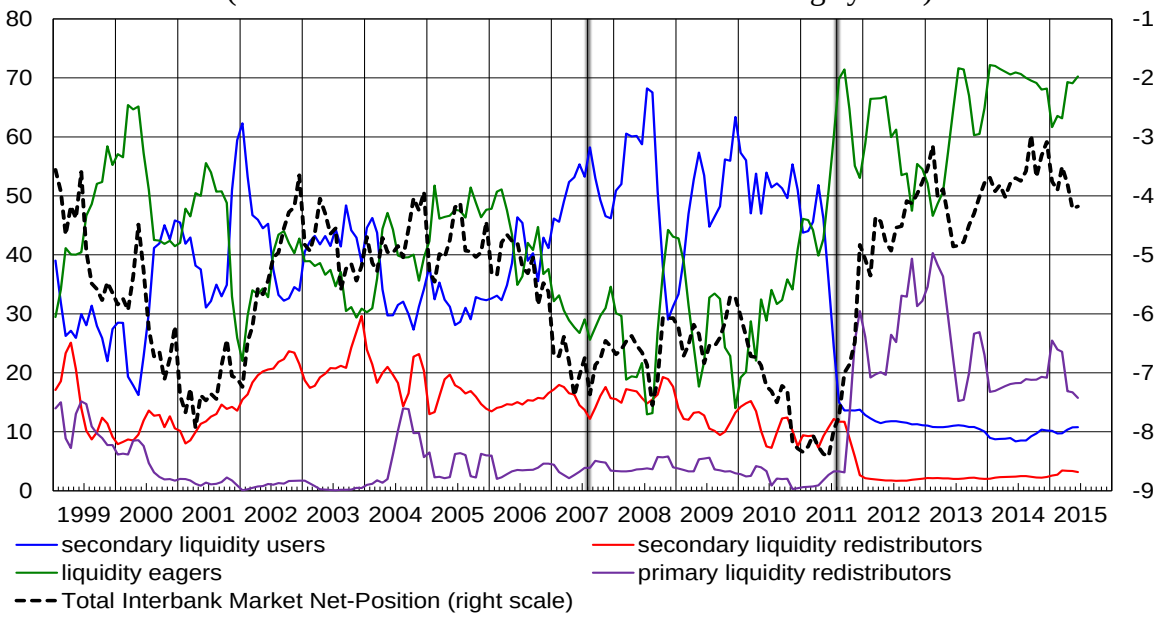
		Total Interbank Market - Net Position			
		< 0	**= 0**	**> 0**	
Net-liquidity position with the CB	**≥ 0**	secondary liquidity users	wholesale liquidity uninterested	secondary liquidity redistributors	**CB liquidity non-users**
	< 0	liquidity eagers	only primary liquidity users	primary liquidity redistributors	**CB liquidity users**
		IM liquidity users	**IM liquidity uniterested**	**IM liquidity reditributors**	**Total**

Table 17. Bank types detected on the basis of their actual behaviour vis-à-vis CB and IM in Italy

The table shows the percentage shares of representativeness of each of the main categories of banks identified in Table 16. For example, the "secondary liquidity users" represent in the pre-crisis period the 21.5 per cent of the total number of banks operating in Italy, the 38.2 per cent of the total assets of the system. Two types of banks ("wholesale liquidity uninterested" and "primary liquidity users") are excluded because of very low figures.

		Total Interbank Market - Net Position																	
		< 0						> 0											
Net-liquidity position with the CB	≥ 0	secondary liquidity users						secondary liquidity redistributors						CB liquidity non-users					
		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis	
		Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets
		21.5	38.2	21.0	49.9	52.8	10.9	68.8	17.1	73.2	12.9	25.5	2.9	97.0	55.5	93.4	62.8	79.3	13.7
	< 0	liquidity eagers						primary liquidity redistributors						CB liquidity users					
		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis	
		Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets
		1.8	40.3	2.8	30.9	11.4	63.4	0.7	4.2	0.9	3.3	8.3	22.8	3.0	44.5	6.6	37.2	20.7	86.3
		IM liquidity users						IM liquidity reditributors						Total					
		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis		Normal times		Global financial crisis		Sovereign debt crisis	
		Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets	Number of banks	Total assets
		30.5	78.7	25.8	83.8	66.2	74.4	69.5	21.3	74.1	16.2	33.8	25.6	100.0	100.0	100.0	100.0	100.0	100.0

Figure 4. Bank types detected by their actual behaviour vis-à-vis CB and IM
(as a share of total assets of the Italian banking system)



The figure shows the development of the shares of Italian banking system's total assets for four types of bank. The four types of bank are identified on the basis of their behaviour in the two wholesale liquidity markets, measured by the Net-Position in the Total Interbank Market and the total Liquidity net-borrowed form CB (see Tables 16 and 17). "Secondary liquidity users" are banks that present a negative Net-Position in the Total Interbank Market while do not borrow from CB (or even present a positive net-deposit to it). "Primary liquidity redistributors" are banks that are net-borrowers of the CB while present a positive Net-Position in the Total Interbank Market.

Table 18. Transition matrix of bank types

		To: Sovereign debt crisis			
		secondary liquidity users	secondary liquidity redistributors	liquidity eagers	primary liquidity redistributors
From: Normal times	secondary liquidity users	**14,5**	11,5	32,7	22,9
	secondary liquidity redistributors	76,0	**68,2**	52,2	60,4
	liquidity eagers	1,6	0,0	**4,4**	4,2
	primary liquidity redistributors	1,3	0,0	2,6	**0,0**
	other	6,6	20,4	8,1	12,5
	Total	100,0	100,0	100,0	100,0

		To: Sovereign debt crisis			
		secondary liquidity users	secondary liquidity redistributors	liquidity eagers	primary liquidity redistributors
From: Global financial crisis	secondary liquidity users	**21,8**	3,8	24,8	12,5
	secondary liquidity redistributors	76,0	**89,2**	44,3	68,8
	liquidity eagers	0,0	0,0	**20,4**	4,2
	primary liquidity redistributors	0,3	0,0	4,4	**10,4**
	other	1,9	7,0	6,2	4,2
	Total	100,0	100,0	100,0	100,0

Table 19. Likelihood to be "Primary liquidity redistributors" and "Liquidity eagers"

Results of the first equation of equation system 2. Dependent variable $im_{i,t}$: a binary variable equal to 1 if bank *i* is found to be a "primary liquidity redistributor" in the period *t* and 0 otherwise, in the first estimation; a "liquidity eager" in the second estimation. "Primary liquidity redistributors" are banks that are net-borrowers of the CB while present a positive Net-Position in the Total Interbank Market. "Liquidity eagers" are banks that are net-borrowers of the CB and IM. Estimation method: RE probit model. Sample time splitting: each specification is identically repeated in each span.

		primary liquidity redistributors			liquidity eagers		
		Normal times	Global financial crisis	Sovereign debt crisis	Normal times	Global financial crisis	Sovereign debt crisis
Central Bank liquidity (to each bank)		32.125 ***	22.481 ***	27.763 ***	9.798 ***	17.451 ***	0.454
		2.470	*2.001*	*1.015*	*1.314*	*1.503*	*0.510*
Domestic Infra-Group	*Debts or Credits*	-5.749 ***	-9.977 **	-2.958	2.243 *	-0.524	4.853 *
		2.069	*4.129*	*3.189*	*1.239*	*2.421*	*2.734*
Size		0.447 ***	0.897 ***	0.536 ***	0.634 ***	1.229 ***	1.229 ***
		0.068	*0.180*	*0.090*	*0.088*	*0.172*	*0.097*
Retail Loans		-1.354 **	-1.339 *	-3.132 ***	4.243 ***	3.195 ***	6.663 ***
		0.562	*0.749*	*0.569*	*0.892*	*0.987*	*0.632*
Retail Fundraising		2.211 ***	2.682 ***	8.057 ***	-5.613 ***	-1.680 **	-2.412 ***
		0.589	*0.874*	*0.735*	*0.652*	*0.700*	*0.449*
Bad Loans		1.805 ***	0.593	0.638	-1.181	-5.252 *	-4.547 ***
		0.692	*2.202*	*1.027*	*0.803*	*2.812*	*1.030*
ROE		-1.093	-1.777	-0.823	-1.387 **	-0.191	-1.062 **
		0.754	*1.155*	*0.632*	*0.618*	*0.987*	*0.514*
Capital		-5.896 ***	7.567 ***	10.257 ***	-3.695	-10.755 ***	5.063 ***
		2.222	*1.927*	*1.596*	*2.358*	*2.527*	*1.832*
Portfolio of domestic Gov't Debt Securities		-3.559 ***	-10.196 ***	-10.748 ***	2.665 ***	-0.140	9.401 ***
		0.918	*1.810*	*0.698*	*0.944*	*1.555*	*0.678*
Por. Gov't Debt Se. other euro-area countries		11.713 ***	4.269	-17.889 ***	15.682 ***	-7.062	9.176 ***
		2.789	*3.786*	*3.164*	*3.824*	*8.637*	*3.272*
Portfolio of Bank Bonds		0.551	-7.611 ***	-6.435 ***	5.076 ***	3.434 **	7.654 ***
		1.772	*2.133*	*1.110*	*1.599*	*1.697*	*0.916*
Rating		0.091	-0.812 ***	-0.159	-0.870 ***	0.130	-0.065
		0.133	*0.219*	*0.149*	*0.109*	*0.100*	*0.132*
Banks without Rating		-1.104	6.542 ***	2.157 **	4.099 ***	-0.414	-0.276
		0.909	*1.599*	*1.005*	*0.796*	*0.586*	*0.943*
Constant		-7.181 ***	-9.685 ***	-11.849 ***	-3.672 ***	-15.490 ***	-15.783 ***
		1.175	*2.214*	*1.477*	*1.267*	*2.208*	*1.449*
Bank random effects		yes	yes	yes	yes	yes	yes
Time fixed effets		yes	yes	yes	yes	yes	yes
Number of observations		65,073	27,210	24,240	65,073	27,210	24,240
rho		0.67	0.71	0.79	0.78	0.80	0.80

Appendix

The Appendix is organized in two Sections. Section A1 presents (in addition to those described in the main text) statistical diagnostics on the instrumental variables of matrixes $M_1^I{}_{i,t-1}$ and $M_2^I{}_{i,t-1}$. Section A2 summarizes the robustness checks of the econometric analysis.

A1. Statistical diagnostics on the instrumental variables

As clarified in Section 3, in both matrixes $M_1^I{}_{i,t-1}$ and $M_2^I{}_{i,t-1}$ I experiment with different instrumental variables alternating the lagged values of the endogenous regressors, as it is easy and standard in many applications, and other more specific instruments.

In equation (1), where the dependent variable is $cb_{i,t}$, I use in $M_1^I{}_{i,t-1}$ either the pair of variables 'GDP gap and inflation rates' or the pair of variables 'official rates and CB's total assets', weighting or not for banks' market share. To verify the quality of the instruments, first, Table A1 shows the summary statistics of all bank variables used in my estimations at different quartiles of the variables GDP gap and inflation rates, weighted or not for banks' market share. While showing a clear trend between instruments and the relevant endogenous variable (CB liquidity) the data present absence of a systematic pattern between the instruments and banks' other regressors supporting the assumption of orthogonality with the other potential determinants. Second, Table A1 also shows the results of the test described by Imbens and Wooldridge (2009) and Imbens and Rubin (2015) to verify the assumption of unconfoundedness. Specifically, the test consists in computing for each variable the normalized difference between the average for the quartile in column and the average of the other quartiles (results are reported in italics).[39] Imbens and Wooldridge (2009) and Imbens and Rubin (2015) point out as a rule of thumb that with a normalized difference less than 0.25 the difference is not statistically significant. Outcomes confirm that macro-variables are relevant for monetary policy decisions (even measured at bank level) and at the same time show both: there are no systematic patterns between the instruments and the other regressors, and the reference threshold of 0.25 is really seldom overtaken (in particular never when instruments are not weighted by banks' market share). Therefore, statistical diagnostics confirm the exogeneity of the two pairs of instruments, which however should be rather plain as macro variables are relevant for the decisions of monetary authorities, while are exogenous for individual behaviour of single banks.

In equation (2), where the dependent variables are alternatively the IM positions $im_{i,j,t}$, I use as instruments, in addition to the lagged variables, the pair of variables "Rating" and "Banks

[39]In detail, for each covariate, the statistic is computed as the difference in averages by treatment status, scaled by the square root of the sum of the variances, as a scale-free measure of the difference in distributions.

without Rating". I run in Table A2 the same exercise carried out for inflation and GDP in Table A1. Table A2 shows the summary statistics of regressors at different quartiles of Rating and for the two values of the dummy Banks without Rating. The data show a clear trend between instruments and the relevant endogenous variables (that is, IM positions: Table A2, upper side) and the absence of a systematic pattern between the instruments and banks' other regressors (Table A2, lower side). Results of the exercise test of Imbens and Wooldridge (2009) and Imbens and Rubin (2015) are again reported in italics. Results show that the test statistic generally exceeds one quarter for the IM positions, while it is almost always less than the reference threshold of 0.25 for the other regressors. An exception is the variable Size, which confirms that larger banks are well valued by rating agencies, while smaller banks are typically non-rated. However, just for these cases, the presence of the dummy Banks without Rating in the multivariate analysis helps to control for possible biases. There is also some weaker evidence of sorting by banks' Capital. To understand the broad exogeneity of credit scores with respect to the other regressors, one needs to consider two elements: first, the variable Rating also seizes unrated banks (which are very different from each other and therefore this alters possible linear relations), and, second, rating agencies' scores are complex financial assessments that do depend on banks' individual characteristics, however they are related not to a single and specific feature but to the bundle of bank characteristics as a whole.

A2. Econometric robustness checks

a) Alternative instrumental variables

I used the macro-instruments weighted at bank level because it make easier the advantage of maintaining in the estimations the time fixed effects. However, results remain unchanged when weights are not used. Table A3 shows the results of equation (2) using in $M1^{I}_{i,t-1}$: (i) the non-weighed pair 'GDP gap and inflation rates'; (ii) the weighed pair 'official rates and CB total assets' and (iii) the non-weighed pair 'official rates and CB total assets'. When the macro-instruments are not weighed at bank-level, in order to offset the loss of time fixed effects, I balance with a number of time-varying macro variables.[40] In spite of the changes in the magnitude of coefficients and some minor changes in the level of significance, results remain basically the same.

[40] The list includes a set of time varying macro-variables on the developments of Italian economy: exports and imports of goods and services; household consumption; gross fixed investment; households' both financial assets and liabilities; non-financial corporations' financial assets; non-financial corporations' both bonds and shares and other equity; General government's both debt and deficit; mutual fund shares. All these variables are taken as ratios to GDP. Furthermore, the list includes: the gross yield to maturity on 10-year General government bonds; the aggregated growth rate of bank lending to the private sector; the average interest rates on loans and deposits; persons in work and unemployment rate.

b) 2SLS IV estimates

The 3SLS estimator coincides with the 2SLS IV estimator apart from the covariance matrix of the equation disturbances, which is exploited by the 3SLS to obtain more efficient estimates. In a jointly dependent system the only reason why the 2SLS estimates could be preferred is when there are doubts on a possible misspecification of one equation in the system. In these cases one may choose to estimate two different sets of 2SLS regressions to avoid the misspecification of one equation affects the other. In order to verify the risk, I also ran two sets of 2SLS regressions, where the causal nexus of the relation between CB and IM liquidity is not assumed to be joint determined, but to be alternatively one-way determined. In the first 2SLS regression $cb_{i,t}$ is the dependent variable and $im_{i,j,t}$ is the instrumented variable. In the second 2SLS regression the experiment is reversed: IM positions are estimated as dependent variables and CB liquidity is the instrumented variable. The coefficients of $cb_{i,t}$ from 2SLS are very close to the 3SLS coefficients; those of $im_{i,j,t}$ are identical.

c) Heterogeneous IV tests

Another concern with IV estimations regards the fact that results may be heterogeneous just because of the instrument (Heckman, 1997). In other words, results may be not representative for the entire population of banks (the average treatment effect, ATE), but just for a group of banks that change their treatment owing to the instrument (local average treatment effect, LATE). To verify the concern, I ran (non reported but available) single-equation regressions with the same dependent variables and covariates as before, but including as new covariates the interactions between each regressor and the variables used as instruments in the equation-system estimates. If the effect of instrumental variables were heterogeneous in relation to bank characteristics, the coefficients of the interaction terms would be significantly different from zero. Instead, I find that, while the coefficients of the basic regressors do not vary substantially, the coefficients of the interaction terms are hardly significant.

d) Net CB liquidity

As noted in my basic estimations the key variable CB liquidity is measured as banks' *gross* borrowing form CB. I re-measured it as *net* borrowing, subtracting (from the gross liquidity that the CB grants to each bank) the amounts that each bank re-deposits at the CB. Results remain substantially unchanged. However, I preferred to use the gross variable because deposits at the CB are driven by reserve requirements (See Section 2) and their inclusion is inconsistent with the variable Retail Fundraising, which is worth keeping.

e) IM Credits and Debts

As mentioned in the text, the pairs of variables "Debts and Net Position" and "Credit and Net Position" are never estimated in the same specification because of collinearity. Instead, Debts and Credits can be included in the same estimate adding to the simultaneous-equations system a third equation, where the first equation is still for CB liquidity and the other two equations are respectively for IM Debts and Credits. Such an estimation requires however new instruments to cover the additional endogenous IM variable. An alternative approach is to estimate a non-complete system. More specifically, I estimated a system still composed of three equations, where equation (1) still included both Debts and Credits as key regressors, but equations (2) and (3) did not include mutually Debts and Credits among covariates, though contained the CB liquidity as the key regressor. I found that IM Debts and Credits were insignificant in equation (1), but, respectively in equations (2) and (3), CB liquidity still had the same significantly negative impact on IM Debts and significantly positive on IM Credits.

f) Estimations at bank level

As remarked, my estimations are carried out at (*i*, *j*, *t*) bank-counterparty-time level to exploit within counterparty variation and capture demand for interbank lending through the inclusion of interbank counterparties fixed effects. However, I also estimated the same simultaneous-equations system of equations (1) and (2) at (*i*, *t*) bank-time level, that is, collapsing all IM counterparties of each bank *i* and hence aggregating the total positions (Credits, Debts and Net) of each bank *i* towards the IM as a whole. The total number of observations $N_t \times T_i$ decreases to 130,226. This exercise may be useful to verify whether the IM liquidity obtained by those borrowing-banks that receive more from lending-banks with a greater CB liquidity is somehow compensated by less liquidity from lending-banks with lower CB liquidity. In other words, the exercise may contribute to verify whether the total effect at bank level might be offset despite the effect at bank-counterparty level. The results (not reported but available) are very close to those shown so far.

g) Foreign banks

Since I analyse the Eurosystem liquidity provision, which is decentralized, foreign banks could influence the results if they massively exploit the option to refinance at a given CB. However, the results remain unchanged when foreign banks are dropped.

Table A1. Distribution of variables conditional on instrumental variables of CB liquidity: GDP Gap and Inflation

For each quartile of the instrumental variables GDP Gap and Inflation (both weighted and not for banks' total assets), the table presents the summary statistics of each bank variable in the dataset and in italics the normalized difference between the average for the quartile in column and the average of the other quartiles (Imbens and Wooldridge, 2009; Imbens and Rubin, 2015). If the statistic in italics is less than 0.25, then the difference is not statistically significant.

Variables		Quartiles of GDP gap				Quartiles of Inflation				Quartiles of GDP gap weighted for banks' total assets				Quartiles of Inflation weighted for banks' total assets			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Instrumented covariate	Central Bank liquidity (to each bank)	0.001	0.002	0.003	0.020	0.012	0.005	0.004	0.005	0.000	0.002	0.002	0.023	0.004	0.002	0.004	0.015
		0.14	*0.14*	*0.25*	*0.30*	*0.26*	*0.27*	*0.07*	*0.03*	*0.26*	*0.17*	*0.13*	*0.29*	*0.06*	*0.25*	*0.07*	*0.26*
Other regressors	Domestic Infra-Group *Debts or Credits*	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.010
		0.03	*0.00*	*0.03*	*0.00*	*0.02*	*0.00*	*0.02*	*0.00*	*0.17*	*0.17*	*0.17*	*0.20*	*0.12*	*0.17*	*0.17*	*0.29*
	Size	5.27	5.48	5.95	6.26	5.81	5.65	5.68	5.82	3.89	5.09	6.03	8.07	4.43	4.94	5.82	7.88
		0.23	*0.14*	*0.11*	*0.24*	*0.04*	*0.05*	*0.03*	*0.04*	*0.27*	*0.25*	*0.19*	*0.26*	*0.26*	*0.26*	*0.26*	*0.27*
	Retail Loans	0.50	0.54	0.61	0.58	0.57	0.56	0.56	0.59	0.48	0.56	0.63	0.58	0.50	0.55	0.61	0.59
		0.23	*0.09*	*0.21*	*0.11*	*0.17*	*0.00*	*0.03*	*0.15*	*0.20*	*0.04*	*0.16*	*0.12*	*0.18*	*0.01*	*0.16*	*0.15*
	Bad Loans	0.06	0.05	0.04	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.06	0.05	0.04
		0.04	*0.04*	*0.19*	*0.18*	*0.20*	*0.04*	*0.10*	*0.09*	*0.05*	*0.01*	*0.03*	*0.07*	*0.10*	*0.10*	*0.08*	*0.19*
	Portfolio of Gov't Debt Securities	0.21	0.19	0.14	0.18	0.20	0.18	0.17	0.20	0.12	0.20	0.16	0.21	0.11	0.21	0.18	0.20
		0.21	*0.07*	*0.33*	*0.02*	*0.18*	*0.01*	*0.04*	*0.16*	*0.20*	*0.17*	*0.10*	*0.25*	*0.18*	*0.24*	*0.01*	*0.24*
	Portfolio of Bank Bonds	0.02	0.02	0.02	0.04	0.03	0.03	0.02	0.03	0.04	0.02	0.03	0.02	0.03	0.03	0.03	0.03
		0.12	*0.14*	*0.11*	*0.19*	*0.16*	*0.04*	*0.10*	*0.03*	*0.19*	*0.12*	*0.02*	*0.26*	*0.04*	*0.06*	*0.05*	*0.13*
	Securitized Loans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.08	*0.01*	*0.08*	*0.03*	*0.05*	*0.01*	*0.01*	*0.03*	*0.04*	*0.02*	*0.03*	*0.11*	*0.06*	*0.01*	*0.02*	*0.10*
	ROE	0.07	0.08	0.08	0.05	0.07	0.08	0.07	0.08	0.07	0.06	0.07	0.11	0.07	0.06	0.05	0.12
		0.00	*0.06*	*0.08*	*0.13*	*0.06*	*0.03*	*0.00*	*0.03*	*0.21*	*0.06*	*0.00*	*0.23*	*0.22*	*0.10*	*0.00*	*0.23*
	Capital	0.13	0.12	0.12	0.11	0.11	0.12	0.12	0.12	0.11	0.12	0.15	0.09	0.14	0.12	0.14	0.14
		0.14	*0.07*	*0.01*	*0.23*	*0.08*	*0.04*	*0.03*	*0.01*	*0.24*	*0.10*	*0.17*	*0.15*	*0.24*	*0.09*	*0.10*	*0.23*
	Reatil Fundraising	0.68	0.69	0.69	0.62	0.65	0.68	0.69	0.67	0.55	0.73	0.70	0.65	0.67	0.57	0.72	0.72
		0.06	*0.10*	*0.08*	*0.24*	*0.09*	*0.04*	*0.06*	*0.00*	*0.15*	*0.17*	*0.12*	*0.23*	*0.00*	*0.20*	*0.22*	*0.24*

Table A2. Distribution of variables conditional on instrumental variables of IM positions: Rating and Banks without Rating

For each quartile of the instrumental variable Rating, and for the two possible values of the dummy Banks without Rating, the table presents the summary statistics of each bank variable in the dataset and in italics the normalized difference between the average for the quartile in column and the average of the other quartiles (Imbens and Wooldridge, 2009; Imbens and Rubin, 2015). If the statistic in italics is less than 0.25, then the difference is not statistically significant.

Variables			Quartiles of Rating				Banks without Rating	
			1	2	3	4	0	1
Covariates instrumented by Rating and Banks without Rating	Total Interbank Market	*Debts*	0.165 *0.34*	0.116 *0.26*	0.116 *0.26*	0.091 *0.33*	0.150 *0.33*	0.098
		Credits	0.071 *0.25*	0.078 *0.25*	0.081 *0.28*	0.094 *0.26*	0.109 *0.30*	0.091
		Net	-0.054 *0.41*	-0.038 *0.29*	-0.035 *0.28*	0.002 *0.31*	-0.042 *0.31*	0.002
	Domestic Extra-Group	*Debts*	0.069 *0.28*	0.060 *0.28*	0.060 *0.27*	0.041 *0.26*	0.065 *0.26*	0.040
		Credits	0.042 *0.28*	0.045 *0.42*	0.059 *0.27*	0.076 *0.27*	0.065 *0.27*	0.077
		Net	-0.023 *0.26*	-0.015 *0.45*	-0.002 *0.32*	0.035 *0.29*	-0.001 *0.30*	0.039
	Foreign Extra-Group	*Debts*	0.124 *0.43*	0.041 *0.26*	0.035 *0.27*	0.030 *0.26*	0.064 *0.27*	0.050
		Credits	0.022 *0.34*	0.025 *0.27*	0.020 *0.23*	0.018 *0.27*	0.037 *0.28*	0.018
		Net	-0.082 *0.43*	-0.015 *0.23*	-0.015 *0.23*	-0.012 *0.26*	-0.026 *0.26*	-0.011
	Foreign Infra-Group	*Debts*	0.010 *0.25*	0.008 *0.25*	0.001 *0.20*	0.000 *0.31*	0.009 *0.31*	0.000
		Credits	0.003 *0.26*	0.005 *0.26*	0.001 *0.23*	0.000 *0.30*	0.004 *0.30*	0.000
		Net	-0.006 *0.26*	-0.003 *0.26*	0.000 *0.20*	0.000 *0.25*	-0.005 *0.29*	0.000
	CCPs	*Debts*	0.002 *0.25*	0.007 *0.24*	0.019 *0.32*	0.020 *0.33*	0.013 *0.33*	0.018
		Credits	0.003 *0.41*	0.003 *0.30*	0.001 *0.27*	0.000 *0.32*	0.002 *0.32*	0.000
		Net	0.001 *0.29*	-0.003 *0.30*	-0.017 *0.42*	-0.020 *0.35*	-0.010 *0.35*	-0.018
Other regressors	Domestic Infra-Group	*Debts or Credits*	0.041 *0.09*	0.046 *0.10*	0.030 *0.26*	0.001 *0.18*	0.044 *0.18*	0.001
	Size		10.51 *0.27*	10.01 *0.22*	9.44 *0.21*	5.54 *0.32*	9.91 *0.30*	5.58
	Retail Loans		0.53 *0.12*	0.57 *0.07*	0.53 *0.12*	0.56 *0.18*	0.51 *0.18*	0.58
	Bad Loans		0.03 *0.20*	0.05 *0.02*	0.04 *0.00*	0.05 *0.03*	0.06 *0.03*	0.05
	Portfolio of Gov't Debt Securities		0.12 *0.12*	0.07 *0.20*	0.09 *0.20*	0.18 *0.20*	0.08 *0.20*	0.17
	Portfolio of Bank Bonds		0.02 *0.09*	0.04 *0.19*	0.04 *0.22*	0.03 *0.20*	0.04 *0.20*	0.03
	Portfolio of euro Gov't Debt Securities		0.00 *0.00*	0.00 *0.15*	0.00 *0.03*	0.00 *0.08*	0.00 *0.08*	0.00
	ROE		0.10 *0.20*	0.08 *0.11*	0.07 *0.01*	0.08 *0.04*	0.08 *0.04*	0.07
	Capital		0.09 *0.28*	0.09 *0.18*	0.09 *0.22*	0.11 *0.16*	0.09 *0.21*	0.12
	Retail Fundraising		0.61 *0.18*	0.59 *0.21*	0.59 *0.22*	0.65 *0.20*	0.57 *0.20*	0.63

Table A3. Robustness check: Determinants of Total IM positions – simultaneous system estimates of equation 2, estimated with alternative instruments

Results of the simultaneous system equation (2) replacing instrumental variables. Instruments: GDP and Inflation rates, Official rates and CB's total assets weighted and not for banks' total assets. When instruments are not weighted at bank level, there are no time fixed effect and regressions include a list of time varying macro-variables on the developments of Italian economy. Sample time splitting: each specification is identically repeated in each span.

Instruments:	***GDP and inflation rates non-weighted for banks' total assets***									***Official rates and CB's total assets weighted for banks' total assets***									***Official rates and CB's total assets non-weighted for banks' total assets***								
Dependent variable:	**Net-Position**																									
	Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis		
	1	2	3	1	2	3	1	2	3	**2**	**3**	**4**	**2**	**3**	**4**	**2**	**3**	**4**	1	2	3	4	2	3	1	2	3
Central Bank liquidity (to each bank)	0.0815*** *0.005*	0.0806*** *0.005*	0.0798*** *0.005*	0.0517*** *0.004*	0.0508*** *0.004*	0.0494*** *0.004*	0.0974*** *0.007*	0.0980*** *0.007*	0.0976*** *0.007*	0.515** *0.175*	0.148 *0.186*	0.199 *0.175*	0.19*** *0.031*	0.212*** *0.037*	0.254*** *0.042*	0.0979* *0.059*	0.229* *0.123*	0.374* *0.159*	0.235* *0.096*	0.217* *0.096*	0.237* *0.096*	0.158* *0.080*	0.158* *0.079*	0.121 *0.090*	0.169*** *0.026*	0.157*** *0.027*	0.048 *0.038*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945
Adj R-squared	0.19	0.19	0.25	0.25	0.26	0.29	0.20	0.20	0.23	0.17	0.16	0.22	0.26	0.21	0.24	0.18	0.15	0.15	0.19	0.19	0.25	0.25	0.26	0.29	0.17	0.17	0.20
Bank FEs	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no
Time FEs	no	no	no	no	no	no	no	no	no	yes	no	no	yes	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
Macro control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Counterparty FEs	no	yes	no	no	yes	no	no	yes	no	yes	no	no	yes	no	no	yes	no	no	no	yes	no	no	yes	no	no	yes	no
Counterparty FEs × Time FEs	no	no	no	no	no	no	no	no	no	no	yes	yes	no	yes	yes	no	yes	yes	no	no	no	no	no	no	no	no	no
Bank FEs × Counterparty FEs	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Dependent variable:	**Credits**																									
	Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis		
	1	2	3	1	2	3	1	2	3	**2**	**3**	**4**	**2**	**3**	**4**	**2**	**3**	**4**	1	2	3	1	2	3	1	2	3
Central Bank liquidity (to each bank)	0.0424*** *0.01*	0.0413*** *0.01*	0.0390*** *0.01*	0.0174*** *0.00*	0.0165*** *0.00*	0.0190*** *0.00*	0.0133* *0.01*	0.0134* *0.01*	0.0134* *0.01*	0.597*** *0.116*	0.237* *0.136*	0.192* *0.102*	0.0997*** *0.026*	0.244*** *0.030*	0.311*** *0.034*	0.143*** *0.043*	0.500*** *0.108*	0.523*** *0.140*	0.258*** *0.07*	0.240*** *0.07*	0.177* *0.07*	0.269*** *0.07*	0.266*** *0.07*	0.301*** *0.08*	0.0606*** *0.02*	0.0810*** *0.02*	0.0969*** *0.02*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945
Adj R-squared	0.24	0.25	0.28	0.29	0.30	0.33	0.26	0.27	0.29	0.22	0.22	0.25	0.30	0.25	0.27	0.26	0.19	0.20	0.24	0.25	0.28	0.27	0.29	0.31	0.26	0.26	0.27
Bank FEs	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no
Time FEs	no	no	no	no	no	no	no	no	no	yes	no	no	yes	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
Macro control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Counterparty FEs	no	yes	no	no	yes	no	no	yes	no	yes	no	no	yes	no	no	yes	no	no	no	yes	no	no	yes	no	no	yes	no
Counterparty FEs × Time FEs	no	no	no	no	no	no	no	no	no	no	yes	yes	no	yes	yes	no	yes	yes	no	no	no	no	no	no	no	no	no
Bank FEs × Counterparty FEs	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes

Dependent variable:	**Debts**																									
	Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis			Normal times			Global financial crisis			Sovereign debt crisis		
	1	2	3	1	2	3	1	2	3	**2**	**3**	**4**	**2**	**3**	**4**	**2**	**3**	**4**	1	2	3	1	2	3	1	2	3
Central Bank liquidity (to each bank)	-0.0391*** *0.007*	-0.0393*** *0.007*	-0.0408*** *0.007*	-0.0343*** *0.003*	-0.0343*** *0.003*	-0.0305*** *0.003*	-0.0841*** *0.003*	-0.0846*** *0.003*	-0.0842*** *0.004*	-0.082 *0.164*	-0.0108 *0.179*	-0.0193 *0.165*	-0.0808** *0.027*	-0.0314 *0.033*	0.0562 *0.037*	-0.241*** *0.057*	-0.271* *0.122*	0.149 *0.151*	0.0228 *0.084*	0.0236 *0.084*	-0.0606 *0.083*	-0.111* *0.055*	-0.108* *0.055*	-0.18** *0.057*	-0.109*** *0.031*	-0.0765* *0.031*	0.0509 *0.032*
Bank characteristics and control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945	579,212	545,875	542,700	207,470	194,888	193,812	198,041	189,815	188,945
Adj R-squared	0.13	0.13	0.18	0.17	0.17	0.21	0.18	0.19	0.21	0.13	0.14	0.15	0.17	0.12	0.16	0.15	0.14	0.14	0.13	0.13	0.18	0.16	0.16	0.20	0.17	0.18	0.21
Bank FEs	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no
Time FEs	no	no	no	no	no	no	no	no	no	yes	no	no	yes	no	no	yes	no	no	no	no	no	no	no	no	no	no	no
Macro control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Counterparty FEs	no	yes	no	no	yes	no	no	yes	no	yes	no	no	yes	no	no	yes	no	no	no	yes	no	no	yes	no	no	yes	no
Counterparty FEs × Time FEs	no	no	no	no	no	no	no	no	no	no	yes	yes	no	yes	yes	no	yes	yes	no	no	no	no	no	no	no	no	no
Bank FEs × Counterparty FEs	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes

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