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Ronald Heijmans, Richard Heuver
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DeNederlandscheBank
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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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De Nederlandsche Bank NV
P.O. Box 98
1000 AB AMSTERDAM
The Netherlands

How to monitor the exit from the Eurosystem's unconventional monetary policy: Is EONIA dead and gone?*

Ronald Heijmans[a], Richard Heuver[a], and Zion Gorgi[a]

[a] *De Nederlandsche Bank*

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Abstract

This paper investigates the impact of the "unconventional" monetary policy measures taken by the Eurosystem on both the unsecured and the secured money markets. Furthermore, we provide insight into the shifts between the unsecured and secured markets. We provide a euro area overview and a Core-versus-Periphery breakdown. Our results show that: 1) there is a clear segmentation between Core and Periphery; 2) the use of the unsecured money market has decreased substantially and is no longer representative as a reflection of the euro area as a whole; and 3) the use of the secured money markets has increased substantially in value terms since the start of the crisis. Both the secured and the unsecured money markets reacted strongly to the first 3-year long term refinancing operations and quantitative easing. It is not to be expected that turnover in the money markets will revert to pre-crisis levels, in part because new regulation, such as the Basel III requirements, dissuades banks from engaging in short-term lending. Therefore, monetary policy experts should also devote their attention to steering the rates in the secured money market.

Keywords: monetary policy, repo, GC Pooling, MTS Repo, unsecured money market, central bank, Basel III.
JEL classifications: E42, E44, E58, G01.

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The authors are members of one of the user groups with access to TARGET2 data in accordance with Article 1(2) of Decision ECB/2010/9 of 29 July 2010 on access to and use of certain TARGET2 data. DNB and the PSSC have checked the paper against the rules for guaranteeing the confidentiality of transaction-level data imposed by the PSSC pursuant to Article 1(4) of the above mentioned issue. The views expressed in the paper are solely those of the authors and do not necessarily represent the views of the Eurosystem.

1 Introduction

Monetary policies of central banks worldwide have changed drastically since the onset of the crisis in the summer of 2007, leading to fundamental changes in money markets and global liquidity conditions. Up until this crisis, most central banks, including the Eurosystem, maintained an environment in which they provided just enough reserves to allow financial institutions to meet their reserve requirements. In keeping reserves scarce and setting the key interest rate at which banks could borrow, central banks could steer the market interest rate by adjusting the provided reserves and policy rate by relatively small increments. In reaction to the financial crisis and the emerging sovereign debt problems in the euro area, the Eurosystem, like many other central banks in the western world, lowered its interest rates to close to zero while providing large amounts of excess liquidity.[1]

This paper investigates the impact which the financial crisis and the subsequent monetary and regulatory responses have on the structure of the European money markets. We will attempt to answer the question whether the unsecured money market can be revived and still fulfil its role in the transmission of monetary policy in the post-crisis environment or, if not, whether the Eurosystem should adopt a new framework, including the targeting of the secured market. Since EONIA lost its representativeness reflecting the interest rate development in the Eurosystem, our study looks at a more comprehensive data set of the unsecured money market.[2] We also look at secured money market sources as shifts have been observed from the unsecured to the secured money market (see e.g. Cappelletti et al. (2011), ECB (2012) and Couré (2013)). Our analysis provides guidance in how to monitor the money markets and therefore measure the effectiveness of the monetary policy transmission. This will be particularly relevant if the Eurosystem intends to move away from the present situation of large excess liquidity.

In contrast to the literature, this paper looks at the impact of monetary policy on both the unsecured and the secured money market. Usually, the impact of monetary policy measures is typically studied from the perspective of the unsecured money market. This is not surprising, as central banks, including the Eurosystem, aim to steer the rate in this market (i.e. EONIA) and not the rate in the secured

[1] ECB (2010); van Riet (2010) provide a clear description of the Eurosystem's initial response. For a comprehensive overview of the changes in monetary policy up until 2013, see Heijmans et al. (2013). Engen et al. (2015) provide a comprehensive overview of the policy measures taken by the Federal Reserve. Joyce et al. (2012); Joyce (2012)assesses the impact of Quantitative Easing and other unconventional monetary policies followed by central banks since the start of the crisis.

[2] The loss of representativeness of EONIA was caused by the decrease in reporting banks from 42 (September 2010) to 24 (October 2015), the fall in turnover from roughly EUR 65 billion (September 2008) to EUR 15 billion (September 2015) and the bias towards northern European banks.

market. Heijmans et al. (2013)), for instance, look at the impact of the changes in the monetary policy framework on the volatility of the rate. Their study focuses solely on the Dutch segment of the euro area due to limited data availability. Cassola and Huetl (2010) studied the euro overnight interbank market and the ECB's liquidity management policy during tranquil and turbulent times. Soares and Rodrigues (2011) analysed the determinants of the EONIA spread and the financial crisis. Research on repo markets is still very scarce due to limited data availability. Mancini et al. (2015) were one of the first to publish a paper using GC Pooling data.[3] They found that the euro interbank repo market was resilient during crisis episodes and may even act as a shock absorber, in the sense that repo lending increases with counterparty risk, while spreads, maturities and haircuts remain stable. Berentsen et al. (2015) developed a dynamic general equilibrium model of secured money markets to see how a central bank can control interest rates in an environment with large excess reserves. Heijmans and Yun (2015) studied risk factors in the Korean repo market based on the US and European experience during the global financial crisis.

Aside from unconventional monetary policy measures, new regulatory initiatives have had an effect on the functioning of the money markets. The new liquidity ratios under Basel III may have dissuaded very short-term unsecured interbank activity and promoted banks' hoarding of high-quality collateral. The simple non-risk-based leverage ratio may reduce the activity in repo markets (see ICMA (2013)). They found that the Basel III requirements were the major factor impacting the repo market in the future. Each of their components - liquidity coverage ratio, net stable funding ratio and Leverage Ratio - impact the repo market in different, yet cumulative ways, significantly adding to the cost of capital required to run a repo trading book. Schmitz (2013) described the impact of the liquidity coverage ratio on the implementation of monetary policy in the euro area. His paper analyzed the impact of unconventional monetary measures and new regulatory initiatives such as the Basel III liquidity ratios, on the European money market. He argued that the isolated focus on the impact of the liquidity coverage ratio tends to underestimate the future challenges to monetary policy implementation for two reasons: first, feedback and network dynamics exacerbate the impact of the standard; second, the ongoing crisis itself challenges monetary policy implementation in the euro area by its impact on the - perceived - arbitrage relationship between open market operations and the unsecured money market.

This paper is organized as follows. Section 2 describes the changes in the monetary policy framework since the start of the crisis and the different data sources. Section 3 gives an overview of how banks

[3]GC Pooling is a European trading service for CCP-based repo transactions, see section 2.3.

have used the Eurosystem facilities. Section 4 zooms in on the euro area and the Core-Periphery structure of the unsecured money market. Section 5 describes the developments in GC Pooling and MTS Repo, also at euro area and Core-versus-Periphery level. Section 6 presents conclusions.

2 Data

This section describes the data sources used in this paper, including their potential uncertainty, biases and limitations. The following data sources were used:

- monetary policy instruments: daily country level data (section 2.1),
- unsecured money market: transaction level data (section 2.2),
- secured money market from the GC Pooling system; anonymous transaction level data (section 2.3),
- secured money market from the MTS Repo system; daily country level data (section 2.4).

Section 2.5 provides an overview of important events since the collapse of Lehman.

2.1 Monetary policy instruments

We aggregated daily data per country for the following monetary policy instruments: 1) main refinancing operations (MROs), 2) long-term refinancing operations (LTROs), 3) marginal Lending (ML), 4) overnight deposit (OND) and 5) fixed-term deposit (FTD).

For confidentiality reasons we had to aggregate Eurosystem lending (items 1, 2 and 3) and depositing (items 4 and 5) to single numbers. However, we are able to distinguish between these individual items for central bank's internal reporting purposes.

In order to fully assess the liquidity situation, we added current accounts-data per day per country. The current accounts are the locations in which banks had to place their reserves in order to meet the minimum requirement. Our data set ranged from June 2008 to September 2015.

2.2 Unsecured money market

Detailed data on unsecured money market transactions are usually not readily available in most markets, including the euro area. To obtain such data, researchers applied an algorithm to identify the

size and interest rates of unsecured money market loans from large value payment system data, based on Furfine (1999).

We used the algorithm developed and validated by Arciero et al. (2016).[4] Their algorithm is suitable for the entire euro area, for loans up to one year. They found a Type 2 error (false negative) of just below 2% and a Type 3 error (wrong assignment to the maturity) of less than 1%. Some caution, however, must be exercised with respect to loans from the summer of 2014 onwards. As interest rates were getting close to zero and even negative, the performance of the algorithm was declining. This was investigated and corrected by Rainone and Vacirca (2015). Despite the uncertainties in their algorithm, it delivered reliable data on a euro area-wide scale. Besides, as the algorithm provides individual unsecured money market trades it enables researchers to choose any preferred aggregation level. The data set ranged from June 2008 to August 2015. From the data set we used maturities up to one year.

Besides unsecured money market trades based on an algorithm we also had the daily reported totals of EONIA. EONIA is the Euro Overnight Index Average. It is an effective overnight interest rate computed as the weighted average of all overnight unsecured loans reported by the contributing euro area panel banks. It is traditionally used by the Eurosystem to measure the impact of their monetary policy. In addition, banks use this rate as the bench mark rate for the unsecured interbank lending rates.

2.3 Secured money market: GC Pooling

GC Pooling is one of the largest pan-European trading services for CCP-based repo transactions. GC stands for General Collateral, which typically refers to high-quality and most liquid assets. The GC Pooling ECB Basket includes some 4,000 ECB-eligible assets, mostly in the form of euro area government bonds and covered bonds with a minimum rating of A-/A3. The GC Extended basket includes over 20,000 investment grade instruments that meet the ECB eligibility criteria, including uncovered bank bonds and corporate bonds.

GC Pooling (GCP) was launched in March 2005 and has become a highly liquid market for secured funding in euros, US dollars and Swiss francs. The international participants benefit from anonymous electronic trading through a central counterparty (CCP) with real-time collateral management.

[4] Arciero et al. (2016) built on Heijmans et al. (2010) who were the first to present an algorithm that is suitable for - part of - the euro area.

GCP makes it easy to trade extremely large tickets, and deals can be seamlessly completed and then processed automatically without any issues with regard to credit or security allocation. The GC Pooling Market ensures straight-through processing with automated connectivity to Eurex Clearing AG as central counterparty and the central securities depository Clearstream Banking, which settles the securities leg of the transactions. As soon as a GCP transaction is concluded on the electronic Eurex Repo trading system, Eurex Clearing steps in as legal counterparty. The maturities of the trades range from one day up to two years; the minimum contract size is EUR 1 million. More detailed information on GC Pooling can be found at the website of Eurex Repo GmbH.[5]

Our data set ranged from June 2008 to June 2015. The participants trade anonymously and do therefore not know to whom they lend or from whom they borrow. The data set, however, provided this information in the form of fake ID's so we can trace the transactions of a bank through time, but do not know its true identity. By linking part of the trades to TARGET2 data, we are, however, able to generate an approximation. The cash leg of the trade will be settled through a participant in TARGET2. These are, however, netted positions, which may also be settled through a different participant of TARGET2. Therefore, we are not able to identify all participants.

2.4 Secured money market: MTS Repo

MTS Repo is an electronic trading platform for the European repo market. At the moment it is accessed by 150 participants across Europe. The data set used contained daily rates and total value of trades, spanning from June 2008 to June 2015. The total trades can be broken down into country totals of Germany, France and Italy. As these country totals represent an overall share of 83% we will use this as a proxy for generating the Core-Periphery breakdown. Italian banks appear to have a much larger share in MTS Repo turnover than in GC Pooling. More detailed information on the MTS Repo platform can be found at its website.[6]

2.5 Monetary policy and events

2.5.1 Monetary policy interest rate channel

Before the crisis, the ECB used the interest rate channel to maintain price stability. The rate at which banks are able to borrow from the ECB is transferred to the short-term rate that banks charge each

[5] see `http://www.eurexrepo.com/repo-en/markets/gc-pooling-market`
[6] see `http://www.mtsmarkets.com/Products/MTS-Repo`

other, followed by longer term interbank rates. These rates are then transferred to real interest rates and the cost of capital. This makes the interbank rate a crucial entity for monitoring the effectiveness of the transmission mechanism.

2.5.2 Events

Since the start of the crisis in mid-2007, several important events occurred, see also Arciero et al. (2016) and ECB (2010). We will describe these using three main periods.

The start of the crisis: July 2007 - March 2010 After the default of Lehman Brothers, the ECB started Fixed Rate Full Allotment, the purchasing programme for covered bonds and LTROs with 1-year maturity.

Start of the sovereign debt crisis: April 2010 - December 2013 Greece was the first country that was affected by a sovereign debt crisis, followed by Ireland, Italy, Portugal and Spain. The ECB responded with 3-year LTROs, a lowering of the deposit rate to 0% and several additional measures (see Table 1).

Recent developments: Januari 2014 - September 2015 During the most recent period, further measures were taken by the ECB in order to provide liquidity, in the form of Targeted LTROs, negative deposit rates and quantitative easing.

Table 1 provides an overview of the main crisis events and the most important changes in the monetary policy framework of the Eurosystem. The third column describes the changes in the monetary policy framework, the fourth column describes the crisis events and the fifth column states whether the change in monetary policy or crisis event is depicted in the graphs of sections 3, 4 and 5.

3 Use of Eurosystem facilities

This section describes the monetary policy decisions in terms of the use of lending facilities (long-term refinancing operations, main refinancing operations and marginal lending) and deposit facilities (overnight deposit and fixed-term deposit). In order to fully assess the liquidity situation we added the current account balances to the analysis as they were also used as a location to store liquidity.

Table 1: Overview of crisis events and changes in the monetary policy of the Eurosystem.

Nr.	Date	Monetary policy events	Crisis events	In graphs
1	2007-08	ECB provides extra liquidity (incl dollars).		no
2	15-09-08		Default of Lehman Brothers.	yes
3	2008-10	ECB starts with Fixed Rate Full Allotment .		no
4	2009-06	ECB announces purchase programme for covered bonds.		no
5	2009-07	ECB provides LTROs with maturity of 1 year.		no
6	01-04-10		Start of the sovereign debt crisis with Greece.	yes
7	2010-05	ECB introduces the Securities Markets Programme (SMP).		no
8	01-08-11		Intensivation of the sovereign debt crisis by the problems of Italy.	yes
9	21-12-11	ECB provides VLTROs with maturity of 3 years (first). Reserve ratio to 1% starting on 18 January 2012.		yes
10	08-03-12	VLTROs with maturity of 3 years (second).		no
11	11-07-12	Overnight deposit rate set to 0%.		yes
12	12-07-12	Draghi's "Whatever it takes" speech.		no
13	2012-08	ECB announces Outright Monetary Transactions. The Governing Council decides to terminate the SMP and announces OMT in secondary sovereign bond markets.		no
14	2013-07	ECB provides forward guidance on future interest rates (key interest rates to remain low).		no
15	2014-06	ECB announces Targeted LTRO.		no
16	04-09-14	Negative rates (NR) , Targeted LTRO, ABS/Covered bond program.		yes
17	22-01-15	Quantitative easing (QE) announcement.		no
18	09-03-15	Start of QE.		yes

First, we provide a euro area view (section 3.1) and subsequently zoom in to take a Core-Periphery view to investigate the Eurosystem's segmentation (section 3.2). The Periphery countries are the GIIPS countries (Greece, Italy, Ireland, Portugal and Spain), Malta and Cyprus. These countries faced sovereign debt problems between 2008 and 2015. The other Eurosystem countries are the Core countries.

3.1 Monetary policy: Euro area

Figure 1 shows the use of the Eurosystem facilities, from June 2008 to September 2015. The positive values present the sum of the lending facilities of MRO, LTRO and marginal lending (in orange). The negative values refer to the sum of the overnight deposit and fixed-term deposit (in blue) and the current account (in green). All though not visible in the figures, the liquidity effect of the Extended Assets Purchasing Programs were taken into account, as these will be reflected in the account balances or in the use of the overnight and fixed-term deposit facilities. The black line shows the difference between the use of the lending and depositing facilities (net positions).

After the introduction of the 3-year LTRO by the Eurosystem (December 2011 and March 2012), the amount of liquidity obtained by banks and the amount deposited simultaneously increased substantially. The use of the lending facilities (orange) increased from roughly EUR 600 billion (December 2011) to EUR 1,150 billion (March 2012). The amount banks simultaneously deposited (including current accounts) at the Eurosystem increased in the same period from EUR 650 billion to EUR 1,100 billion. Simultaneous and substantial usage of the Eurosystem's lending and depositing facilities is a clear sign of distrust in the market.[7] In this case, banks preferred to deposit their surpluses at the Eurosystem facilities over trading in the market. Or, similarly, banks with shortages were unable to borrow from those with surpluses as they were not perceived to be sufficiently credit-worthy. The situation of distrust arose after the collapse of Lehman. However, the extent we observed after the introduction of the 3-year LTROs goes beyond a situation of distrust and could be considered a complete melt down of the interbank markets. After the Eurosystem had set the overnight deposit rate to zero, excess liquidity steadily decreased until the rate was made negative (September 2014), only to increase again after the Eurosystem had started quantitative easing (March 2015).

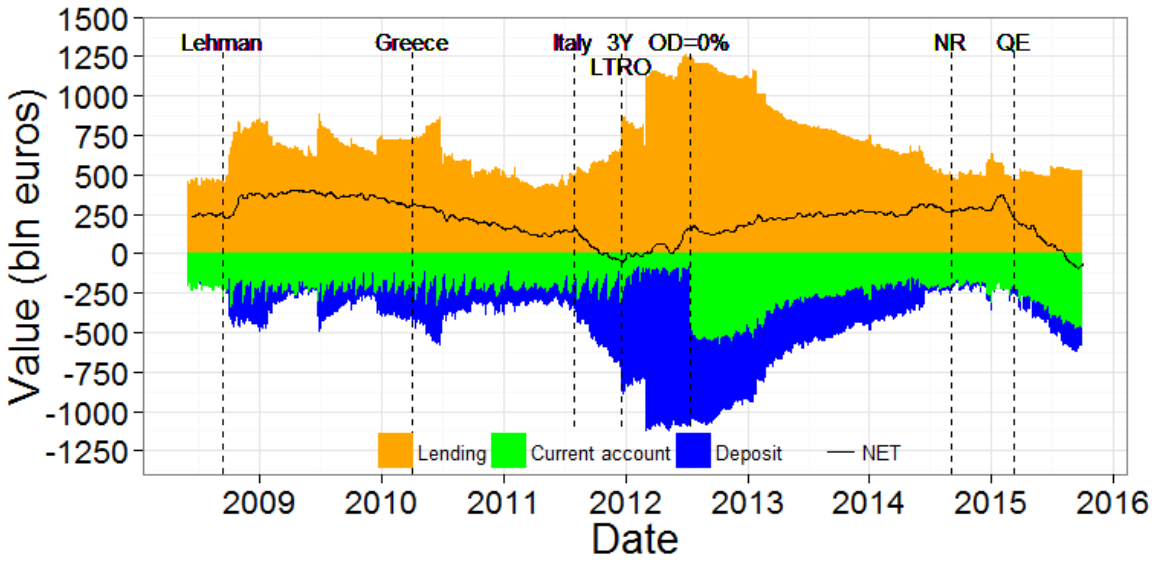
3.2 Monetary policy: Core-Periphery

Figure 1 in the previous section shows a clear fragmentation between banks in the Eurosystem with a liquidity shortage (borrowing from the Eurosystem) and those with a surplus (depositing at the Eurosystem). The figure does, however, not illustrate how it is fragmented geographically.

Figure 2a and 2b depict the use of the Eurosystem facilities by the banks in the Core and in the

[7] In normal times, banks may also use the deposit and lending facilities simultaneously in relatively small amounts, which is not a sign of distrust. However, when many banks use the lending and depositing facilities at the same time in substantial amounts, this is a sign of distrust in the market.

Figure 1: Euro area: Use of Eurosystem facilities in the euro area



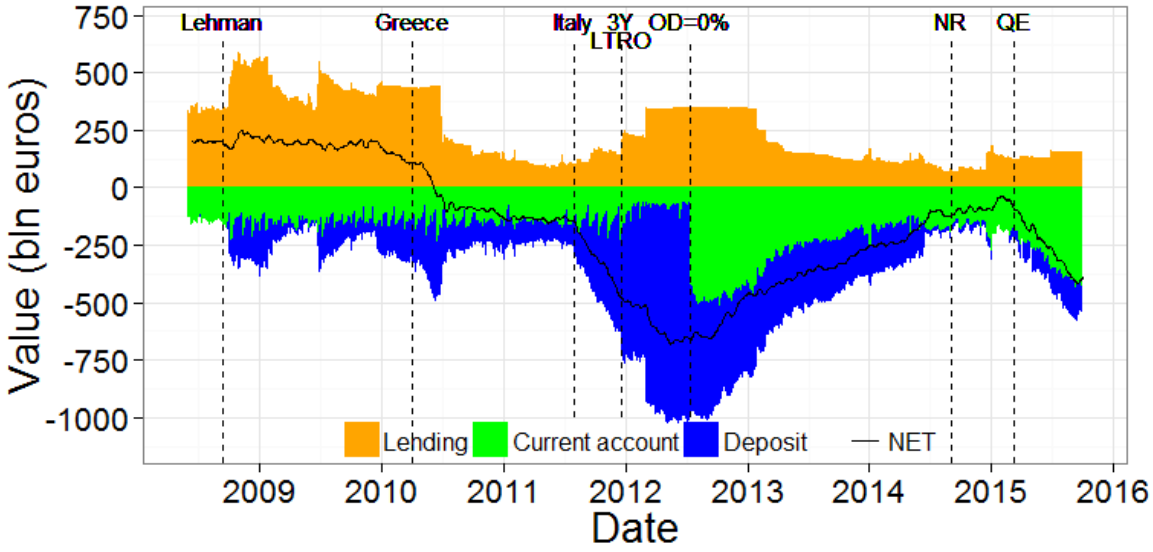
Periphery, respectively. From these two figures we can clearly see that the banks in the Core deposit at the Eurosystem, while those in the Periphery borrowed from the Eurosystem. The figure depicting the Periphery almost mirrors that of the Core. In other words, it shows that the fragmentation in the euro area was between banks in the Core and in the Periphery. This was also reflected by the elevated TARGET2 imbalances between stressed and non-stressed countries, which indicates increased net financial inflows into Core countries versus increased net financial outflows from Periphery countries.

The net position of the Periphery (the black line in Figure 2b) remained positive during the entire investigated period and shows positive spikes after the indicated crisis events until the overnight deposit rate turned negative. It increased from approximately EUR 50 billion before the Lehman collapse to over EUR 750 billion at the time of the introduction of the 0% overnight deposit rate. This clearly indicates the increase in Peripheral banks' demand for central bank liquidity, which they did not obtain from the money market. The net position decreased to approximately EUR 350 billion at the start of quantitative easing and remains roughly constant since then. This indicates that the demand of central bank liquidity did not decrease after quantitative easing had started.

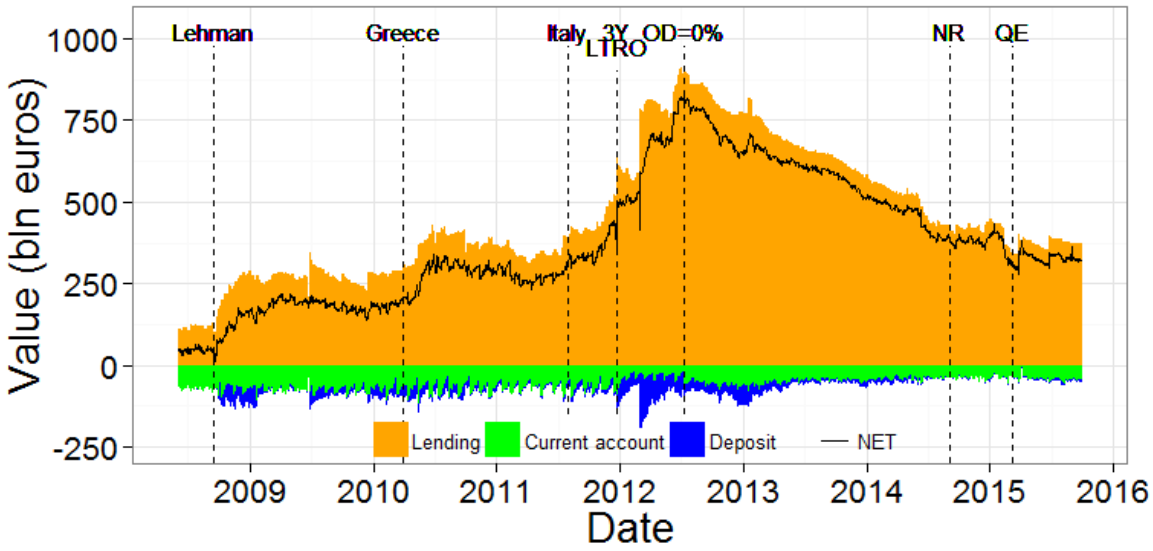
The net position of the Core (the black line in Figure 2a) became negative (more depositing than borrowing from the Eurosystem) a few months after the sovereign debt problems in Greece had started. It had decreased to a net value of almost EUR -750 billion just before the overnight deposit rate was

Figure 2: Use of ECB facilities in the Core.

(a) Banks active in the Core.



(b) Use of ECB facilities in the Periphery.



set to 0%. This clearly indicates the excess liquidity of the banks in the Core, which they did not trade in the money market. The net position of the Core shows an increasing trend (becoming less negative) from the time the overnight deposit rate was set to 0%, only to decrease again (more negative) after the introduction of quantitative easing. The liquidity of the quantitative easing was located at the accounts of the banks in the Core.

4 Developments in the unsecured money market

This section describes how the fragmentation in the Eurosystem becomes visible in the unsecured money market. We will first look at the turnover developments of this market for the euro area as a whole and subsequently for the Core and Periphery (Section 4.1). Section 4.2 describes the rate development.

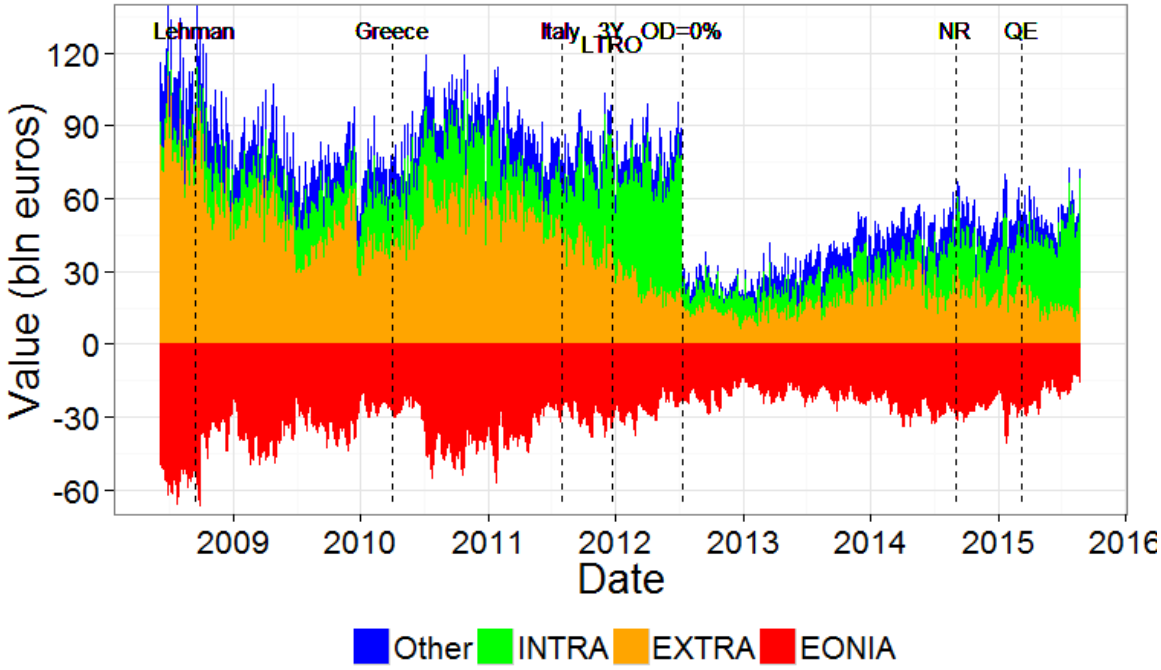
4.1 Turnover development

4.1.1 Euro area view

Figure 3 depicts turnover in the unsecured money market based on EONIA (negative y-axis, red area) and on the algorithm developed by Arciero et al. (2016) (positive y-axis, green and blue area). The orange and green area represents the turnover of the extra and intra group transactions, respectively. Intra group transactions are loans between banks belonging to the same group in TARGET2. These can be transactions e.g. between the mother and daughter bank, but officially they are separate legal entities. Extra group transactions are loans between banks belonging to different groups in TARGET2. These are also the transactions, which have to be reported to EONIA by the EONIA panel banks. The blue area represents the turnover of banks that have their headquarters outside the euro area, but hold an account in TARGET2 (e.g. UK banks), which we referred to as 'Other'. The limitations and uncertainties of both data sets are described in section 2.2. The sum of the 'Intra', 'Extra' and 'Other' transactions in the graph represent the total turnover of all overnight transactions between participants in TARGET2. EONIA is just the turnover of the banks reporting to EONIA.

Figure 3 depicts that the Extra group turnover (orange) is higher than EONIA at all times (as it represents the whole market instead of a subset). It also shows that it follows the trend of EONIA in many but not all cases. This suggests that EONIA does not always reflect the activity in the unsecured money market very well. Furthermore, the figure shows that since the failure of Lehman (September 2008) until the moment the Eurosystem set the overnight deposit rate to 0 percent (July 2012), that the intra group turnover increases relatively to the extra group. This means that banks prefer lending within their own group, which is at lower or no counterparty risk, than to banks belonging to a different group. After the overnight deposit rate was set to 0 percent, the intra group transactions plummeted. This is most likely due to the fact that liquidity was left at the account instead of lend to

Figure 3: Eurosystem: Turnover in the unsecured money market of banks active in the euro area.



The positive y-axis shows the turnover based on the algorithm developed by Arciero et al. (2016). The negative y-axis shows the turnover based on EONIA.
Note: 5 day moving average.

the mother bank or head of the group.[8] After the Eurosystem introduced negative overnight deposit rate (September 2014) we see a relative increase again of the intra group turnover.

Figure 3 shows that the introduction of the 3-year LTRO caused a small decrease in the overnight unsecured money market from roughly EUR 90 billion to EUR 75 billion. There was a pickup in turnover, from roughly EUR 75 billion to EUR 105 billion a few months after the Greek sovereign debt problems started, but amounts never returned to pre-crisis levels. Turnover decreased again to roughly EUR 80 billion at the start of the Italian sovereign debt problems. When the overnight deposit rate was set to 0% the turnover of the algorithm dropped tremendously. This drop can be explained by the fact that the algorithm found trades that are not considered trades according to the EONIA definition. Some banks in the Eurosystem have been able to "borrow" below the overnight deposit rate.[9]

When comparing the euro area total of the unsecured money market to the use of Eurosystem facilities

[8] As not each daughter bank has access to the Eurosystem facilities, they send their access liquidity to the mother or head of the group. The mother or head would place it at the overnight deposit facility.

[9] These trades come from banks not having access to the Eurosystem facilities and customers of banks.

of Figure 1, we note that the steep increase in use of lending and depositing facilities did not have a strong impact on the turnover in the unsecured money market. A few months after the sovereign debt problems started in Greece, we observe both a decrease in the use of lending and depositing facilities and an increase in unsecured money market activity. However, the order of magnitude is completely different. The decrease in Eurosystem facilities is roughly EUR 250 billion and in the increase in the unsecured overnight money market it is approximately EUR 25 billion.

4.1.2 Core-Periphery view

In section 3, we identified a clear segmentation between the Core and the Periphery in the use of the Eurosystem facilities. The question is whether this segmentation also becomes visible in the unsecured money market. Figures 4a and 4b show the borrowing and lending turnover in the unsecured money market for the Core and the Periphery, respectively. We distinguish between borrowing from foreign banks (blue) and euro area banks (extra group is orange and intra group is green) and between lending to foreign banks (yellow) and euro area banks (extra group is red and intra group is pink).

The start of the sovereign debt problems in Italy (August 2011) and the 3-year LTRO (December 2011 and March 2012) clearly show a difference between turnover in the Core and Periphery. In the Core, lending and borrowing turnover remained roughly constant, while in the Periphery turnover volumes decreased substantially. Borrowing in the Core from foreign banks increased after the introduction of the first 3-year LTRO until the Eurosystem set the overnight deposit rate at 0%. This is the result of Core banks being able to attract liquidity below the overnight deposit rate from foreign banks, which was a positive rate up until that point. Most foreign banks do not have access to the Eurosystem facilities and can therefore not place their excess liquidity at the overnight deposit of the Eurosystem. These foreign banks obviously prefer to have a positive rate lower than the overnight deposit rate above the 0% they get at their account of the Eurosystem. It is clear from the figures that the foreign banks mainly lent to Core banks during this period of time as they were perceived to be more trustworthy. The Core banks attracting liquidity from these foreign banks below the overnight deposit rate, placed it at the deposit facility of the Eurosystem.

Directly after the Eurosystem set the overnight deposit rate at 0% we see the largest change to any of the events. The amount of lending and borrowing in the Core plummeted by two-thirds, largely caused by international borrowing (visible in the green area). As it was no longer profitable for

foreign bank to lend to Core banks, they kept their liquidity at their Eurosystem accounts. Besides, customers of banks also stopped lending to Core banks for the same reason.[10] The introduction of the negative rate caused turnover in lending and borrowing in the Core to increase. In the Periphery, this only caused an increase in borrowing activity. After the introduction of quantitative easing (March 2015) borrowing in the Core from foreign banks rose again to roughly 50% of borrowing turnover.

4.2 Rate developments

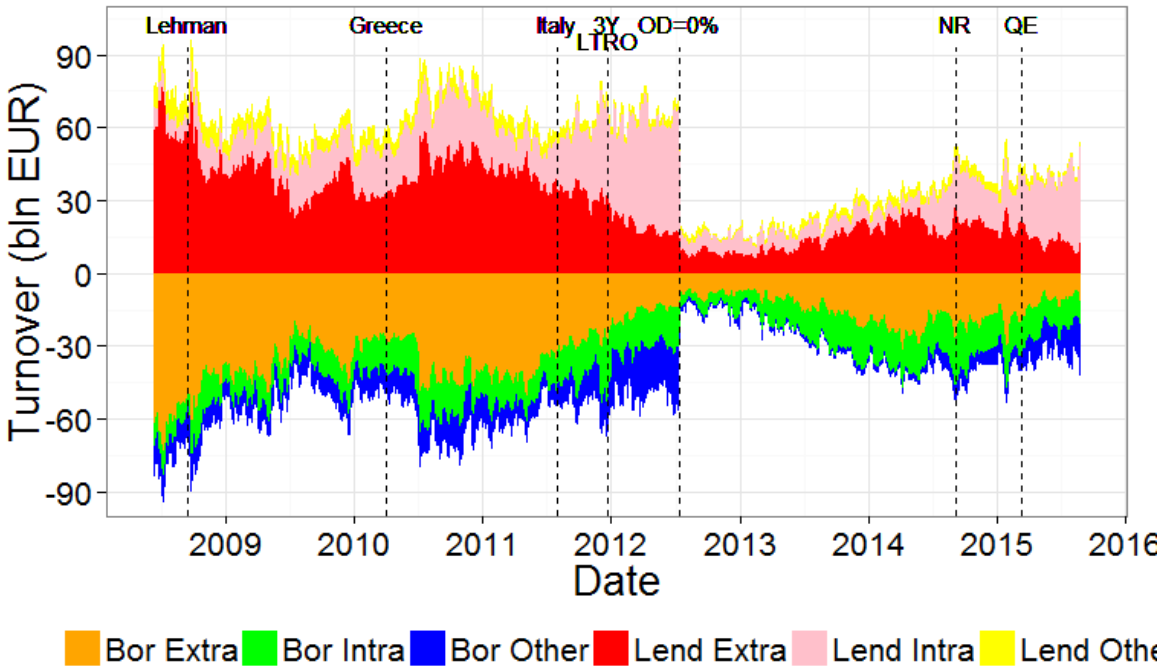
Figure 5 presents the difference in borrowing rates between banks in the Periphery and banks in the Core. A positive value means that banks in the Periphery paid higher rates for their loans than those in the Core. The overall picture is that, on average, the Periphery banks paid higher rates than those in the Core. The start of the Greek sovereign debt problems (April 2010) caused an increase of between 0 and 0.1 percentage point. Between the start of the Italian sovereign debt problems (August 2011) until the first 3-year LTRO (December 2011), the rate difference between Periphery and Core increased from 0.1 to more than 0.3 percentage point. At the same time turnover decreased by roughly 50% (see Figure 4b) and the use of the lending facilities increased substantially (see Figure 2b). It must be noted that the rate difference was calculated by the actual trades made by banks in the Eurosystem. Given the distrust in the market since Lehman's failure, in particular in banks in the Periphery, the banks that could still borrow unsecured were the relatively trustworthy ones. Given the fact that the Periphery banks borrowed substantial amounts from the Eurosystem, we may conclude that the rate differences would have been higher on average than depicted in Figure 5 if all banks had to borrow unsecured. After the introduction of the 3-year LTRO, the rate difference decreased to just above 0 percentage points. Since the negative rate was introduced, the rate differences have been less than 0.1 percentage point.

Given the volume development of EONIA and its decreasing representativeness, it is better to look at the turnover of the algorithm. However, this also shows a clear segmentation between Core and Periphery and significantly less activity than before the crisis. The borrowing turnover decreased from approximately EUR 23 billion to EUR 5 billion (80% decrease) in the Periphery and from approximately EUR 90 billion to EUR 45 billion (50% decrease) in the Core. Given the decreases and the fragmentation in the unsecured money market, we will look at the secured money market in the next section.

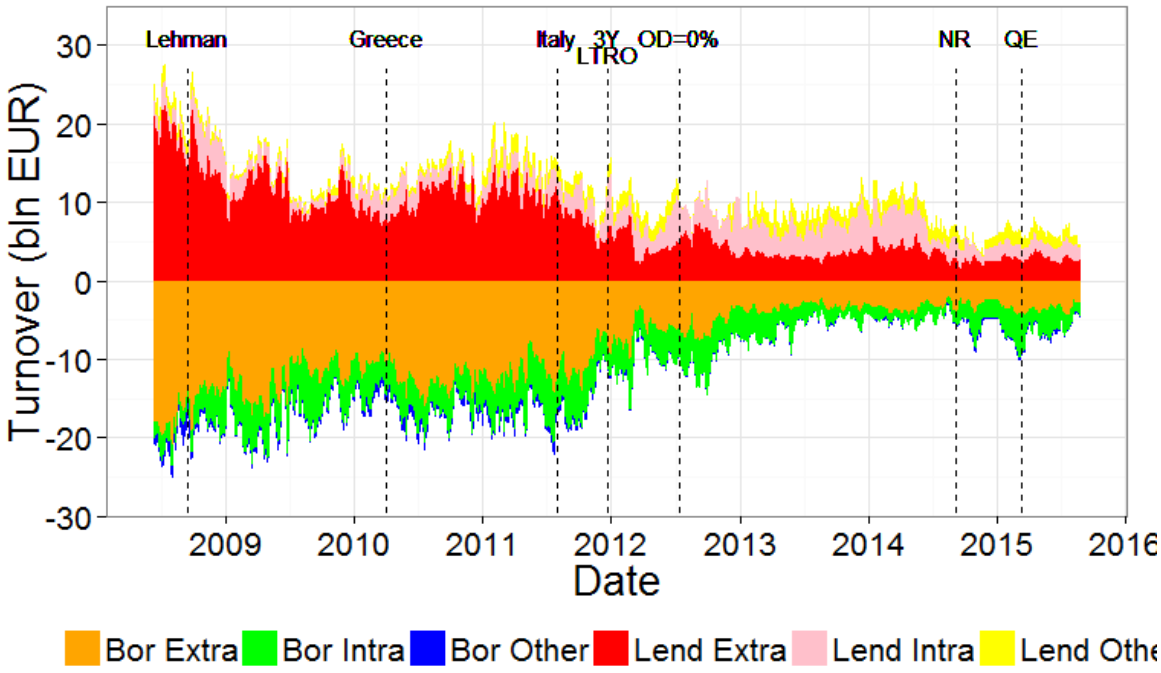
[10] Part of the lending and borrowing of banks is due to trades initiated by - large - customers of banks.

Figure 4: Unsecured money market overnight lending and borrowing turnover.

(a) Banks active in the Core.

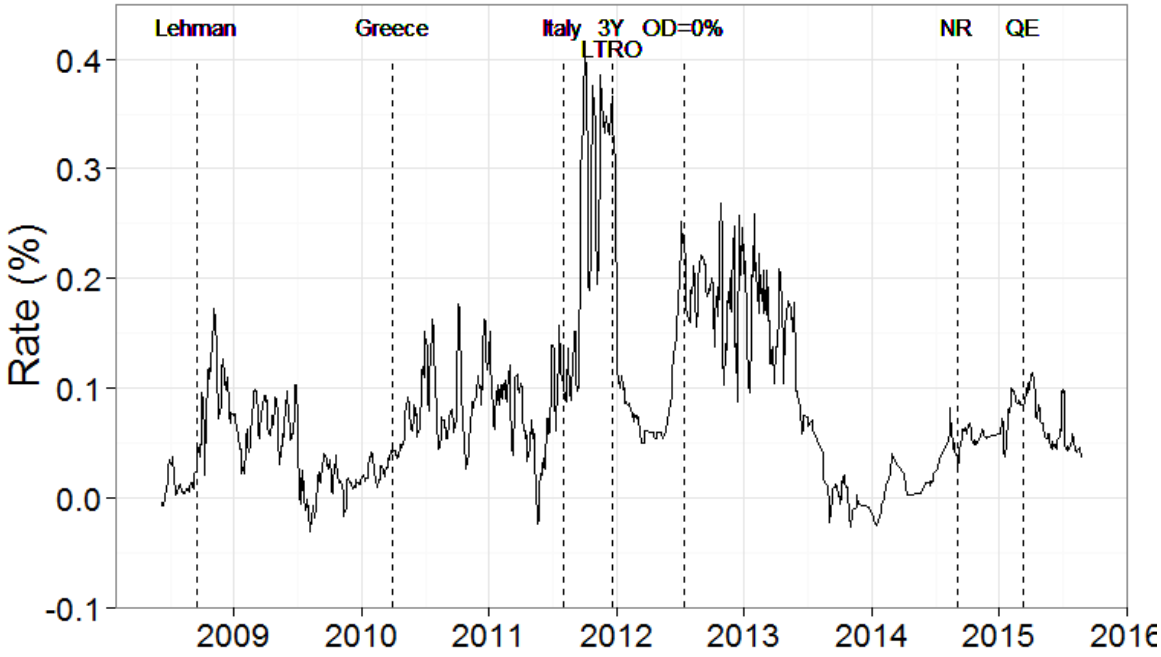


(b) Banks active in the Periphery.



Note: 5 day moving average.

Figure 5: Difference in unsecured borrowing rates between Core and Periphery.



The overall positive difference indicates that borrowing rates in the Periphery were higher than borrowing rates in the Core. Note: 5-day moving average.

5 Developments in the secured money market

This section describes to what extent the segmentation is visible in the secured money market. For the secured market we investigate GC Pooling and MTS Repo data. These sources are described in section 2.3 and 2.4, respectively. In section 5.1 and 5.2, we will describe the developments in the secured money markets: GC Pooling and MTS Repo, respectively.[11]

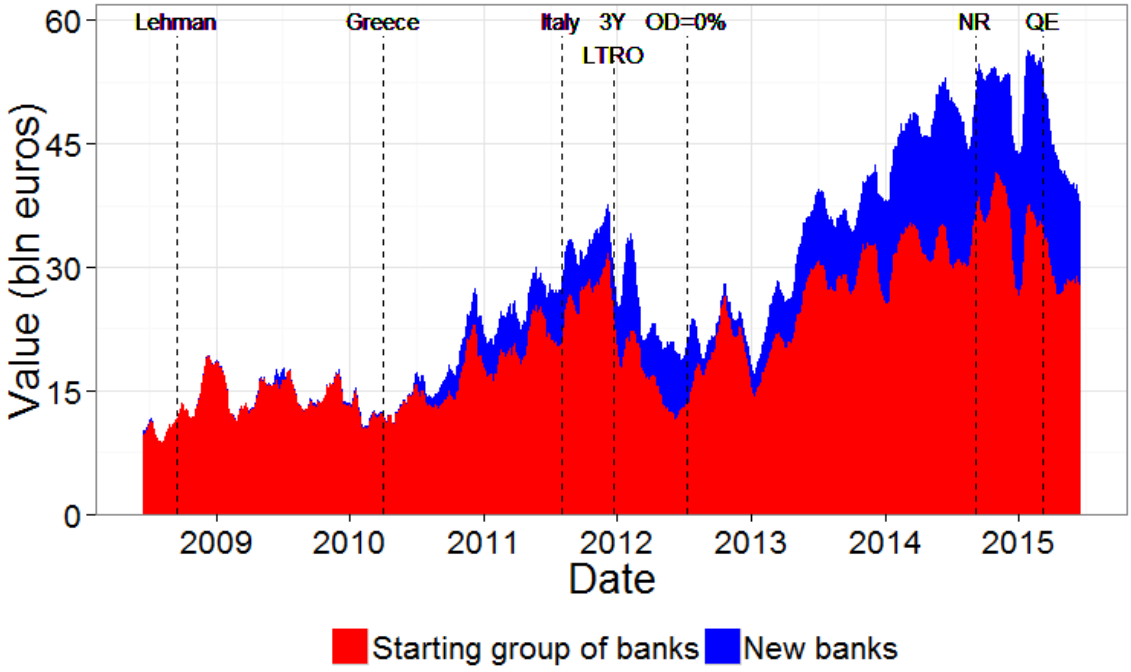
5.1 GC Pooling

5.1.1 Turnover: Euro area view

Figure 6 shows the turnover of GC Pooling from June 2008 until July 2015. The number of banks using the GC Pooling system grew steadily over the years until the end of our data set and is expected to grow further. Therefore, we differentiated between banks that have been active from the beginning of our data set (June 2008 - May 2009, red in the figure) and those who have entered the system later

[11] The crisis events and the changes in the Eurosystem's monetary policy changes are strongly correlated. In response to certain crisis events (including but not limited to the sovereign debt problems of euro area countries) the Eurosystem has changed its monetary policy.

Figure 6: GC Pooling turnover development for all active banks.



The red area represent the banks that have already been active in the first year (June 2008 - May 2009) of the data set. The blue area represents banks that started their activity after May 2009.
Note: 21-day moving average. Red and blue area represents total turnover, red area only represents corrected turnover.

on (blue in the figure). This allowed us to study the developments in turnover due to the increasing number of banks accessing the system and the increasing use made by individual banks.

After the start of the sovereign debt crisis (commencing with Greece in April 2010), we observed a steady increase in turnover (from more than EUR 10 billion to almost EUR 40 billion) until the introduction of the 3-year LTROs. Even when excluding the turnover of the new banks (blue area) we observed this positive trend. The introduction of the the first 3-year LTRO caused a steep decrease in turnover. The second LTRO (March 2012) only resulted in a decrease in turnover. Banks no longer needed to borrow in the secured market, as they had sufficient liquidity available from the LTRO. Around the introduction of the negative interest rates (NR) turnover jumped from approximately EUR 45 billion to EUR 55 billion. The increase in turnover was the result of banks preferring to lend in the - secured - market over paying the negative interest rate on the excess liquidity they keep at their TARGET2 accounts. The introduction of quantitative easing (March 2015) caused turnover to drop substantially.

5.1.2 Turnover: Core-Periphery view

A segmentation can be seen between Core and Periphery in both the use of the Eurosystem facilities (section 3) and the unsecured money market (section 4.1.2). The question is whether this segmentation is also visible in the GC Pooling secured money market. Figures 7a and 7b depict the normalized turnover of the banks in the Core and Periphery countries, respectively. The values of the turnover have been normalized, due to the confidentiality of the data.[12] [13] It is clear, however, that absolute turnover of the Core banks is substantially higher than that of the Periphery banks.

Figure 8 shows the difference between the lending rates for the Core and Periphery banks. It must be kept in mind that the turnover of the banks in the Periphery is relatively low. It may, therefore, be not completely representative for the Periphery as a whole, in particular because Italian banks do still not use GC Pooling.

5.1.3 Rate developments

Figure 8 shows the difference in borrowing rates between the Periphery and the Core banks.[14] After the sovereign debt problems had started, the rates paid by the Periphery banks were 0.2 percentage point lower than those paid by the Core banks. At the same time, the unsecured rates in the Periphery showed a reverse movement, as the rate difference between Periphery and Core increased from 0.1 to 0.3 percentage point. From this figure we can see that the interest rates received by the Periphery banks in the period before the introduction of the 3-year LTRO was approximately 0.2 to 0.3 percentage point lower than those received by the Core banks. The rates received by both Core and Periphery banks remained roughly the same until the Eurosystem's overnight deposit rate was set at zero. This may suggest that the introduction of the 3-year LTRO eased the stress in the market. In the six months after the overnight deposit rate had been set at zero, the rates received by the Periphery banks were approximately 0.2 percentage points higher, remaining roughly similar to the Core rates since the beginning of 2013, with a small decrease of the rate of the Periphery banks just after the introduction of the negative rates by the Eurosystem for about two months. The same movement was visible for the rate differences in the unsecured market. From the beginning of 2013 onwards, the rate difference

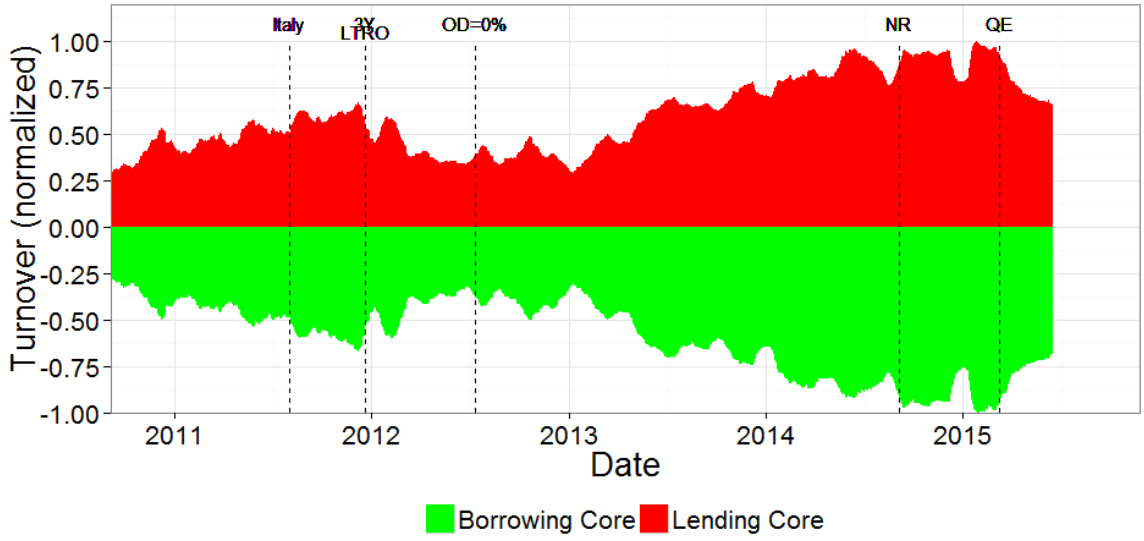
[12] The data of GC Pooling is anonymous. By combining the data of GC Pooling with TARGET2 transaction we have been able to generate an approximation of Core-Periphery shares.

[13] As Peripheral banks have only become active in GC Pooling since the end of 2010, the figures range from end 2010 to June 2015.

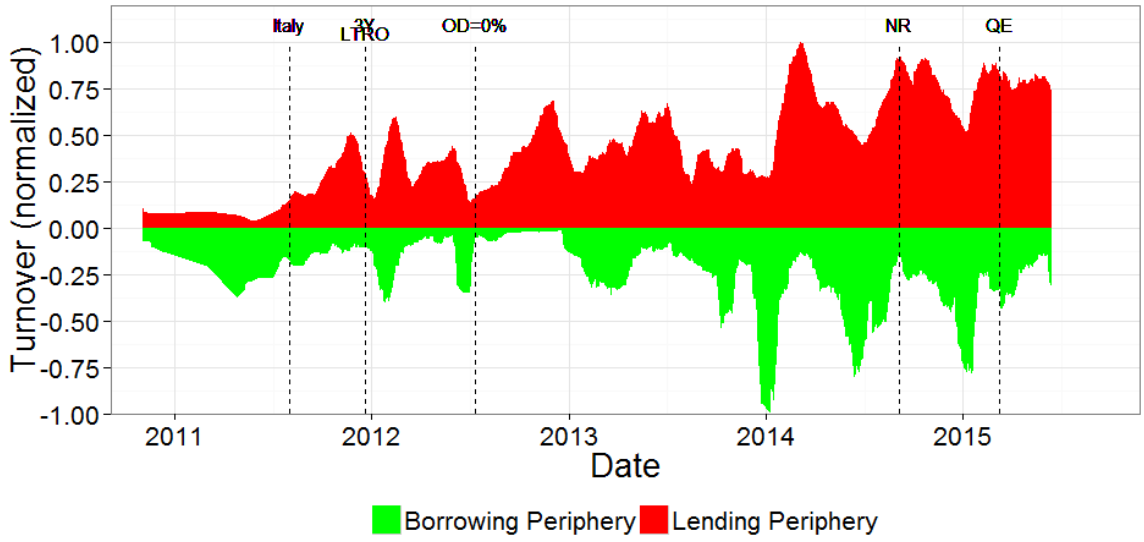
[14] Given the relatively low turnover of the lending and borrowing by Periphery banks, the findings must be interpreted with caution.

Figure 7: Normalized estimated GC Pooling turnover.

(a) For banks active in the Core.



(b) For banks active in the Periphery.



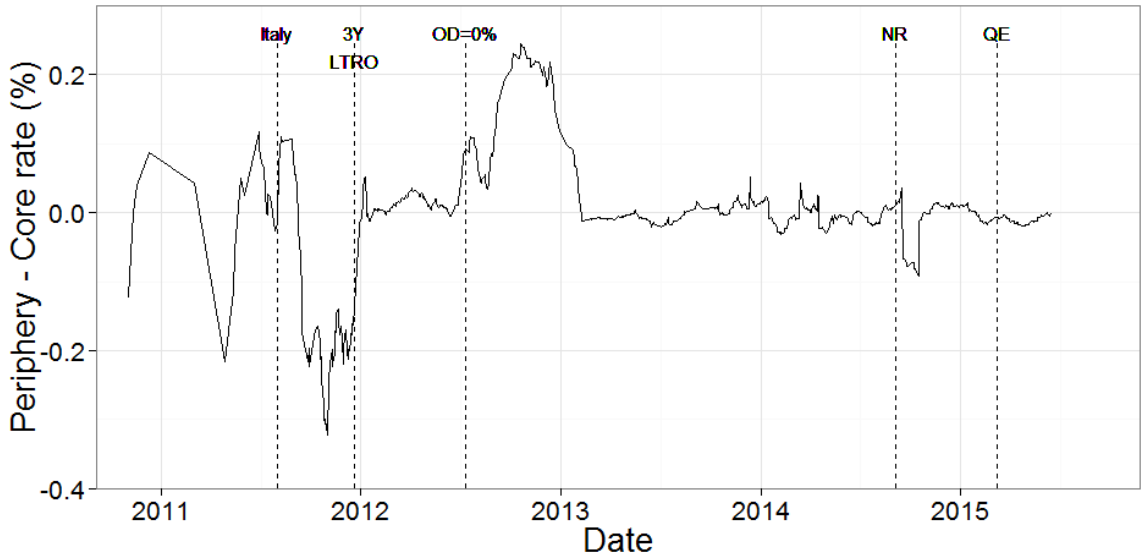
Note: 21-day moving average.

between Periphery and Core has been roughly 0 percentage point.

5.2 MTS Repo

The advantage of MTS Repo - relative to GC Pooling - is a better euro area coverage. Especially Italian banks, which currently do not use GC Pooling, have the largest turnover in MTS Repo of all

Figure 8: Difference in GC Pooling borrowing rates between Core and Periphery.



The overall positive difference indicates that borrowing rates in the Periphery were higher than borrowing rates in the Core. Note: 21-day moving average.

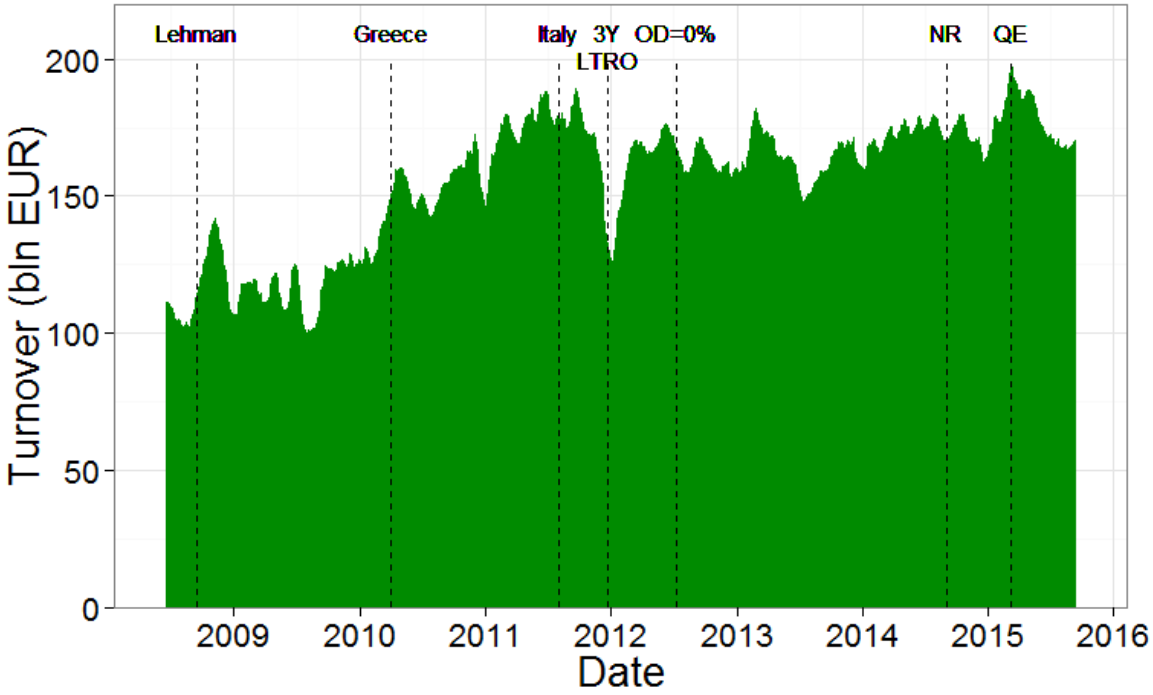
euro area countries. Furthermore, German and French banks make substantial use of the system.

The disadvantage of our data set is that it only includes the daily aggregates of the lending including the weighted average interest rate. Besides, we have only country information of three major countries. It would be preferable to have the details of the trades (transaction level), which includes information on the borrowing value and rates per country. For the unsecured and the GC Pooling markets, we have both the lending and borrowing side. This allowed us to investigate the price banks in a given country had to pay and their respective turnover. Having only lending side data merely gives an indication of the liquidity surplus, but not to what parties they lent.

5.2.1 Euro area view

Figure 9 shows the turnover and the interest rate developments of MTS Repo of all banks in the euro area active in MTS Repo. After a small dip (from EUR 150 billion to EUR 120 billion) just after the failure of Lehman, turnover moved to EUR 180 billion at the start of the sovereign debt problems in Italy. Apart from a steep but short-lived decrease in turnover around the introduction of the 3-year LTRO, turnover fluctuated between roughly EUR 150 billion and EUR 180 billion. Between the announcement of quantitative easing (January 2015) and its actual start (March 2015), turnover increased from EUR 160 to EUR 200 billion, only to ease again after the introduction of quantitative

Figure 9: MTS Repo turnover.



Note: 21-day moving average.

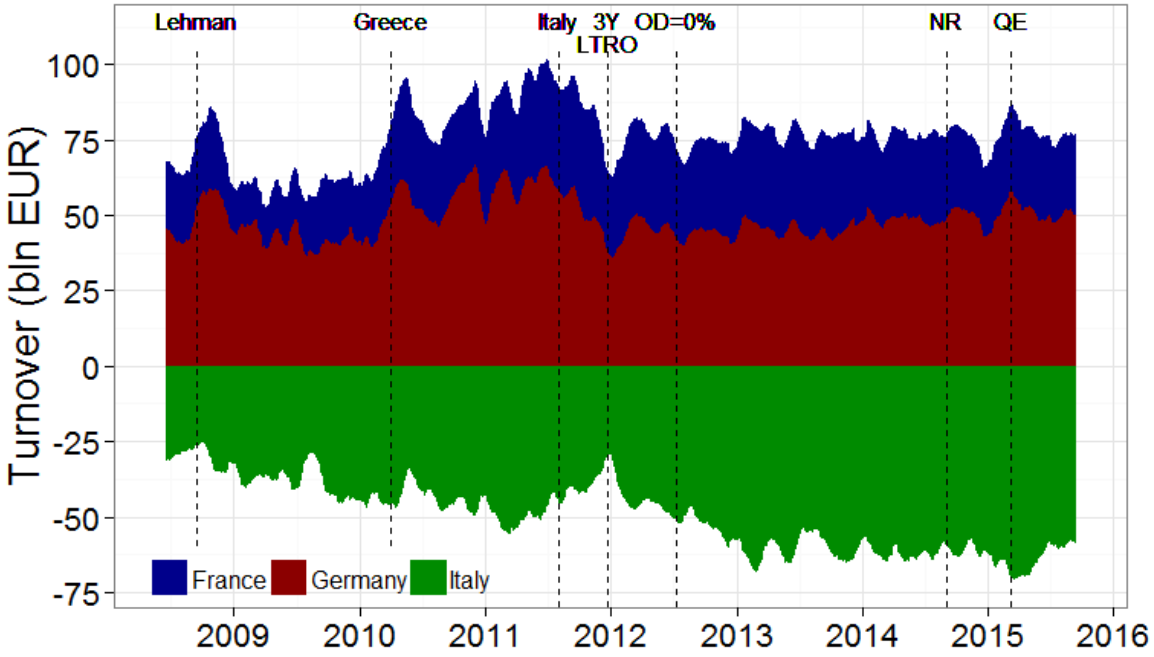
easing.

5.2.2 Core-Periphery view

Figure 10 shows the MTS Repo turnover for the countries France, Germany and Italy. France and Germany (representing the Core) are presented on the positive y-axis and Italy (representing the Periphery) on the negative y-axis. The trends of both Core and Periphery are similar to the ones presented for the Eurosystem. The Core representatives (France and Germany) show an increase in their MTS Repo activity after the collapse of Lehman (from roughly EUR 67 billion to EUR 83 billion) and after the start of the Greece sovereign debt problems (from approximately EUR 65 billion to EUR 90 billion), suggesting a preference for increased secured lending.

The activity of Italy in the MTS Repo market increased over time from about EUR 26 billion in June 2008 to over EUR 55 billion at the end of September 2015. Similar to the banks in the Core, Italy showed an increase in activity after Lehman's collapse. However, it showed a decrease after the Greek sovereign debt problems. Similar to the Periphery activity for GC Pooling, Italy's activity also fell before the introduction of the 3-year LTRO, rebouncing to a maximum value of approximately EUR 65 billion. After the start of quantitative easing turnover decreased again to EUR 55 billion.

Figure 10: MTS Repo turnover of France, Germany (both positive y-axis and Italy (negative y-axis).



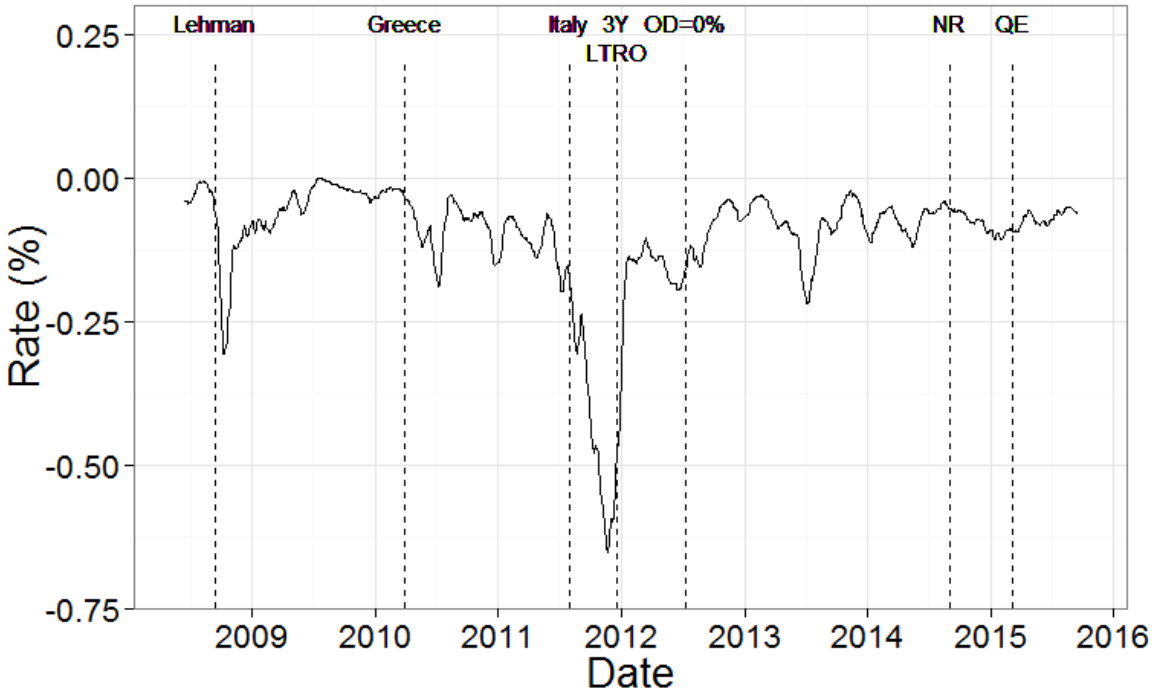
Note: 21-day moving average.

Figure 11 presents the interest rate difference between Italy (Periphery) and the value-weighted average of France and Germany (Core). On average, the rate Italian banks obtained for their liquidity exceeded that which the French and German banks obtained, with a peak (of around -0.7) from just after the Italian sovereign debt problems started until the introduction of the 3-year LTRO. It is to be expected that the vast majority of Italian MTS Repo trades were between Italian parties. This means that the lending rate was also the borrowing rate. In other words, on average, Italian banks paid more for their MTS Repo liquidity than French and Italian banks. However, detailed borrowing data are needed to obtain absolute assurance.

6 Conclusions

This paper presents our investigation into the impact of the monetary policy decisions in the Eurosystem on both the unsecured and the secured money markets. The extensive simultaneous use of the Eurosystem lending and depositing - since the start of the crisis - was a clear sign of fragmentation. We found that banks in the Core used the deposit facilities, whereas banks in the Periphery used the lending facilities. In other words, a single Eurosystem monetary policy does not fit all countries in the

Figure 11: MTS Repo rate difference between Core and Periphery (positive values mean Periphery rates are lower than Core).



The positive difference indicates that borrowing rates in the Periphery were lower than borrowing rates in the Core.
Note: 21-day moving average.

euro area. The 3-year LTROs can be seen as a logical consequence of the increasing fragmentation in the Eurosystem. The fragmentation decreased from the moment the overnight deposit rate was set to 0%, lasting until the introduction of the negative - overnight deposit - rate. The excess liquidity of the banks in the Core increased again after the Eurosystem started quantitative easing (March 2015). It would seem that this liquidity is located at banks in the Core only, as the banks overall do not have excess liquidity.

This paper proposes a method for monitoring the the effects of monetary policy by the Eurosystem, which is particularly relevant once the Eurosystem will start to reduce excess liquidity in the market. The first step in monitoring the effect of monetary policy measures is to look at the use of the Eurosystem liquidity. This should be done at country level, so that it is clear how the policy impacts each country individually and what the differences are between countries.

The second step is to look at the developments in the unsecured money market. Traditionally, the Eurosystem monitored the effect of this policy by looking at the EONIA volume and rate development. However, we have shown that EONIA is no longer representative of the entire Eurosystem.

Therefore, other money market sources must be analyzed, which provide information on the rate and volume developments of each country in the euro area. The first aspect to look at is a comprehensive unsecured money market, provided by applying the Arciero et al. (2016) algorithm or by detailed reported money market trades that will start in 2016. The lending and borrowing behaviour must be studied in terms of volume and rates. Moreover, extensive borrowing from foreign banks (e.g. UK banks), which do not have access to Eurosystem facilities can be seen as sign of trust. As some of those foreign banks do not have access to the Eurosystem facilities, they can not use the deposit facility for their excess liquidity. In order to have some return on their excess liquidity, they need to turn to other commercial banks. We have seen that, in the period before the overnight deposit had been set to 0% and after the start of quantitative easing, Core banks obtained increasing amounts of liquidity from those foreign banks. Even though a comprehensive unsecured money market source other than EONIA provides better information on the well functioning of this market, we again noted clear fragmentation between Core and Periphery. Overall, the rates paid by Periphery banks are over were up to 0.3 percent points higher than those paid by Core banks. In addition, the relative reduction in turnover by banks in the Periphery (around 80%) is much higher than that by banks in the Core (roughly 50%).

The third step is to investigate the secured money market. As a proxy for the secured market we used GC Pooling and MTS Repo data. Even though GC Pooling both increased in turnover and in number of banks active in the system, it is currently - in mid 2015 - mainly suitable to illustrate the activity of Core banks. However, due to the increasing number of banks using this system it may become more and more suitable for illustrating the activity in the Eurosystem as a whole. In the MTS Repo market mainly banks in Italy, France and Germany are active. It therefore provides a better Core and Periphery description. Combining GC Pooling and MTS Repo trades give a reliable indication of the secured money market and relatively complete Eurosystem coverage. However, more detailed information on MTS Repo transactions is needed to gan a better understanding of the developments in turnover and rates between countries.

One of the aspects to keep in mind when monitoring money markets is the impact of regulation. The Basel III requirements have dissuaded banks from borrowing in the short term. Besides, it is to be expected that the secured money market will be more important as a result of these regulation than before the crisis. This means that money markets will never return to the normalized situation before

the collapse of Lehman.

References

Arciero, L., Heijmans, R., Heuver, R., Massarenti, M., Picillo, C., and Vacirca, F. (2016). How to Measure the Unsecured Money Market? The Eurosystem's Implementation and Validation using TARGET2 Data. *Interntional Journal of Central Banking*, Forthcoming.

Berentsen, A., Kraenzlin, S., and Müller, B. (2015). Exit strategies and trade dynamic in repo markets. *Swiss National Bank Working Paper*.

Cappelletti, G., Socio, A. D., Guazzarotti, G., and Mallucci, E. (2011). The Impact of the Financial Crisis on Inter-bank Funding: Evidence from Italian Balance Sheet Data. Questioni di Economia e Finanza (Occasional Papers) 95, Bank of Italy.

Cassola, N. and Huetl, M. (2010). The Euro Overnight Interbank Market and ECB's Liquidity Management Policy During Tranquil and Turbulent times. *ECB Working Paper Series*, 1247.

Couré, B. (2013). Speech: Ensuring the smooth functioning of money markets. *17th Global Securities Financing Summit, Luxembourg*.

ECB (2010). The ECB's Response to the Financial Crisis. *ECB Monthly Bulletin*, May:59–74.

ECB (2012). Euro money market survey. *Frankfurt am Main*.

Engen, E., Laubach, T., and Reifschneider, D. (2015). The macroeconomic effects of the federal reserve's unconventional monetary policies. *Finance and Economic Discussion Series. Board of Governors of the Federal Reserve System (U.S.)*.

Furfine, C. (1999). The Microstructure of the Federal Funds Market. *Financial Markets, Institutions and Instruments*, 8:24–44.

Heijmans, R., Heuver, R., and Hernández-Hernández, L. (2013). Determinants of the Rate of the Dutch Unsecured Overnight Money Market. *DNB Working Paper*, 374.

Heijmans, R., Heuver, R., and Walraven, D. (2010). Monitoring the Unsecured Interbank Money Market Using TARGET2 Data. *De Nederlandsche Bank Working Paper*, 276.

Heijmans, R. and Yun, S.-G. (2015). Analysis of risk factors in the korean repo market based on us and european repo market experiences during the global financial crisis. *Journal of Financial Market Infrastructures*, 4(1):25–58.

ICMA (2013). European repo market survey.

Joyce, M. (2012). Quantitative easing and other unconventional monetary policies: Bank of england conference summary. *bank of England's Quarterly Bulletin*, pages 48–56.

Joyce, M., Miles, D., Scott, A., and Vayanos, M. (2012). Quantitive easing and unconventional monetary policy: An introduction. *The Economic Journal*, (122):271–288.

Mancini, L., Ranaldo, A., and Wrampelmeyer, J. (2015). The euro interbank repo market. *Swiss Finance Institute Research*, 13-71.

Rainone, E. and Vacirca, F. (2015). Estimating the money market microstructure with negative and zero interest rates: An econometric correction based on decentralized market's regularities. *ResearchGate*.

Schmitz, S. (2013). The impact of the liquidity coverage ratio (lcr) on the implementation of monetary policy. *Economic Notes by Banca Monte dei Pasche di Siena SpA*, 42:135–170.

Soares, C. and Rodrigues, P. (2011). Determinants of the EONIA Spread and the Financial Crisis. *Banco de Portugal Working Paper*, 12.

van Riet, A. E. (2010). Euro Fiscal Policy and the Crisis. *ECB occasional paper series*, 109.

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020 524 91 11
dnb.nl