UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

THE IMPACT OF QUANTITATIVE EASING ON BANK LENDING: THE CASE OF EURO AREA BANKS

Ljubljana, April 2017   VESNA NUfiDI

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INTRODUCTION

The monetary response to the financial crisis of the 2007 was unprecedented. Central banks around the world have soon exhausted the tools of standard monetary policies and have taken actions to support demand by loosening monetary policy. In order to stop the slowdown in economic growth and deflation they turned to unconventional monetary policies since policy rates were faced with zero lower bound. One of these unconventional measures is also quantitative easing.

In 2015 European Central Bank (hereinafter: ECB) joined several others central banks in implementing asset purchase programme, known as quantitative easing programme. The main reason to turn to quantitative easing non-standard monetary policy measure is to address the risk of a prolonged period of too low inflation. The aim is to provide additional monetary policy stimulus, to support aggregate demand and in addition to ease borrowing conditions of households and companies.

The asset purchase programme or quantitative easing conducted by ECB is an open-ended programme. The amount purchased and the duration of it are conditional on the outlook of future inflation. It consists of monthly purchases of securities, either from banking or non-banking sector, financed by central bank money. The composition and size of balance sheets of involved parties change substantially since quantitative easing involves an exchange of securities for bank reserves or deposits. A common objective of the quantitative easing programme is to help reduce long-term interest rates, which will through several transmission channels affect economic output and inflation. One of these transmission channels is also bank lending channel. However, even policymakers, when designing quantitative easing programme, knew that the effect through this channel would be small due to deleveraging process banks have been actively involved in.

Nevertheless, bank lending channel is important especially for the euro area economy since it is mainly dependent on bank financing. In the period leading up to the global financial crisis, loan growth grew at an unprecedented rate. However, global financial crisis of 2008 provoked a strong credit slowdown. Several authors (Gambacorta & Marques-Ibanez, 2011, Disyatat, 2011) have accordingly investigated monetary policy transmission through bank lending channel since the onset of the financial crisis. Ehrmann, Gambacorta, Martínez-Pagés, Sevestre, & Worms (2001) tested the role of banks in the transmission of monetary policy even before the start of global financial crisis. However, the empirical evidence on the impact of quantitative easing monetary policy on bank lending in the euro area is scarce. Studies on the impact of quantitative easing on bank lending have been conducted for the United States, United Kingdom and Japan, while to my knowledge there exists no similar research for the entire euro area. Although, Blattner, Farinha, & Nogueira (2016) in their research evaluate the effect of quantitative easing on lending conditions, this is only conducted for Portugal. On the other hand, Carpinelli and Crosignani (2016)

examine the effect of the liquidity injections conducted by ECB (i.e. long-term liquidity provision). This is conducted only on the Italian bank credit supply while investigating the impact of the 3-year long-term refinancing operation measure.

Accordingly, the aim is to fill this gap and empirically test the effect of quantitative easing on bank lending in the euro area by using bank level dataset. Furthermore, attempt is to disentangle the effects of quantitative easing on loan growth. The main question of the study is: what is the effect of quantitative easing monetary policy on bank's balance sheet, mainly loan growth. The impact of quantitative easing on loan growth should be seen implicitly through the increase in liquidity and deposits, which are then reflected in higher loan growth. The contribution of this study is giving the answer whether quantitative easing worked through bank lending channel in the euro area in 2015 and lastly to quantify this effect of quantitative easing on bank lending if it worked through bank lending channel.

A theoretical-empirical approach will be used to be able to answer the main question of the thesis. A theoretical knowledge of how quantitative easing works will provide an insight on the effect of quantitative easing on balance sheets of the involved parties; moreover it will show how can quantitative easing boost bank lending through an increase in liquidity and deposits. An empirical analysis will be based on the estimation of a panel data model while controlling for heteroscedasticity and endogeneity problem. Furthermore, several robustness checks will be performed to control for variables that vary substantially. The bank level data will be used, obtained from the BankScope database, while using the sample consisting of euro area banks that are under direct supervision of ECB (i.e. the list of significant supervised entities under single supervisory mechanism regulation).

The remainder of the thesis is organized as follows. The first chapter will review the existing literature on the impact of quantitative easing on bank lending and will additionally provide answer if quantitative easing worked through bank lending channel in United States, United Kingdom and Japan. The second chapter will theoretically describe the quantitative easing and its impact on balance sheets of the involved parties. It will provide the insight of the transmission channels of quantitative easing and will emphasize and describe the quantitative easing programme in the euro area, mainly it design, effects and risks. The second chapter will conclude with the credible reversibility or unwinding of quantitative easing. The third chapter will focus on the bank lending channel. It will underline the importance of bank loans and bank lending channel for the economy. It will additionally extract determinants of bank lending; internal and external or supply side and demand side or bank specific and macroeconomic factors. The third chapter will conclude with bank lending during the financial crisis and later. The fourth chapter will include empirical analysis and will provide main hypotheses that will be tested to answer the main question of the thesis. This chapter will conclude with the findings and will provide an answer on the impact of quantitative easing on bank lending of euro area banks.

1 LITERATURE REVIEW

The literature on the impact of quantitative easing on bank lending is scarce. Most of the studies have focused on the effects of quantitative easing on interest rates, asset prices, demand, output growth and inflation (Butt, Churm, McMahon, Morotz, & Schanz, 2014, p. 1). The impact of quantitative easing on financial markets and the wider economy has been focus of many studies whereas less attention has been put on banks' balance sheet and the impact on bank lending. This is mainly due to the fact that policymakers expected that quantitative easing affects demand through the impact on asset prices. Moreover, the effect on bank lending is expected to be small because banks have incentives to engage in deleveraging process and reduce the size of their balance sheets in times of market distress (Joyce & Spaltro, 2014, pp. 1‒2). Nonetheless, a few studies test whether quantitative easing affected bank lending in the United Kingdom (hereinafter: UK), United States (hereinafter: US) and Japan.

Butt et al. (2014) and Joyce and Spaltro (2014) investigate the impact of Bank of England's quantitative easing policy on bank lending in the UK. Butt et al. (2014, pp. 1‒4) use two alternative approaches to identify whether the variation in deposits boosted bank lending because banks gain both new reserves and customer deposits through quantitative easing. They find no statistically significant evidence in an increase in lending due to increased deposits in banks from quantitative easing. On the other hand, Joyce and Spaltro (2014, pp. 1‒8) find a small statistically significant increase in bank lending growth during the first round of the Bank of England's quantitative easing purchases. They also show that the effects of quantitative easing on bank lending were heterogeneous across banks. Lending of small banks was more responsive to the level of deposits than the lending of large banks. Their analysis suggests that bank lending is positively related to the capitalisation of banks. This in turn leads to potentially weaker impact of quantitative easing on bank lending because of the lower levels of bank capital during the crisis. The main difference between these two papers is in the use of the dataset from which the evidence of the impact of quantitative easing on bank lending differs. Butt et al. (2014) focus on the data during the quantitative easing period in the UK to estimate the direct effect on bank lending, whereas Joyce and Spaltro (2014) use a 20‒year period to explore changes between deposits and bank lending before and during the crisis in the UK. Using the historical data, they simulate the potential effects of quantitative easing on banks.

Rodnyansky and Darmouni (2014, pp. 2‒4) explore the impact of quantitative easing on commercial bank lending in the US. They focus on banks with noticeable holdings of mortgage-backed securities (hereinafter: MBS) on their books. By using difference-in-difference identification strategy, they provide evidence on stimulating bank lending through quantitative easing. Moreover, they show that the first and the third round of quantitative easing had impact on bank lending, whereas the second round had no significant influence on bank lending. This is because the second round of quantitative

easing focused mainly on Treasuries, which are sparsely held by banks. More specifically, banks with large share of MBS increased levels of lending by 2.8% to 3.3% during the third round of quantitative easing. The first round had smaller significant effect on levels of lending of 2.2% to 2.9%.

Bowman, Cai, Davies, & Kamin (2011, pp. 165) assess the impact of Japanøs quantitative easing policy on bank lending. They investigate if quantitative easing by increasing the reserves and thus the liquidity of Japanese banks stimulated bank lending. They find a positive and statistically significant effect of bank liquidity on lending, although the effect was small. Moreover, the effect of liquidity on lending took place only in the first years of quantitative easing when the banking system was at its weakest, whereas the relationship between liquidity and lending had evaporated in later years.

The ECB is the last central bank that has implemented quantitative easing. Empirical evidence of the impact of quantitative easing on bank lending in the euro area is sparse. Mainly because ECB implemented other non-standard policy measures that have addressed liquidity of banks and thus loan supply before quantitative easing. Nevertheless, Bank Lending Survey is an important analytical tool used to investigate lending conditions in the euro area. Banks confirm in their replies a positive impact of quantitative easing on their liquidity. Banksø liquidity position increased up to the first quarter of 2016 due to an increase in customer deposits. Banks in the sample indicated that they use this additional liquidity primarily for granting loans. The gradual recovery of lending started in February 2014 and was additional strengthened prior to the announcement of non-standard measures in the summer 2014. Nevertheless, the growth of loans remained modest (KöhleróUlbrich, Hempell, & Scopel, 2016, pp. 54ó57). Blattner, Farinha, & Nogueira (2016) study the effect of quantitative easing on lending conditions, however only for the Portugal. They find that lending conditions have significantly eased to firms and households at banks that have been exposed to quantitative easing through lower prices and large quantities. Avdjiev, Subelyte, & Takats (2016, pp. 104ó105) on the other hand investigate the impact of ECBøs quantitative easing on euro cross-border bank lending. They estimate that stronger growth in cross-border bank lending was connected to a higher euro share in cross-border claims prior to the quantitative easing announcement. This stronger growth is associated to lending to borrowers in advanced economies outside the euro area, whereas the effect on cross-border lending to borrowers in emerging market economies was insignificant. They exclude the cross-border claims of euro area banks on euro area borrowers in their analysis.

Overall, the Bank Lending Survey, which assesses bank lending conditions in the euro area through questionnaire, does not yet provide empirical evidence of the effect of quantitative easing on loan growth. It provides information on supply and demand conditions on the lending policies of the euro area banks. Accordingly, the aim is to fill this gap and

empirically investigate bank lending behaviour in the light of non-standard policy measure, more specifically quantitative easing, in the euro area.

2 QUANTITATIVE EASING MONETARY POLICY

2.1 Unconventional monetary policies

Major central banks have introduced standard and non-standard monetary policy to deal with the slowdown in economic growth as well as the decline in inflation rates since the onset of the financial crisis of 2007 (Gambacorta, Hofmann, & Peersman, 2014, pp. 615ó 616; Lenza, Pill, & Reichlin, 2010, p. 297). When the tools of conventional monetary policy have been exhausted (i.e. short-term interest rates approached to zero), central banks turned to unconventional policy measures in order to provide additional monetary stimulus (Bowdler & Radia, 2012, p. 606; Kozicki, Santor, & Suchanek, 2011, p.13). As Bernanke (2009) said: »Extraordinary times call for extraordinary measures«.

Borio and Disyatat (2009, pp. 3ó9) and Stone, Fujita, & Ishi (2011, pp. 10ó11) point out that unconventional monetary policies are characterized as »balance sheet« policies. According to Borio and Disyatat (2009, pp. 3ó9), implementation of monetary policy consist of two core elements. The first element is signalling, which tries to signal the desired policy stance and the second one refers to liquidity management operations. These operations involve the use of mainly central bank balance sheet (i.e. managing the amount of funds in the system) to make the desired policy stance effective. They have only technical and supportive role in making interest rate effective. In order to affect market prices and conditions beyond short-term interest rate the central bank actively uses the amount of funds on its balance sheet. Therefore, unconventional monetary policies generally result in essential changes in the central bank balance sheet (i.e. size, composition and risk profile) when central banks try to target market segments that go far beyond bank reserves. Bini Smaghi (2009) defines unconventional monetary policies as those that directly influence banks, households and non-financial companies through the availability and cost of financing.

Bossone, B. (2013) reviewed unconventional monetary policies adopted by several central banks to fight deflationary forces and economic downturn. These policies include forward guidance, negative interest rates, quantitative easing, overt monetary financing of fiscal deficits with extreme neo-chartalist form and debt monetisation. Table 1 presents a synopsis of these policies. On the left side of the table are presented policies that rely mostly on changes in prices and future expectations, whereas right side of the table presents policies that affect spending by adding money balances to the economy.

Table 1. Main features of unconventional monetary policies: a synopsis

Policy types / Indicators	FG	NIR	QE	OMF	MMT	DM
Impact on aggregate demand:						
• Transmission channel	Indirect (via expectations on future interest rate)	Indirect (via interest rates)	Indirect (via asset prices and inflation expectations)	Direct (via helicopter money balances)	Direct (via helicopter money balances)	Direct (via helicopter money balances)
• Effectiveness	Short gestation Limited by ZLB Uncertain impact	Short gestation Poor public acceptance Strong and quick impact	Short gestation Slow and moderate impact	Long gestation Quick and strong impact	Long gestation Quick and strong impact	Long gestation Quick, strong and long lasting impact
Central bank independence	Full	Full	Full	Central bank/ Government cooperation required	Central bank not involved in complementary money policy	Central bank/ Government cooperation required

Note. FG ó forward guidance, NIR ó negative interest rates, QE ó quantitative easing, OMF and MMT ó overt monetary financing of fiscal deficits with extreme neo-chartalist form, DM ó debt monetisation

Source: B. Bossone, *Unconventional monetary policies revisited (Part II),* 2013, p. 114, Table 1.

Bowdler and Radia (2012, pp. 606ó608) discuss and differentiate between conventional unconventional monetary policy and unconventional unconventional monetary policy. According to them, quantitative easing belongs to the first category since it is nothing unusual for a central bank to buy assets. Purchasing short-dated government securities and consequently increasing monetary base is what happens when a central bank conducts open market operation. The important difference is that a central bank in conducting quantitative easing goes beyond short-dated government securities as well as increasing the scale of these purchases. Policies that are designed to improve conditions in the banking sector by providing liquidity of longer-term schemes to ease credit conditions belong in the second category. Long-term Refinancing Operation (hereinafter: LTRO) conducted by ECB is one of them.

2.2 Theoretical background of quantitative easing

Central bank implements monetary policy by controlling short-term interest rates. However, zero lower bound limits the effectiveness of conventional monetary policy to influence the economy and targeted inflation. According to Keynes (1936), monetary policy can influence spending only through short-term rates and is at the zero lower bound impotent. However, Woodford (2012, p. 52) indicates that longer-term interest rates can still move in such a way to provide incentives for increased spending. Mishkin (1996, p. 2) in addition emphasizes that there are actually long-term interest rates rather than short-term

interest rates that are having the major impact on spending. In order to affect the economy and restore the targeted inflation rate even when short-term rates hit the zero floor central banks around the world, including Federal Reserve, Bank of England, European Central Bank and Bank of Japan, increased liquidity in the system by purchasing long-term assets, known as Quantitative Easing (Fawley & Nely, 2013, pp. 52‒53).

Werner R.A. in 1995 introduced the meaning of the expression quantitative easing. The phrase means an increase in the net credit creation in the four possible ways; either by raising bank credit, trade credit, central bank credit or credit created by the government (Ledenyov & Ledenyov, 2013, p. 3). Nonetheless, Bank of Japan is known to be the originator of the term since it put quantitative easing in the practice in the period 2001‒2006. According to Bank of Japan, quantitative easing can be described as a monetary policy of increasing bank reserves (Woodford, 2012, p. 49). Quantitative easing involves buying financial assets from commercial banks and other private institutions thus increasing monetary base. It can be seen as an exchange of one safe asset for another (i.e. exchange of long-term government bonds for bank reserves). A central bank by buying long-term assets creates additional money while injecting it in the economy and thus increasing spending. Quantitative easing therefore influences central bank's balance sheet by expanding its liabilities (Bowdler & Radia, 2012, p. 608). Figure 1 illustrates the effects of quantitative easing on balance sheets of a central bank and commercial bank.

Figure 1. Effects of quantitative easing on bank's balance sheet
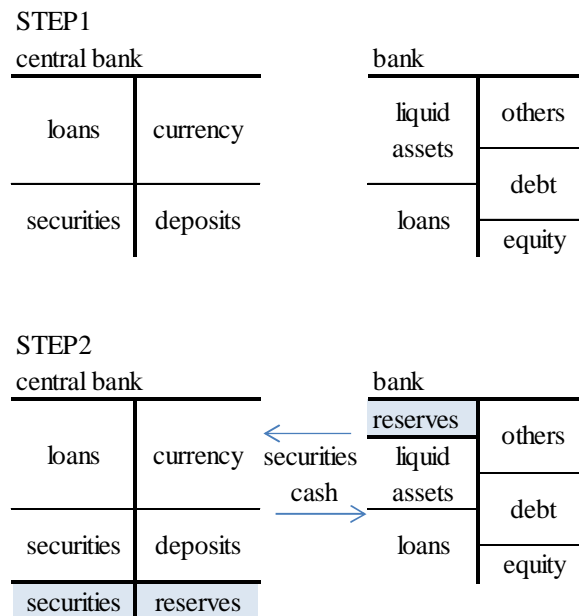
Source: M.A. Joyce & M. Spaltro, *Quantitative easing and bank lending: a panel data approach*, 2014, p. 31.

As can be seen from Figure 1 quantitative easing increases the size of the balance sheet of a central bank by issuing reserves. It changes also the composition of the balance sheet by extending the maturity of bonds held (Reis, 2015, p. 3). Consequently, banks gain from an increase in reserves and new customer deposits if central bank purchases securities from a non-banking private sector (Butt et al., 2014, p. 2). An increase in deposit base can be seen from Figure 2. Since central bank reserves can only be held by banks, then non-bank entities cannot be paid for their assets in reserves. Instead, they are paid in bank deposits by their correspondent bank. For the correspondent bank and the banking sector as a whole an expansion to their balance sheets occurs; with reserves on the asset side and deposits on the liability side of the balance sheet (Christensen & Krogstrup, 2016, p. 2). It is expected that an increase in excessive bank liquidity induces banks to increase lending (Acharya & Naqvi, 2012, p. 351).

Figure 2. Effects of quantitative easing on non-bank private sector's balance sheet

Non-bank private sector		Central bank		Private bank	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
- Securities + Deposits		+ Securities	+ Reserves	+ Reserves	+ Deposits

Source: C. Bowdler & A. Radia, *Unconventional Monetary Policy: The Assessment*, 2012, p. 607.

Woodford (2012, p. 50) points out that the nature of the assets purchased by the central bank with newly created base money is not so much important as it is the expansion of its liabilities. Therefore, the least unnecessary interference of the central bank would be to restrict its purchases to only safe government securities. Landau (2014) goes even further and argues that quantitative easing should involve buying risky assets. According to him, the world has fallen into a safe asset trap. Caballero and Farhi (2013, pp. 2, 9-10) design a model of safety trap. An excess demand for safe assets has a downward pressure on safe interest rates. If these rates have a limit on how much they can drop, then a safety trap emerges. By purchasing risky assets, a central bank would increase the net amount of safe assets in the economy, which would reduce the shortage of safe assets. Safe assets would fall mainly in the hands of the banking sector, which could increase credit again. The resumption of consumption would be expected and consequently inflation and growth could be restored (Landau, 2014). Joyce, Miles, Scott, & Vayanos (2012, p. 276) argue that a central bank can either purchase government bonds (or bills) or assets issued by the private sector. They point out that asset purchases are mainly about quantities where a central bank creates acceptable means of payment in unlimited quantity to buy those assets.

Bernanke and Reinhart (2004) discuss the difference between altering the composition of the central bank's balance sheet and expanding the size of the central bank's balance sheet. Lenza et al. (2010, p. 300) and Shiratsuka (2009, p. 83) distinguish between quantitative

easing and qualitative easing (also known as credit easing) based on the impact on central bankøs balance sheet. Difference between quantitative easing and qualitative easing as the impact on the central bankøs balance sheet can be seen from Figure 3.

Figure 3. Difference between Quantitative easing and Qualitative easing
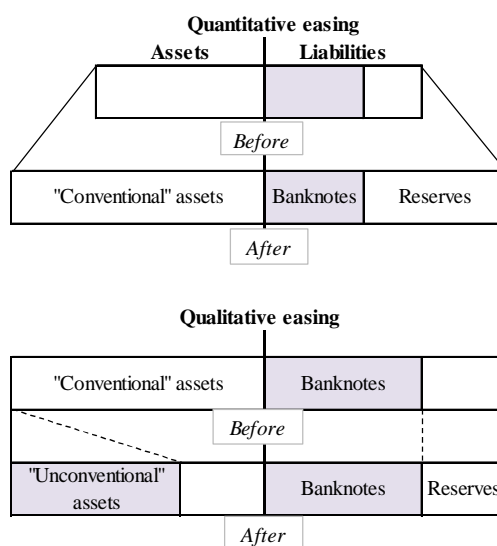
Source: M. Lenza, H. Pill & L. Reichlin, *Monetary policy in exceptional times*, 2010, p. 300.

Quantitative easing changes the size of the central bankøs balance sheet by expanding monetary base. Quantitative easing does not alter the composition of the balance sheet, more explicitly the portfolio of assets held is not changed (i.e. the share of each asset holding does not alter substantially and no new assets are added to the portfolio). It changes only the maturity of the assets held. The changes on the liabilities side of the balance sheet are determined by an increase in reserves. Qualitative easing however does the opposite. The overall size of central bankøs balance sheet is left untouched, it changes the composition of the assets held. It changes the portion of conventional assets with unconventional assets (Lenza et al., 2010, p. 300; Shiratsuka, 2009, p. 83).

2.3 Transmission channels of quantitative easing

Recent literature on unconventional monetary policies and especially quantitative easing has identified potential channels through which quantitative easing can affect economy and inflation level. These potential channels have been identified by Joyce, Tong, & Woods (2011) and Krishnamurthy and Vissingó Jorgensen (2011). Figure 4 illustrates various channels through which quantitative easing influences spending, lending and investment.

Figure 4. Transmission channels of quantitative easing
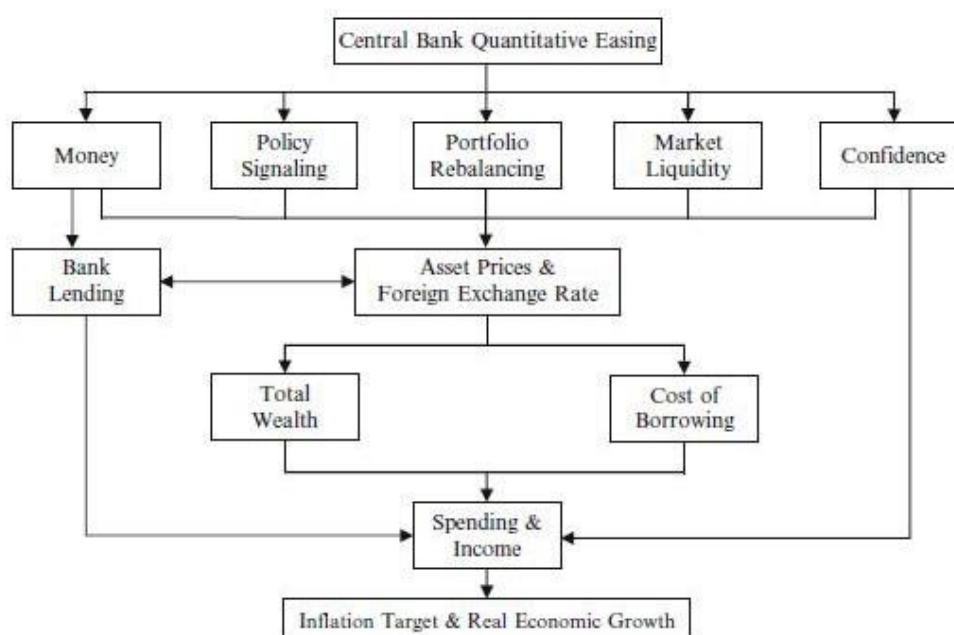
Eggertsson and Woodford (2003, p. 5) point out that there are actually agentøs expectations regarding the future monetary policy (i.e. future path of interest rates) that affect spending and consequently inflation. Quantitative easing can affect interest rates through various channels that in turn may lead to a change in investment behaviour of companies, their willingness to employ, willingness of individuals to spend and willingness of banks to lend. These changes then affect economic growth and inflation level (Hausken & Ncube, 2013). Joyce et al. (2011) discuss that purchases of assets increase broad money holdings since they are financed by central bank money. These purchases are then reflected in higher asset prices that in turn lead to a reduction in borrowing costs and increasing wealth. They also point out that quantitative easing has a broader effect on agentøs expectations.

First transmission channel is **Money Channel**, which leads to **Bank Lending Channel**. Central bank by swapping money for assets increases supply of money to banks to improve banking sector liquidity. By improving and increasing liquidity of the banking sector, it is expected that banks would grant new loans, which would initially lead to increased spending (Hausken & Ncube, 2013). Banking sector through quantitative easing gains new reserves and gains also new deposits (see Figure 1 and Figure 2). Consequently, higher level of liquid assets could encourage banks to grant new loans. However, Joyce et al. (2011) argue that bank lending channel is less material in times of financial crisis when banks are repairing their balance sheets. Hausken and Ncube (2013) also point out that banks are more likely to hold central bank injections of money as a measure of safety rather than pass liquidity onto the real economy through lending.

Central bank by announcing quantitative easing provides information about the future path of monetary policy to market participants through **Signalling Channel**. A commitment of a central bank to meet the targeted inflation may lead market participants to expect that a central bank will keep interest rates low even after the economy recovers. Since central bank buys large quantity of long-term assets, a potential raise in rates would make a loss on these assets. To avoid balance sheet losses in the future central bank has an incentive to keep rates low. Quantitative easing therefore serves as a credible commitment to keep rates low for an extended period and thus provide an effective signal to private sector about future monetary policy. This may keep inflation expectations anchored to the target level. If market participants expect that short-term interest rates will be lower for some time in the future, then this should translate into lower long-term interest rates today to make investors indifferent between rolling over a short-term loan and committing to a long-term loan. Moreover, policy announcements of quantitative easing may contain or signal the news about the underlying state of the economy (Bhattarai, Eggertsson, & Gafarov, 2015; Bowdler & Radia, 2012, p. 611; Christensen & Krogstrup, 2016, p. 1; Hausken & Ncube, 2013; Joyce et al., 2011; Krishnamurthy & VissingóJorgensen, 2011, p. 4). The signalling channel is expected to affect all bond market interest rates with effect depending on bond maturities (Krishnamurthy & VissingóJorgensen, 2011, p. 4).

Central bank by purchasing a large quantity of assets held by the non-bank private sector (e.g. pension fund) changes the relative supply of the assets being purchased. Unless the base money issued by central bank to buy assets and the assets purchased under quantitative easing are perfect substitutes, then the sellers of these assets may attempt to rebalance their portfolios by buying other assets that are closer substitutes (i.e. assets which have similar characteristics). Central bank reserves, deposits and bonds are imperfect substitutes. The imperfect substitutability and converting other assets into cash goes back to Tobin (1958, p. 66). This in turn leads to a further increase of the prices of the assets purchased under quantitative easing and also the prices of their closer substitutes. When a central bank buys long-term bonds, it reduces the amount of these bonds in the market, which leads to an increase in their prices and lowers their return. As a result, term premiums and yields are brought down, which reduces the cost of borrowing for firms and households that in turn leads to higher consumptions. Quantitative easing through **Portfolio Rebalance Channel** affects the prices of the assets that are closer substitutes with the assets purchased by central bank (Christensen & Krogstrup, 2016, p. 1; Hausken & Ncube, 2013; Joyce et al., 2011). Constâncio (2015) points out that portfolio rebalancing is specific to the asset purchase programmes (i.e. quantitative easing). Since quantitative easing involves the exchange of longer-term and relatively less liquid assets for very short-term and highly liquid central bank money, it mitigates liquidity and duration risk in private sector portfolios. Hence, quantitative easing encourages portfolio rebalancing because holding of risky and illiquid assets reduces the required compensation due to liquidity and Value at Risk constraints. As a result, the improvement in the balance sheet

position of banks as well as investors eases leverage constraints and allows banks to grant more credit at lower costs to the private sector. Accordingly, growth prospects improve due to better financing conditions.

Liquidity Channel may operate at times of financial market distress. Central bank increases the liquidity of investors while conducting quantitative easing (i.e. purchasing long-term securities and issuing bank reserves). After all, reserves are more liquid assets than long-term securities (Bowdler & Radia, 2012, p. 611; Hausken & Ncube, 2013; Krishnamurthy & VissingóJorgensen, 2011, p. 6). Joyce et al. (2011) indicate that improved market functioning by increased liquidity as the result of the quantitative easing may lower premium for illiquidity and thus increase asset prices. On the contrary, Krishnamurthy and VissingóJorgensen (2011, p. 6) argue that bonds carry a liquidity price premium and that this premium has been high during severe periods of crisis. An expansion in liquidity will consequently reduce such a liquidity premium and increase yields. According to them, through this channel quantitative easing raises yields on the most liquid assets relative to other less liquid assets. Joyce et al. (2011) also specify that the effects of liquidity channel may only persist while the central bank conducts quantitative easing.

Last transmission channel through which quantitative easing influences inflation and real economic growth is the so-called **Confidence Channel**. Quantitative easing is expected to improve economic outlook and has a broader confidence effect. Quantitative easing might directly boost consumer confidence that may result in increased spending and encourage investment. It could also further increase asset prices by reducing risk premium (Hausken & Ncube, 2013; Joyce et al., 2011).

Bundesbank (2016, p. 38) defines also **Exchange Rate Channel** which is important for open economies since foreign trade represents a significant proportion of economic activity. Quantitative easing causes the yields of assets denominated in domestic currency to fall in relation to those denominated in foreign currency. Foreign investors will consequently reduce their demand for domestic bonds that will cause a reduction in demand for domestic currency needed to buy domestic bonds. This creates downward pressure on the domestic currency. Depreciation in domestic currency therefore makes exports of domestic goods and services cheaper which stimulates demand for these products from abroad. Consequently, foreign goods and services become more expensive for domestic consumers, causing domestic demand to focus on domestic products. An increased aggregate domestic demand due to higher prices for imported products increases domestic inflation.

Through these transmission channels of quantitative easing central bank pushes up prices of the assets bought as well as influences foreign exchange rate. The impact of quantitative easing on asset prices is determinable; however, Gros, Alcidi, & De Goren (2015) argue

that the impact of quantitative easing on exchange rate is not uniform (e.g. effective rate moved little in the case of the US, depreciated in the case of Japan, but appreciated in the case of UK). Higher asset prices increase the wealth of the asset holders and on the other hand reduce the cost of borrowing for companies and households considering that higher asset prices mean lower yields. Increased wealth and reduced borrowing costs are both expected to boost spending of companies and households so as to achieve inflation target, stimulate real economic growth and reduce unemployment rate (Hausken & Ncube, 2013).

Kozicki et al. (2011, p. 15) summarizes the effects of quantitative easing on the economy through variety of channels in the following points:

- quantitative easing encourages investors to rebalance their portfolios towards riskier higher-return assets by reducing yields on government bonds (i.e. asset purchases put upward pressure on the price of the targeted asset thereby lowering their yield) where upward pressure on the prices result in lower interest rates,
- quantitative easing through higher asset prices creates positive wealth effect which induces consumption,
- quantitative easing increases consumption and investment by lowering cost of borrowing,
- quantitative easing exerts downward pressure on the exchange rate in order to favour domestic demand,
- through the exchange rate channel quantitative easing puts upward pressure on inflation by raising domestic demand and increasing domestic price of imports,
- quantitative easing gives confidence by showing that a central bank will do whatever it takes and is necessary to meet its economic objective (i.e. maintaining price stability),
- quantitative easing anchors target inflation level which in turn leads to holding down real interest rates; and
- by reducing long-term interest rates quantitative easing increases effectiveness of fiscal expansion and thus help to mitigate the crowding out of investment and consumption.

2.4 Quantitative easing in the euro area

During the recent financial crisis, the Federal Reserve and the Bank of England took the lead in implementing quantitative easing to restore targeted inflation level. The initial large-scale asset purchase (hereinafter: LSAP), more commonly known as quantitative easing, Fed announced on November 25, 2008; whereas Bank of England made the official announcement of asset purchases on March 5, 2009 (Ledenyov & Ledenyov, 2013, pp. 5ó 7).

Nevertheless, before ECB conducted quantitative easing it has resorted to other non-standard policy measures. ECB changed the maturity structure of its liquidity-providing

operations to address the illiquidity in euro area money markets and in particular tight financing conditions at long maturities. ECB expanded long-term refinancing operations (hereinafter: LTRO) to six months in March 2008. In October 2008, ECB adopted a fixed-rate full allotment (hereinafter: FRFA) tender for all refinancing operations during the financial crisis. It agreed to satisfy all the liquidity demanded by banks against collateral. ECB also expanded the list of assets eligible as collateral in credit operations to include lower-rated and non-euro-denominated assets. In the middle of 2009, ECB introduced covered bond purchase programme (hereinafter: CBPP). ECB committed to purchase covered bonds denominated in euro and issued in the euro area for a total value of þ60 billion over the period between June 2009 and June 2010. In the same time ECB expanded LTRO to 12 months. In May 2010, ECB announced securities markets programme (hereinafter: SMP). ECB conducted direct purchases of government bonds in secondary markets where it agreed to hold purchased bonds until maturity. The liquidity created was sterilized by the ECB via weekly liquidity absorbing operations. The purchases were first limited to Greek, Portuguese and Irish Government bonds and were later extended to Italian and Spanish Government bonds. The ECB stopped purchasing bonds in 2012 as market conditions improved. CBPP finished on schedule where the bonds purchased will be held through maturity. In 2011 ECB launched second covered bond purchase programme (hereinafter: CBPP2) where the Governing Council of ECB decided to make its CBPP2 portfolio available for lending. The programme ended as planned on October 31, 2012. The ECB announced further expansion of LTRO as the sovereign crisis intensified and bank funding conditions deteriorated. ECB launched 36ómonth LTROs (these are known as very long-term refinancing operations ó VLTRO) and expanded eligible collateral. In September 2012, ECB announced a new policy instrument Outright Monetary Transactions (hereinafter: OMTs) to repair the monetary policy transmission mechanism. Countries that apply to the European Stabilization Mechanism (hereinafter: ESM) for support by the terms and conditions of the ESMøs would be eligible to have their debt purchased in unlimited amounts on the secondary market (CouróThimann & Winkler, 2013, pp. 11ó12; Fawley & Nely, 2013, p. 62; Fratzscher, Lo Duca, & Straub, 2014, pp. 4ó7). These measures were implemented to provide flexible liquidity to the banking sector system according to demand with extended maturities and to conduct purchases of assets in malfunctioning market segments. They were not intended to alter monetary policy stance (ECB, 2015c, pp. 1ó2).

In June 2014, ECB introduced new measures to reinforce the accommodative monetary policy stance as well as to fight persistently weak inflation, slowing growth and subdued credit dynamics. ECB announced targeted longer-term refinancing operations (hereinafter: TLTROs) since previous non-standard measures became less suitable in providing liquidity needs for banks due to active deleveraging process. These Eurosystem operations allow banks to borrow at fixed interest rates for a period of up to four years. They are offered in order to stimulate bank lending and ease private sector credit conditions and were launched in September 2014 in a series of eight operations conducted on a quarterly basis (ECB,

2015c, pp. 2ó3). The Governing Council preferred TLTRO over VLTRO since the design of TLRTO is such that it better ensures that the liquidity is effectively converted into credit (Durante, 2014). In June 2014, the Governing Council decided for the first time to introduce negative rate on the deposit facility and likewise on reserves in excess of the minimum reserve requirements. In September 2014 ECB announced two asset purchase programmes, the third covered bond purchase programme (hereinafter: CBPP3) and the asset-backed securities purchase programme (hereinafter: ABSPP). They were launched on October 20, 2014 and November 21, 2014 respectively. But it was not until January 22, 2015 when ECB announced a massive expansion of its purchases programme (i.e. expanded asset purchase programme APP or more commonly known quantitative easing). Expanded APP came into effective in March 2015 with an additional programme, so called public sector purchase programme (hereinafter: PSPP) (ECB, 2015c, pp. 2ó3). In March 2016, ECB announced the second series of the TLTRO programme (TLTROóII). This programme consists of four operations each with a maturity of four years. It started in June 2016 and the difference to the first programme is in the interest rate to be applied that is linked to the participating bankøs lending pattern. Table 2 shows the summary of the monetary policy measures taken by ECB in the period from 2008 to 2016.

Table 2. Summary of ECB's non-standard policy measures

Date	Program	Brief description
March 2008	LTRO	LTRO expanded: 6ómonth LTROs
October 2008	FRFA	Refinancing operations expanded; adpoted fixedórate tenders and full allotment for all refinancing operations; the list of asset eligible as collateral expanded (loweróraed and nonóeuroódenominated assets)
May 2009	CBPP/ LTRO	LTRO expanded: 12ómonth LTROs; CBPP announced (purchase of euroódenominated covered bonds); CBPP launched July 2009
May 2010	SMP	SMP announced: purchases of government bonds in secondary markets
June 2010	CBPP	CBPP finished
October 2011	CBPP2	CBPP2 announced, November 2011 launched
December 2011	(V)LTRO	LTRO expanded: 36ómonth LTROs; eligible collateral also expanded
September 2012	OMT	Countires that apply to the ESM eligible to have their debt purchased in unlimited amounts on the secondary market
October 2012	CBPP2	CBPP2 finished
June 2014	TLTRO	TLTRO announced: stimulate bank lending and ease private sector credit conditions; launched September 2014
June 2014	NIR	Negative rate on deposit facility and reserves in excess of the minimum reserve
September 2014	APP	APP announced: CBPP3 and ABSPP; launched October and November 2014 respectively
January 2015	APP/QE	Expanded APP announced; launched March 2015
March 2016	TLTROóII	Second series of TLTRO announced, launched June 2016

Source: P. CouróThimann & B. Winkler, *The ECBøs nonóstandard monetary policy measures. The role of institutional factors and financial structure*, 2013; B. W. Fawley & C.J. Nely, *Four Stories of Quantitative Easing,* 2013; M. Fratzscher, M. Lo Duca & R. Straub, *ECB Unconventional Monetary Policy Actions: Market Impact, International Spillovers and Transmission Channels*, 2014.

Some think that ECB did »too little too late« and should have stepped up its non-standard policy measures. Buiter (2009) wrote: »Time to wake up and smell the quantitative easing roses«. He pointed out that ECB could have and should have engaged in quantitative easing. According to him, there had been no obstacles (not even treaty-based) preventing the ECB from buying government securities in the secondary markets. Even when quantitative easing would need to be reversed, Buiter (2009) claimed that ECB is independent when deciding about contracting its balance sheet. However, according to him such purchases should be accompanied by a guarantee by all euro area governments for the debt acquired by the ECB. On the other hand, Muellbauer (2014) claimed that households in the euro area (particularly in Germany and France) hold relatively large amounts of liquid assets. Holdings of liquid assets are larger than household debt, which means that reduction in policy rates induced by quantitative easing translates into lower deposit rates. The ultimate consequence might be a reduction in total household spending. Typical quantitative easing programme is according to Muellbauer (2014) also less suitable for the euro area because companies are more reliant on bank financing rather than financing through capital markets. As a result, funds available through quantitative easing would not make much effect on firms and that programmes that focus on providing financing to banks are more suitable for the euro area. However, Levy (2014) stressed that ECB should replace its bank lending programme (i.e. LTRO programme) with quantitative easing due to the slow recovery and sustained low inflation. This is because quantitative easing by buying government debt would enhance liquidity, avoid unnecessary credit policy and be consistent with maintaining the inflation rate of below, but close to 2%, over the medium term.

Nevertheless, ECB started purchasing securities on March 9, 2015 due to insufficient quantity of liquidity generated by the previous monetary policy measures. The reason behind it was the increased likelihood of too low inflation for a prolonged period, implying risks to medium-term price stability. The purchases have been conducted at a monthly pace of þ60 billion. Governing Council said that the purchases would be carried out until September 2016 or until it would be seen a sustained adjustment in the path of inflation (ECB, 2015a, pp. 15ó18). However, the duration of the programme has been several times extended. This is an open-ended programme where the duration of it depends on the future outlook of the inflation rate as being the common objective of the central bank. The Governing Council also decided to reinvest the principal payments on the securities purchased under the APP as they mature for as long as necessary (Andrade, Breckenfelder, De Fiore, Karadi, & Tristani, 2016, p. 11).

Asset purchase programme was initially structured in the following way (Clayes, Leandro, & Mandra, 2015, pp. 2ó3):

- approximately þ10 billion devoted to covered bonds and asset-backed securities (this is the average value of the CBPP and ABSPP since they started in October 2014),

- additional þ50 billion devoted to PSPP:
  - þ6 billion per month devoted to the purchase of the debt of supranational institutions located in the euro area and denominated in euros,
  - þ44 billion devoted to the purchase of sovereign debt securities: þ4 billion held by the ECB and þ40 billion held by national central banks (hereinafter: NCBs).

Allocation of þ44 billion between countries has been split between all euro area countries according to the ECB capital keys (i.e. NCBøs share of the ECBøs capital). The capital keys show the respective countryøs share in the total population and gross domestic product of the European Union (hereinafter: EU). In order to preserve normal secondary market functioning ECB imposed 25% issue limit and 33% issuer limit on Eurosystem holdings. By imposing the security-specific issue-share limit of 25%, ECB does not want to have a blocking minority. ECB does not want to have the power to block a potential vote on the restructuring of debt of a country because not blocking such a restructuring could be interpreted as monetary financing of a member state. The security specific limit was increased to 33% on September 3, 2015 (Andrade et al., 2016, p. 12, Clayes et al., 2015, pp. 3ó4). Figure 5 presents the allocation of monthly asset purchases by the Eurosystem.

Figure 5. Allocation of monthly asset purchases by the Eurosystem
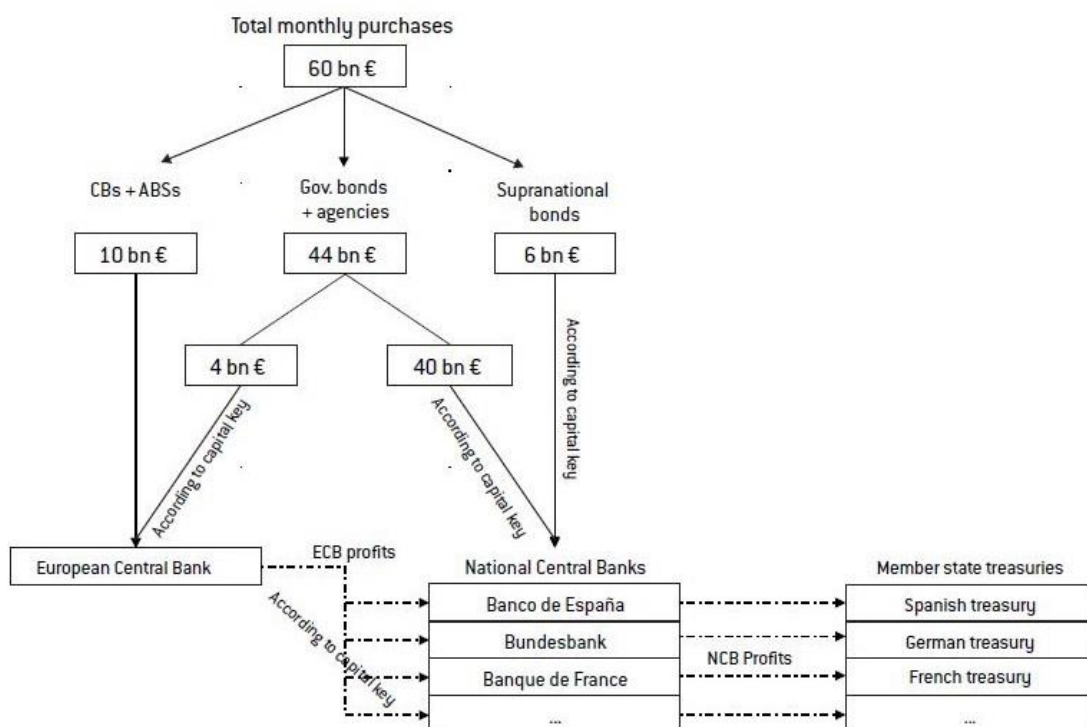
Source: G. Claeys, A. Leandro & A. Mandra, *European Central Bank quantitative easing: the detailed manual,* 2015, p. 3.

Bonds purchased on the secondary market must have a remaining maturity of two to 30 years, denominated in euros and must be eligible as collateral for monetary policy operations. This means that country has either a sufficiently high rating or is benefiting from an EU financial assistance programme (Clayes et al., 2015, pp. 3ó4). Szczerbowicz and Valla (2015) argue that ECB should purchase assets that are close to job-creating, growth-enhancing and innovation-promoting activities instead of sovereign bonds. ECB should therefore select assets based on their final economic use. According to them, PSPP has several shortcomings. Under PSPP ECB allocates purchases according to capital key which translates into almost half of all the purchases to German and French bonds where those markets already benefit from exceptionally low interest rates. Additionally macroeconomic effects and market impact are expected to be limited when buying sovereign bonds. Therefore, ECB needs to focus on private assets, which can be issued by the financial sector or by non-financial corporations themselves. Purchasing assets from banks is already covered under ABSPP. Moreover, they suggest that the best candidate would be financial instruments issued directly by the corporate sector. They also emphasize that instruments issued by European institutions should be given a prominent role and argue that ECB should also purchase debt issued by European Investment Bank. This would lead toward long-term growth objectives and would further deepen European integration.

In March 2016, the Governing Council decided to increase the volume of monthly purchases by þ20 billion to þ80 billion from April 2016. ECB released corporate sector purchase programme (hereinafter: CSPP) on June 8, 2016 where purchases under this programme include corporate sector bonds. These are investment-grade euro-denominated bonds issued by non-bank corporations (Bundesbank, 2016, pp. 32ó33). On December 8, 2016, the Governing Council decided upon some changes regarding the APP. The purchases will continue at a monthly pace of þ80 billion until March 2017 and from April 2017, the purchases will continue at a monthly pace of þ60 billion until December 2017 or beyond if it is necessary. The Governing Council therefore again extended the duration of the quantitative easing. The change was also made to parameters of the APP. The maturity range of the PSPP is as of January 2017 broadened. This is reflected in a decrease of a minimum remaining maturity for eligible securities from two to one year. The second change is a permission of purchasing securities under APP with a yield to maturity below the interest rate of the deposit facility, which is currently -0.40% (ECB, 2016a & ECB, 2016b).

2.4.1 Effects of quantitative easing in the euro area

Quantitative easing should affect aggregate demand, inflation and real economic growth through changes in financial market variables. This means that quantitative easing should cause long-term interest rates to fall, the euro to depreciate and potentially with a certain lag strengthen lending, consumption and economic growth, considering all other things

being equal (Bundesbank, 2016, p. 38). The effectiveness of quantitative easing in the euro area was under question since the financial conditions at the announcement of the programme were stable and various yields and spreads already compressed (Altavilla, Carboni, & Motto, 2015, p. 2). Quantitative easing contribution to developments in individual financial market variables is difficult to determine since these variables are subject to numerous other influences (i.e. other monetary policy measures taken by ECB as well as real economic factors and monetary policy decisions taken outside the euro area). Long-term interest rates in the euro area and the euro's effective exchange rate had fallen even before the quantitative easing announcement due to other policy measures taken by the ECB (Bundesbank, 2016, pp. 38–39).

Andrade et al. (2016, p. 13) provide evidence suggesting that quantitative easing was effective in easing further the monetary policy stance in the euro area. Quantitative easing had a significant effect on asset prices upon announcement. The median announcement effect of quantitative easing is estimated to reduce 10–year sovereign yields by 43 basis points in the euro area. Altavilla et al. (2015, pp. 5–6) also find that quantitative easing has lowered yields significantly in a broad set of market segments. These effects rise with maturity and riskiness of assets. Moreover, non-targeted assets have also been affected. They estimated that the impact on long-term sovereign bonds was a decline in yields by about 30–50 basis points at the 10–year maturity for the implied euro area term structure. De Santis (2016, p. 12) also proves that quantitative easing in the euro area reduced sovereign yields by 63 basis points with the vulnerable countries benefiting most.

Andrade et al. (2016, pp. 19–27) investigate the impact of quantitative easing on euro area banks regarding the banks' stock prices. The higher the exposure to sovereign bonds the higher was the increase in bank's stock prices (i.e. the larger was the share of the bank balance sheet invested in sovereign bonds, the more banks benefited from the PSPP). Due to a reduction in interest rate margins, bank's profitability has been affected. However, they also assert that banks with larger asset share in sovereign bonds are expected to have higher discounted future profits after the programme. A reduction in leverage can therefore lead to an expansion in lending which in turn supports the economic recovery.

Evidence of existence of signalling channel in the euro area was also provided. Private sector adjusted their expectations on future monetary policy. After the quantitative easing announcement, the expectations of future interest rates were lowered and the inflation rate and output growth rates expectations were increased. Long-term inflation expectations increased by 9 basis points in the first quarter of 2015 (from 1.77% to 1.86%) and got closer to the definition of price stability. Without the quantitative easing programme, the shock that mitigates consumption demand would have reduced the inflation rate by more than 2% and the output by around 7%. Monetary policy by using conventional measures cannot stabilize the economy by itself (Andrade et al., 2016, pp. 29, 40).

2.4.2   Risks related to quantitative easing in the euro area

Besides positive effects, quantitative easing can also entail risks and unwanted side effects. The main risks for the euro area Andrade et al. (2016, p. 43) divide into three groups:

- risks to financial stability,
- factors that limit the effectiveness of quantitative easing, and
- risks of losses on the balance sheet of the ECB.

Quantitative easing by increasing inflation and output and thus public debt sustainability should benefit financial stability. Nevertheless, an ultra-loose monetary policy over a prolonged period of time may impose certain challenges for financial institutions to engage in riskier activities and have adverse impact on financial stability (Andrade et al., 2016, p. 43; Claeys & Leandro, 2016, p. 10). Andrade et al. (2016, p. 44) prove that PSPP has contributed in reduction of yields across the entire term structure and that this has negatively affected interest rate margins of euro area banks. A prolonged period of low yields can endanger financial stability and this risk is high for banks facing capital shortfall. These banks are unable to raise external capital and lower margins may delay their deleveraging process that in turn leads to slow recovery of bank lending. They also argue that the effectiveness of quantitative easing is maximised when all banks in the economy are well capitalised. Claeys and Leandro (2016, pp. 10´11) specify that quantitative easing reduces profitability of financial institutions which threatens financial stability. When deposit rates are close to zero banks cannot pass falling interest rates through deposit rates anymore. Banks are reluctant to reduce deposit rate into negative territory since this would encourage depositors to withdraw their money. A reduction in the spread between lending and deposit rates in the euro area due to quantitative easing has influenced bank profitability. However, quantitative easing may have also positive effect on banksø profit due to a reduction in the cost of obtaining funding via the interbank market and the central bank. Banks can also realise a gain by selling their holdings due to higher asset prices caused by quantitative easing (Bundesbank, 2016, pp. 44´45).

The euro area is faced with additional challenges for the coordination of monetary and debt management policies due to the presence of independent fiscal authorities with heterogeneous financing needs. The environment of low interest rates provides incentives for governments to shorten the maturity of newly issued bonds that limits the effectiveness of the PSPP. Therefore, the coordination between the ECB and national fiscal authorities should be ensured while implementing quantitative easing (Andrade et al., 2016, pp. 46´49).

Risks on the balance sheet of the ECB arise from the potential losses on the portfolio of risky assets held by ECB. Quantitative easing transfers risks from the balance sheet of banks to that of the central bank. One source of risk arises from the possibility of debt

restructuring. The value of the assets on the balance sheet of the ECB would in this case fall significantly. This risk is in the case of euro area unavoidable because there is no area-wide fiscal issuer that can be considered as truly risk free. No loss sharing can also be part of this risk. Nonetheless, quantitative easing should improve macroeconomic conditions and thus tend to reduce the risk of sovereign or corporate defaults. A second source of risks arises from the exposure to duration risk. ECB will at the time of recovery be induced to increase policy interest rates which will have adverse effect on its balance sheet. This effect will be stronger if the portfolio of the ECB consists of mainly long-term low-yield bonds. The ECB is also exposed to risk of capital losses due to an expected reduction in bond prices along an exit path. In addition, low sovereign yields reduce the possibility of asset returns and earnings on the portfolio of bonds for the ECB (Andrade et al., 2016, pp. 49650).

De Grauwe and Ji (2015) specify that capital losses for the ECB and a recapitalisation of the ECB that would have to be financed by all taxpayers in the euro area can be overcome by not mixing monetary and fiscal policy when structuring quantitative easing programme. Both the profits and the losses resulting from the ECB holding sovereign debt should not be distributed according to the equity shares but should be returned to the same government. Quantitative easing structured in such a way restores the neutrality and taxpayers are shielded from movements of the value of the bonds on the ECBøs balance sheet. However, Annunziata (2015) emphasizes that the lack of risk sharing will not be problematic within the next few years, although additional steps towards fiscal union are needed.

2.5 Unwinding quantitative easing

Buiter (2009) argues that there is a need for an exit strategy to avoid inflation risk premia. Quantitative easing, which has expanded monetary base, is considered potentially inflationary. This inflation risk arises from three sources: activity overstimulated by hyper-accommodative monetary policy, excess liquidity in the banking system and the potential deanchoring of inflation expectations. When the economy recovers, quantitative easing will have to be unwounded. Central banks will have to withdraw the monetary stimulus injected into the system. Without credible reversibility the risk of price stability and longer-term inflationary expectations will rise which can in turn raise longer-term nominal and real interest rates. Due to the use of unconventional measures, the fear arises that central banks lack the tools needed to undo previous actions, at least in a timely manner. The integral part of exit strategy must be a communication and transparency of central banks otherwise the effectiveness of the policy stimulus would be undermined. Exit strategy is defining a plan for a tightening of monetary policy when the economy recovers. By designing and discussing about the exit strategy central banks are being clear about the end game once the economic environment returns to normal levels (Belke, 2009, pp. 466).

Buiter (2009) claims that the ECB is the world's most independent central bank therefore the future reversibility of quantitative easing should not be a problem for the euro area. The decision of unwinding of quantitative easing is solely in the hands of the ECB. When it decides to contract its balance sheet, it can release the surplus of government debt holdings into the open market where it becomes the problem of the respective euro area member. On the other hand, Claeys and Darvas (2015, p. 17) note that an exit from quantitative easing and other unconventional monetary policies could have a number of negative side effects. These include an increase of short-term and long-term interest rates, decrease in stock, bond and housing prices, weakening of public debt sustainability and creation of volatility in emerging markets. According to them, the smoothness of the exit of quantitative easing in the euro area will depend on inflationary and output developments as well as the duration of quantitative easing.

3 BANK LENDING

In the context of human anatomy, bank lending can be defined as the heart of banking business (Moussa & Chadia, 2016, p. 27). Banks as a financial intermediaries perform beneficial operations on both sides of the balance sheet. On the asset side of the balance sheet banks grant loans to illiquid borrowers and as a result help to enhance the flow of credit in the economy. On the liability side of the balance sheet banks provide liquidity on demand to depositors (Diamond & Rajan, 1999, p. 1). Diamond and Dybvig (1983, p. 402) emphasize that banks perform transformation of liquid assets (deposits) into illiquid assets (loans). Granting profitable loans to individuals, corporations and government is hence the main purpose of banks. Lending is the most important service and the principal business for commercial banks (Moussa & Chadia, 2016, p. 27). Malede (2014, p. 109) specifies that lending is the main function of commercial banks due to the volume of loans that constitute banks' assets as well as the annual considerable raise of loan. Bank loans are typically the largest asset and the predominant source of income for banks. Bank loans are considered the most valuable assets of banks in view of their significant contributions to the financial health of banks through interest income earnings.

Commercial banks hold illiquid assets funded mainly with deposits. Although only a certain percentage of the amount deposited is used to provide loans. The remaining is kept as a reserve to maintain its liquidity (Moussa & Chadia, 2016, p. 27). The illiquidity of bank assets results mainly because of their information sensitivity. In originating and pricing loans, banks monitor borrowers and collect information about the loans that inhibits their marketability. Nevertheless, additional information about borrowers may be a comparative advantage. The illiquidity of assets encourages banks to establish relationship with borrowers, which will result in long-term commitments. Moreover, this relationship will help to restructure the debt contracts of borrowers in financial distress (Boot & Thakor, 2000, p. 683). Kashyap, Rajan, & Stein (2002, p. 33) point out that lending is the process that involves obtaining costly information about opaque borrowers and then

granting loans based on this information. Bank by accepting customer deposits and granting loans expects to generate a return that is higher than the interest payments to depositors for the use of their funds. However, bank lending strategy can be influenced by the level of banking industry competition. Furthermore, the transformational process of bankøs activity can be influenced by macroeconomic factors and industry level characteristics (Moussa & Chadia, 2016, p. 27).

Malede (2014, p. 109) highlights that commercial banks play an important role for the growth of the economy by maintaining three main operating guiding principles (i.e. profitability, liquidity and solvency). Banks can finance activities that cannot be financed in the bond market; therefore, bank loans acquire a special status. If financial intermediation is reduced, either by rationing or by price, aggregate supply and demand may be affected (Bernanke & Blinder, 1988, p. 1). Bank lending is special. Shocks to the supply of bank loans, especially if there are no good substitutes, may affect the consumption of borrowers (Himmelberg & Morgan, 1995, p. 15). General agreement is that monetary policy works mainly through interest rates. The interest rate mechanism does not depend on what assets banks hold. A reduction in the money supply, which consists mainly of deposit liabilities of banks, is one of the key factors that push up interest rates. Consequently, a rise of interest rates leads to a decrease in spending by interest-sensitive consumers. Regardless of the composition of bankøs assets (i.e. proportions of bankøs assets classified as loans or securities) the same response would happen (Morris & Sellon Jr, 1995, p. 60). In addition to this money/interest rate channel, an additional policy channel works through bank credit. The transmission of monetary policy through the supply of credit is labelled as the bank lending view (Himmelberg & Morgan, 1995, p. 15; Hosono & Miyakawa, 2014; Morris & Sellon Jr, 1995, p. 60).

3.1 Bank lending channel

In the credit channel, banks play essential role in the transmission of monetary policy. The credit channel provides explanation for the distributional effects of policy on the economy if we assume that there are asymmetric information between lenders and borrowers. Within the credit channel, there are two subchannels: the borrower net worth channel and the bank lending channel. According to the first subchannel, monetary policy can weaken the balance sheet of borrowers. Moreover, tightening of monetary policy can reduce borrowersø net worth which leads to a reduction in borrowing and consequently in investment. This can be described as the effect of monetary policy on loan demand. On the other side, impact of monetary policy on banksø balance sheet influences loan supply that in turn then affects bank dependent borrowers. Monetary policy influences bank loan supply through bank lending channel (Kishan & Opiela, 2000, pp. 1216122). The focus of the thesis is bank lending channel and the impact of monetary policy on bank loan supply.

The bank lending channel is a separate channel of monetary policy transmission. It is supposed to operate in addition to the conventional interest rate channel. Monetary policy can influence aggregate demand not only through interest rates but also through the supply of loans. In addition, the existence of bank lending channel is based on credit market imperfections that are caused by asymmetric information (Brissimis & Magginas, 2003, p. 5). Due to imperfect substitutability between bank loans and other sources of funding, banks play a special role in the transmission process and an important role in the financial system. This is because they are well suited to solve asymmetric information problems in credit markets (Mishkin, 1996, p. 9). Brissimis and Magginas (2003, p. 3) also note that the lending view of monetary policy builds on the assumption of incomplete markets which are characterized by imperfect information. In the bank lending view there are three assets ó money, bonds and bank loans ó that differ from each other in meaningful ways. Therefore banking sector is special in two ways because it is involved in creating money and making loans. In this three-asset world, monetary policy works also through the impact on the bank loan supply and not just through the impact on the bond-market rate. For example, even if monetary policy is tight and would have little effect on the bond-market rate, it could have under certain circumstances a significant effect on the spread between loans and bonds. This could then lead to a reduction in investment of those firms that rely on bank loans for financing (Kashyap & Stein, 1994, p. 222).

Mishkin (1996, p. 9) specifies that certain borrowers are bank dependent because of banksø special role. This means that borrowers cannot easily switch to alternative forms of external financing and will accordingly not have access to the credit markets unless they borrow from banks. If there is no perfect substitutability of retail bank deposits with other sources of funds then the bank lending channel operates in the following way: expansionary monetary policy increases bank reserves and bank deposits which in turn lead to an increase in the quantity of bank loans available. Because banksø have a special role as lenders to bank dependent borrowers the increase in the availability of bank loans will cause investment and possibly consumer spending to rise. The monetary policy effect of the bank lending channel is schematically presented in equation (1):

$$M \Rightarrow bank\ deposits \Rightarrow bank\ loans \Rightarrow I \Rightarrow Y \tag{1}$$

where M indicates an increase in money supply, I corresponds to a rise in investment spending and Y indicates an increase in aggregate demand and a rise in output.

Bernanke and Blinder (1992, p. 901) note that when central bank reduces the volume of reserves and therefore of loans, spending by customers, who depend on bank loans, must fall and as a consequence aggregate demand falls. Mishkin (1996, p. 9) also points out that regarding the bank lending view monetary policy will have a greater effect on expenditure by smaller firms that dependent on bank loans than it will on larger firms since they can directly access the market without banks.

According to Bernanke and Blinder (1988) and later Kashyap and Stein (1994, pp. 225‒226) three necessary conditions must hold in order for a bank lending channel to work:

1. Loans and bonds must not be perfect substitutes for firms on the liability side of their balance sheet. It means that firms are dependent on bank loans and are therefore unable to offset a decline in the supply of loans simply by borrowing directly from the market.
2. Central bank must be able to affect the supply of loans by changing the quantity of reserves available to the banking system. Therefore, banking sector should not be able to completely isolate its lending activities from shocks to reserves, either by switching from deposits to less reserve-intensive forms of finance (e.g. certificates of deposit, commercial paper or equity) or by paring it net holdings of bonds.
3. Imperfect price adjustment that prevents any monetary policy shock from being neutral should exist. If prices adjust easily, they are not sticky, then the change in nominal reserves will be met with the change in prices, which leads to unaltered balance sheets of both banks and firms in real terms. The impact of monetary policy through the lending channel or the money channel is wiped out.

However, Gambacorta and Marques-Ibanez (2011, p. 141) provide evidence that non-financial corporations were able to raise funding through the corporate bond market even if at very high interest rates during the recent financial crisis in the euro area. Corporate bond market issuance by euro area non-financial corporations substantially increased in 2009, which means that large firms were able to bypass supply constraints in the banking sector. This in turn casts certain doubt about the first condition of imperfect substitutability between bank loans and bonds, at least for large firms.

According to bank lending view, monetary policy shifts banks' loan supply curve. In addition, these shifts in loan supply curve depend on the banks' balance sheet. When the central bank conducts monetary policy through open market operations and sells securities to a bank this decreases bank's reserves. This may force the bank to reduce its loans unless it catches up with any shortfall in deposits by selling securities holdings or by issuing non-reservable debt. Banks having fewer liquid assets will need to decrease loans more if they are unable to issue non-reservable debt or are only able to do that at a higher cost than deposits (Hosono & Miyakawa, 2014). However, Disyatat (2011, pp. 711‒712) argues that the concept of monetary policy affecting deposits and that deposits act as the driving force of the bank lending is misplaced. According to him, process works in reverse, with loans actually driving deposits. The concept of money multiplier is flawed and uninformative when analysing the dynamics of bank lending. Thus, the availability of deposits is not a constraint on lending. Furthermore, he stresses that there is no exogenous constraint on the supply of loans except for the regulatory capital requirements. Hence, an adequately capitalized banking sector could always fulfil the demand for loans.

Kashyap and Stein (1994, p. 223) emphasize that the impact of the bank lending channel on aggregate demand might depend on the financial condition of the banking sector. This means that when bank capital is reduced and when the decision of the bank loan is tied to the risk-based capital requirements, then the impact of the monetary policy on the aggregate demand through bank lending channel is weaker. This has implications for the ability of monetary policy to offset particular sorts of adverse shocks to the economy. Peek and Rosengren (1995, pp. 476648) also point out that the health of the banking system is an important factor in the transmission of monetary policy through both money channel and lending channel. The health of the banking system affects bank behaviour that leads to the nature and the size of bank responses to shifts in monetary policy, especially the impact through the bank lending channel. The capital constraint is having a noticeable effect on bank lending and is consequently very important for the bank lending channel of monetary policy. For example, if a bank is facing a binding capital-to-asset ratio, it will be unable to expand its assets. A shortage of capital, not reserves, will be preventing the bank to increase its lending even though there is an increase in loan demand due to the ease in policy. According to them, when banks are capital-constrained the bank lending channel is eliminated. Moreover, they show that loans by capital-constrained banks will rise in response to a tightening of monetary policy. In this case, the liability side of the balance sheet is left unchanged, whereas both reserves and securities decline.

Gambacorta and Marques-Ibanez (2011, pp. 1446145) shed the new light on the functioning of the bank lending channel. They show that banksø business model has an impact on the bank loans supply. The financial crisis has in turn showed changes in monetary policy transmission mechanism due to deregulation, financial innovation and the increasing role of institutional investors. As a result, banksø business models have changed and the use of market funding sources has become more intensive, such as the securitization market. This has led banks into being less reliant on deposits to expand their loan base. Moreover they show that the amount of short-term funding and securitization activity have become important on how banks react to monetary policy shocks and the banksø ability to withstand adverse shocks. Disyatat (2011, p. 712) goes even further and suggests a reconsideration of the traditional bank lending channel. Greater reliance on market-based funding might enhance the importance of the bank lending channel by increasing the sensitivity of banksø funding costs to monetary policy. He also suggests that the transmission mechanism should apply also to non-bank intermediaries since they also play an essential role in it. Gambacorta and Marques-Ibanez (2011, p. 166) also add that the functioning of the bank lending channel in the years ahead will be also influenced by the financial regulations and their impact on banksø profitability and funding costs.

3.2 Determinants of bank lending

The banking industry is an important component of the financial system. Through efficient financial intermediation banks are capable of collecting funds from the surplus spending

units in order to bring financial costs down and transform liquid assets into illiquid assets. Transformational process is influenced by several factors, namely bank level, industry-specific and macroeconomic factors (Ladime, SarpongóKumankoma, & Osei, 2013, p. 42). On the other hand, determinants of bank lending can be classified also as internal factors and external factors (Malede, 2014, p. 109; Moussa & Chadia, 2016, p. 29). Determinants of bank lending behaviour can be classified as demand-side and supply-side factors as well (Pham, 2015, p. 2) where supply-side factors are understood as bank specific factors, while demand for loans depends on the macroeconomic environment and is independent of the situation of individual banks. Among bank specific factors of bank lending behaviour are classified bank size, bank capital, volume of deposits, liquidity, credit risk and profitability. On the other side, inflation rate, interest rate and growth rate of gross domestic product are classified as macroeconomic factors.

3.2.1 Bank specific factors

Bank size is considered an important factor affecting bank lending behaviour. First, bank size can show economies of scale where large banks benefit from it because of a reduction in the cost of production and information gathering. Moreover, larger banks have a greater ability to diversify (Moussa & Chadia, 2016, p. 30). Peek and Rosengren (1995, p. 51) show that small banks tend to lend more to small firms than larger banks. However Cole, Goldberg, & White (2004, p. 230) suggest that this small business loan underwriting practices tend to be riskier. Nevertheless, small banks tend to have advantage in evaluating credit due to the use of soft information (Carter, McNulty, & Verbrugge, 2004, p. 234). On the other hand, large banks have also a comparative advantage in lending based on hard information (Moussa & Chadia, 2016, p. 30) as well as they can invest in different geographical and business segments to deal with shocks (Malede, 2014, p. 110). The size of the bank has also a significant impact on the occurrence of nonperforming loans (Moussa & Chadia, 2016, p. 30). Kishan and Opiela (2000, p. 138) argue that bank size affects the ability of banks to raise funds and consequently maintain loan growth. This is especially seen in times of contractionary policy. Several authors (Ladime et al. (2013), Malede (2014), Moussa and Chadia (2016), Tomak (2013)) find a positive and statistically significant relationship between bank size and bank lending. Larger banks thus lend more than smaller ones. On the other hand, Ko–ak, Li, Lon arski, & Marin (2015, p. 19) specify that bank size affects bank lending behaviour, however in the negative way. The negative and significant coefficient for the bank size indicates that larger banks experience lower loan growth than small banks in normal times.

Bank capital is the key factor affecting bank lending that determines the relationship between the financial conditions and the real activities of the bank. A well-capitalized bank or a bank with access to additional sources of capital will be able to bear capital losses without having to reduce its assets and consequently lending (Berrospide & Edge, 2010, p.

1). Gambacorta and Marques-Ibanez (2011, p. 143) argue that bank capital affects bank lending if two conditions hold:

- Banks have an incentive to limit the risk of future capital inadequacy and to reduce the risk of insolvency. Because capital requirements are linked to the amount of credit outstanding, this would determine an immediate adjustment in lending. Conversely, if banks are well-capitalized or even have an excess of capital, the losses could be easily absorbed without any consequences for the lending portfolio.
- An imperfect market for bank capital must exist: banks cannot easily issue new capital due to tax disadvantages, adverse selection problems and agency costs.

Kishan and Opiela (2000, p. 223) show that this two conditions hold. However, they also show that risk-based capital requirements (such as the ones under Basel Accord) can tie a bankøs ability to extend loans to the level of equity capital. Moussa and Chadia (2016, p. 34) prove a positive relationship between capital and loan growth. The increase in capital thus has a positive effect on loan growth. Ladime et al. (2013) and Pham (2015) find similar results. On the contrary, Berrospide and Edge (2010) find only a slight impact of the capital in the size of loans. Bridges, Gregory, Nielsen, Pezzini, Radia, & Spaltro (2014) prove that capital requirements impact bank lending behaviour with different responses. Koñak et al. (2015) go even further and evaluate whether the quality of bank capital affects bank lending. They prove that tier 1 capital (i.e. high-quality bank capital) positively affects credit growth. Moreover, tier 2 capital positively affects lending growth in normal times, although it had no significant effect on lending during the crisis.

Volume of deposits is another bank specific factor affecting lending since the primary function of the bank is to transform deposits into loans. Accordingly, deposits are the primary source of bank loans and thus have a positive effect on lending (Malede, 2014, p. 111). Moussa and Chadia (2016) find a negative relationship between deposits and loan growth, meaning that an increase in deposits has a negative effect on bank loans, whereas Malede (2014) finds positive although insignificant relationship between deposits and loan growth. The reason lies in collecting mainly demand deposits, which are repayable to depositors on demand. As a result, banks hold large amount of deposits as a reserve to meet customers demand instead of lending. The other reason might be that bank does not immediate issue loan from currently deposited amount. Koñak et al. (2015) confirm that customer deposits positively affected loan growth during the crisis. As Berlin and Mester (1999, p. 600) point out customer deposits seem to be the most stable source of bank funding which allow banks to insulate bank-dependent borrowers from credit shocks.

Liquidity position is along bank size and capital most widely used variable to define bank lending. Liquidity in turn determines bank loan supply since excess liquidity encourages bank to increase the volume of loans (Acharya & Naqvi, 2012, p. 351). Ehrmann et al., (2001, p. 5) show that banks in the euro area respond differently to monetary policy with

liquidity position of banks being the most important factor determining this difference. Malede (2016) finds a positive and statistically significant relationship between liquidity and loan growth.

Credit risk is a crucial factor because even a default of a small number although important customer could generate large losses that in turn lead to insolvency. Accordingly, the variation in credit risk shows a change in health of the bank loan portfolio (Malede, 2016, p. 110). Fight (2004) specifies that the only method of lending successfully is to accurately assess a borrower's creditworthiness because lending is the primary function of banking. Cucinelli (2015) shows a negative impact of credit risk variables (i.e. non-performing loans and loan loss provisions) on bank lending behaviour. An increase in non-performing loans (hereinafter: NPL) is therefore expected to reduce banks' loans.

Aisen and Franken (2010, p. 10) emphasize that a bank with sound **profitability** (measured by the return on equity and return on assets) will have great access to financing which indicates a positive relationship to bank lending. On the other hand, sound profitability could indicate that bank has taken riskier positions, which would indicate a negative relationship.

3.2.2   Macroeconomic factors

Inflation rate and growth rate of gross domestic product (hereinafter: GDP) are external factors or macroeconomic factors used to control for the loan demand-side effects. It is expected a positive effect of these two variables on the bank lending behaviour (Cucinelli, 2015, p. 64). Ko-ak et al. (2015) show that credit growth is positively correlated with GDP growth. Cucinelli (2015) shows similar result for the GDP growth and also finds positive although statistically insignificant relationship between inflation rate and loan growth. Cucinelli (2015) also uses unemployment rate to control the demand-side of lending and is negatively correlated with loan growth. This is because when unemployment increases people are less willing to take loans.

Monetary policy conducted by central bank through bank lending channel affects loan growth as an external factor. Non-standard policy measures conducted by ECB are expected to ease borrowing conditions by easing banks' refinancing conditions. Moreover, by addressing liquidity of banks it is expected that an increase in liquidity will result in bank loan growth (ECB, 2015b, p. 9).

3.3 Bank lending during the crisis

The banking panic in the 2008 resulted in severe recession around the world (Ivashina & Scharfstein, 2010, p. 319). According to Kwan (2010, p. 1), banks tightened their lending terms and standards to unprecedented levels in response to the global financial crisis. This

could in turn lead to slow economic recovery and price stabilization, which is the main objective of a central bank. Ivashina and Scharfstein (2010, p. 320) point out that lending fell across all types of loans as well was the liquidity in the banking sector reduced. However, they also show that banks, which had more stable sources of funding (i.e. deposits), cut lending less than banks without as much access to this stable source of funding.

Euro area has experienced two severe recessions: the first was the »Great Recession« started in 2008 and the second started in 2011, so called »Euro area sovereign debt crisis«. The name already implies that it was determined by the euro area specific event where both economic growth and bank loans decreased substantially (Altavilla, Darrcaq Paries, & Nicoletti, 2015, p. 3). Accordingly, the growth of lending to non-financial corporations declined since 2011; moreover it became significantly negative in certain countries (e.g. Cyprus, Greece, Ireland, Italy, Portugal, Spain and in euro area new member states). Banks have tightened credit standards since 2007 although in the mid 2014 a slight net easing of credit standards happened (EIB, 2014, pp. 2 3). Altavilla et al. (2015, p. 3) indicate that banks might tighten lending standards due to falling aggregate demand and poor economic performance. Furthermore, banks react to the increased level of counterparty risk by raising prices on new credit lines in times of financial distress. Under such conditions banks could be seen as only responding to already existing adverse economic shocks rather than generating them. Figure 6 presents the credit growth in the euro area in the period before and during the financial crisis as well as the period when ECB implemented non-standard policy measures. The key drivers in such bank lending trends are according to EIB (2014, p. 10) driven by both, demand-side and supply-side factors.

Figure 6. Credit growth in the euro area, 2005 September 2016 (year-on-year)
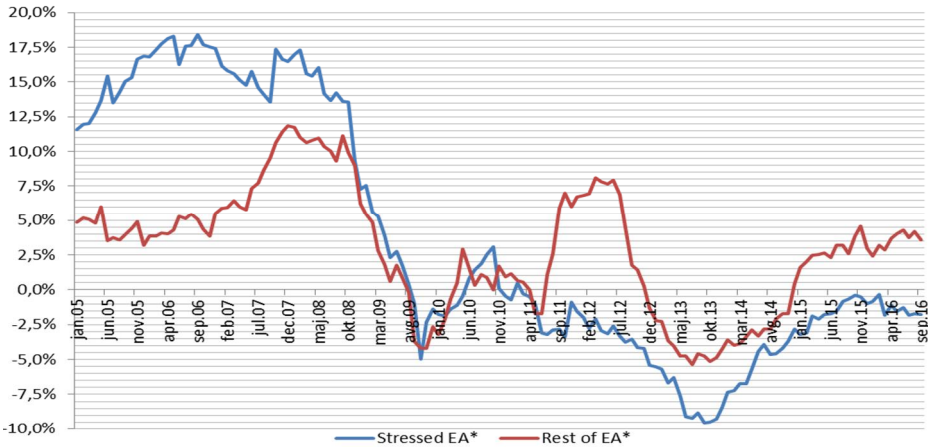
Note. *Stressed EA include: Cyprus, Greece, Ireland, Italy, Portugal and Spain. Rest of EA include other euro area countries except stressed EA. The definition of the accounting rules concerning the balance sheet of the monetary financial institutions sector and therefore reporting loans is provided in the Appendix B.

Source: ECB (n.d.)*, Aggregated balance sheet of euro area monetary financial institutions,* Own calculation.

4 EMPIRICAL EVIDENCE OF THE EURO AREA BANKS

4.1 Background of the study

What is the effect of quantitative easing monetary policy conducted by ECB on bank lending in the euro area? The main question of this study where the answer and results to it will provide an insight to whether the transmission of quantitative easing have worked also through bank lending channel in the euro area. Banks as a financial intermediaries play an important role with their transformational process (i.e. collecting deposits and converting them to loans) in the economy. The main idea is to provide answer if quantitative easing by influencing banksø balance sheets (i.e. increasing liquidity and deposits) have operated through bank lending channel. Moreover, it is to provide answer to some of the critiques that quantitative easing programme is less suitable for the euro area.

In a certain way, this study uses a novel approach to assess the impact of quantitative easing monetary policy on bank lending. By implying empirical research to the collected data the attempt is to see whether variation in liquidity and deposits causes variation in lending, more specifically if quantitative easing by increasing on one hand liquidity in the banks and on the other hand deposits increased lending. Other authors (Bowman et al., 2011, Joyce & Spaltro, 2014, Butt et al. 2014) focused only on either one of it (e.g. if quantitative easing helped increasing lending by increasing liquidity or if quantitative easing helped increasing deposits which resulted in higher loan growth). The logic behind this study is to some extent following certain research papers to correctly design econometric model. Accordingly, the estimation used is panel data regressions while controlling for heteroscedasticity, endogeneity problem and multicollinearity.

4.2 Structural model and hypotheses

After an in-depth review of theoretical literature, the following chapter presents the structural model of determinants affecting bank lending while controlling for the effect of quantitative easing monetary policy. As can be seen from Figure 7 bank lending is driven by both bank specific and macroeconomic factors as well as monetary policies conducted by central bank.

Figure 7. Structural model of the determinants affecting bank lending

Through transmission channels of quantitative easing (see Figure 4)
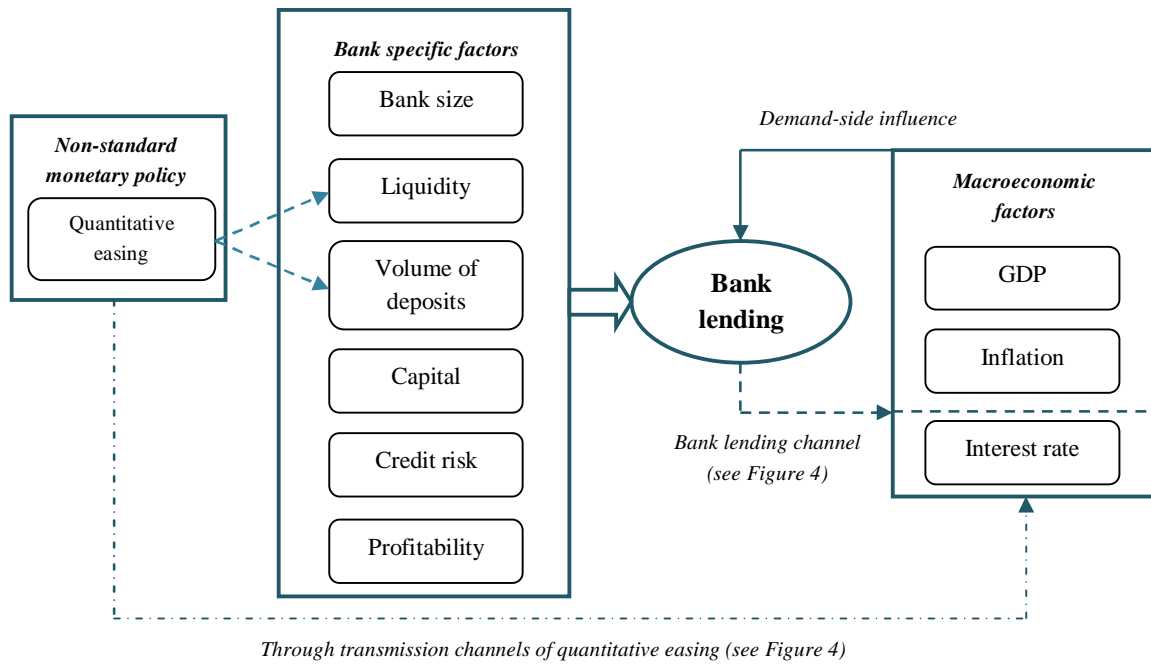
According to the structural model and theoretical review of the literature, the following hypotheses are built and will be tested to answer the main question of the thesis:

Hypothesis 1: Bank lending deteriorated during the global financial crisis (in the period from 2008 to 2010) and prior to the implementation of non-standard monetary policies in 2014 in the euro area. Lending deteriorated mainly due to a decrease in liquidity in the banks and consequently an increase in non-performing loans.

The banking panic of 2008 caused a significant decrease in bank lending where it eventually hit the negative territory (see Figure 6). Banks in the euro area were faced with liquidity shortages in the periods of financial stress as well did the increase in non-performing loans dampen banksø potential lending capacity (ECB, 2015b). ECB tried to address bank funding conditions by implementing several measures; however, there was no guarantee that banks will pass this additional liquidity to real economy (Durante, 2014). Moreover, banks have in this period made significant effort to shrink their assets (mainly by cutting back loans) in order to boost their capital ratios. The risk of new lending was also caused by soaring NPL ratios, which have a significant negative impact on loan growth, since NPLs affect lending by increasing asymmetric information and also uncertainty about asset quality and capitalization (EIB, 2014). Therefore, first hypothesis will show whether shortage of liquidity and an increase in non-performing loans were the causes of low and even negative loan growth. This will show whether it was correct to address liquidity of the banking sector with additional non-standard monetary policy measures.

Hypothesis 2: Quantitative easing increased bank lending in the euro area due to an increase in liquidity.

Central banks, especially ECB, implemented quantitative easing to address shortage of liquidity in the banking sector. Previous non-standard measures could not generate sufficient quantity of liquidity in the system. The second hypothesis will test whether quantitative easing by buying securities directly from the banking sector increased liquidity in the banks (see Figure 1). As pointed out by Joyce and Spaltro (2014, p. 7) buying securities from banks constitute and exchange of securities for reserves. As a result, reserves are higher and the so-called narrow money increases (i.e. monetary base or currency in circulation plus reserves held at the central bank). By imposing negative interest rate on the reserves in excess of the minimum reserve requirements ECB tried to force banks to increase lending. The second hypothesis will accordingly test if an excess liquidity caused by quantitative easing in 2015 increased bank lending in the euro area.

Hypothesis 3: Quantitative easing increased bank lending in the euro area due to an increase in volume of deposits.

On the other hand, assets can be bought from non-banking sector as well. Since non-banking sector cannot be paid in reserves (i.e. reserves are only held by banks), they are paid in deposits by their correspondent bank (see Figure 2). An increase in deposit base by corresponding bank makes more funds available for a bank to lend because the primary function of a bank is to transform deposits into loans. Therefore, the third hypothesis will test if quantitative easing by purchasing assets from non-banking sector caused an increase in volume of deposits by banks that could in turn lead to an increase in loan growth in 2015.

To sum up, the second and the third hypothesis will test whether quantitative easing has made a bank's balance sheet more liquid on the assets side and increased deposits on the liability side in 2015. Joyce and Spaltro (2014, p. 8) affirm that higher level of liquid assets, which could result in above required to meet payment demands from customers, may be less costly for the bank to use these funds and increase lending to the real economy.

Hypothesis 4: Due to quantitative easing bank lending was higher of the banks located in Germany, France, Italy and Spain than banks of other euro area countries in 2015.

The design of quantitative easing is such that the allocation of monthly asset purchases has been split between all euro area countries according to the ECB capital keys. On January 1, 2015 (date of the last update) Deutsche Bundesbank (Germany), Banque de France (France), Banca d Italia (Italy) and Banco de Espana (Spain) have the highest capital keys (see Table 3). As a result, loan growth due to increased liquidity and deposits should be

higher for the banks located in these countries. Accordingly, the last hypothesis will test the special design of quantitative easing programme, which was also under critique.

Table 3. Euro area NCBs capital keys

National Central Bank (Country)	Capital key (in %)*
Deutsche Bundesbank (Germany)	17.9973
Banque de France (France)	14.1792
Banca d Italia (Italy)	12.3108
Banco de Espana (Spain)	8.8409
De Nederlandsche Bank (The Netherlands)	4.0035
Banque Nationale de Belgique (Belgium)	2.4778
Bank of Greece (Greece)	2.0332
Oesterreichische NationalBank (Austria)	1.9631
Banco de Portugal (Portugal)	1.7434
Suomen Pankki ó Finlands Bank (Finland)	1.2564
Central Bank of Ireland (Ireland)	1.1607

Note. *The NCBsø shares in the capital of the ECB (comes from the NCBs of all EU Member States) are calculated using a key which reflects the respective countryøs share in the total population and gross domestic product of the EU. ** Other NCBs of the euro area have the capital key less than 1 % (i.e. Eesti Pank Estonia, Central Bank of Cyprus, Latvijas Bank Latvia, Lietuvos bankas Lithuania, Banque de Centrale Luxembourg, Central Bank of Malta, Banka Slovenije Slovenia, Narodna Banka Slovenska Slovakia).

Source: ECB (n.d.), *Capital subscription.*

4.3 Sample and data description

To be able to answer the main question of the thesis on how quantitative easing affects bank lending, the data of banks located in the euro area are taken. To get the most representative sample of banks the list of supervised entities under single supervisory mechanism (hereinafter: SSM) regulation is taken; more specifically the list of significant supervised entities is used. These are the banks under direct supervision of ECB and the types of supervised banks refer to credit institutions, financial holding companies, mixed financial holding companies and branches of credit institutions established in non-participating Member States. SSM Framework regulation (ECB/2014/17) states that the significance is determined on the basis of the size criterion (total assets exceeds þ30 billion), on the basis of national economic importance (total assets above 20% of GDP), on the basis of significance of cross-border assets or if the entity is among the three most significant credit institutions in a participating country. The update of the list was made on November 15, 2016 where the number of significant supervised entities is equal to 127.

The financial data of the banks are collected on an annual basis covering the period from 2008 and 2015 (the latest financial information). These bank specific data are obtained from BankScope database whereas data for macroeconomic factors affecting loan growth

are obtained from World Bank database and ECB Statistical Data Warehouse. The data are in euros and only those that report under international reporting financial standards are used in order to ensure comparability and consistency between banks. As a result, 12 banks that report under local generally accepted accounting principles (GAAP) are excluded from the sample. Furthermore, for 13 banks the data are not available in the Bankscope database, while for one bank in Austria the data are only available for 2015 and one bank in Portugal was established on August 4, 2014 as a split of one bank and the data are again available only for 2015. Bearing in mind these corrections the final sample consists of 100 banks. The detailed information on the sample of banks can be found in the Appendix C.

Moreover, bank specific data are collected on a consolidated basis. First, ECB conducts supervision on a consolidated basis. Joyce and Spaltro (2014, p. 8) also use data on a consolidation level since they assume that lending decisions are taken on a group-level. According to them, the use of lower level of consolidation would assume that subsidiaries act in isolation and that liquidity cannot be transferred within groups. Therefore, a consolidation level should better reflect the relationship between bank lending and liquidity when considering complex banking groups. Additionally, Houston, James & Marcus (1997, pp. 137ó138) show that loan growth of a subsidiary is more sensitive to the holding companyøs cash flow and capital than to its own and that loan growth is negatively correlated with loan growth among other subsidiaries within the banking group. Accordingly, shocks to one subsidiary are partially transmitted to others in a complex banking group so the consolidation level is used.

4.4 Empirical estimation

Following the empirical specification of Bowman et al. (2011) and Joyce and Spaltro (2014) the relationship between loan growth, liquidity and deposits is designed while controlling for other bank specific and macroeconomic factors. The empirical model is designed to explain the response of lending growth to changes in liquidity and deposits. This study analyses panel dataset. Since bank specific data are observed different numbers of years, an unbalanced panel dataset is observed. According to Greene (2012, pp. 386ó 387) there are several techniques that can be applied to analyse panel data; usually fixed effects or random effects model are applied. To decide between fixed or random effects a Hausman test is applied where under null hypothesis the random effects is preferred and under the alternative the fixed effects. The p-value from the Hausman test applied to the dataset indicates that the null hypothesis cannot be rejected therefore random effects model should be used rather than fixed effects. Moreover, to decide between a random effects and a simple ordinary least square regression a Breusch-Pagan Lagrange multiplier test is applied. According to this test, an ordinary least square regression is inappropriate for this data set; the null hypothesis is therefore rejected in favour of random effects model. To control for heterogeneity the random effects model with robust standard errors is used. The baseline estimating equation (2) is:

$$\hat{e}\, lnGL_{i,t} = \alpha_i + \beta_1 LR_{i,t} + \beta_2 DEP_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CAP_{i,t} + \beta_5 NPL_{i,t} + \beta_6 ROAA_{i,t} +$$
$$\beta_7 GDP_t + \beta_8 INF_t + \beta_9 IR_t + u_i + \varepsilon_{i,t} \qquad (2)$$

where variables are:

- α is the intercept and β are coefficients
- $\hat{e}\, lnGL_{i,t}$ is the growth rate of the logarithm of gross loans of a bank i at time t
- LR denotes the liquidity ratio of a bank i at time t
- DEP represents the share of deposits (or TCD the share of customer deposits) over total assets of a bank i at time t
- SIZE denotes a log of total assets as a proxy for the size of a bank i at time t
- CAP denotes the capital-to-assets ratio of a bank i at time t
- NPL is a proxy for credit risk of a bank i at time t and presents the non-performing loans over total gross loans for a bank i at time t
- ROAA is a proxy measure of profitability and denotes a return on average assets of a bank i at time t
- GDP is a growth rate of gross domestic product at time t
- INF denotes inflation rate at time t
- IR is an interest rate at time t
- u_i is the random heterogeneity specific to the i-th observation and is constant through time
- ε_{it} is an idiosyncratic error term where $\varepsilon_{it} \sim IDD(0, \sigma^2)$
- i = 1, 2, í , N, where N is the number of banks in the sample
- t = 1, 2, í , T_i, where T_i is the number of years in the sample for bank i

Detailed information, definition and the source of variables can be found in Appendix D. It includes also bank type variables in order to be able to perform robustness check according to the specialization of banks in the sample.

The baseline estimating equation will be tested gradually. First model will include bank specific factors except profitability. These are liquidity ratio, deposit ratio, size, capitalization and non-performing loans. Profitability is in the first model excluded due to causality problem, since it can be both, either higher loan growth improves profitability or profitability helps improving loan growth. Second model will include all bank specific factors including profitability. Third model will add the first macroeconomic factor GDP as a proxy for the demand side affecting lending and fourth model will add all macroeconomic factors. The exclusion of the macroeconomic factors from the first two models is to control only for the supply side factors, while then gradually adding demand side factors.

4.5 Descriptive statistics of the data

Table 4 presents summary statistics of the variables for the total sample of banks over the entire period (2008 ó 2015). First and second panel of the table show descriptive statistics for the bank specific variables. Average value of gross loans equals to þ100,051 million, which amounts to a little less than half of the total assets for the average-sized bank (46%). The minimum value of gross loans has a bank, which is specialized in clearing and custody. The lowest amount of gross loans belonging to the 10th percentile is observed for banks that are also according to size classified as small. Non-performing loans representing a measure for credit risk equal to þ7,356 million, which equals to less than 10% of the total gross loans. The average value of total assets as a proxy for the size of a bank amounts to þ219,786 million; however the size varies substantially where for the smallest bank assets amount to þ1,391 million and for the biggest bank in the sample assets equal to þ2,202,423 million. As the size of the banks in the sample differs significantly, it is necessary to take into account the size effect when conducting further analysis. Average value of liquid assets equals to þ52,774 million, which accounts for the average liquidity ratio of 18.3%. Liquidity ratio of the banks in the sample also varies significantly from lowest 1.1% to highest 75.4%. Average value of equity amounts to þ9,842 million; moreover, in the period 2011 ó 2013 several banks experienced negative equity. This is the period when euro area was hit by sovereign debt crisis. Banks reporting negative equity are located in Cyprus and Greece. Average value of capital-to-assets ratio (capitalization) equals to approximately 6.5%. Average value of net income amounts to approximately þ187 million. Negative net income banks experienced at the beginning of the global financial crisis in the period from 2008 to 2010 and in the period of euro area sovereign debt crisis. However, some banks even in 2014 and 2015 could not manage to generate enough revenue to cover high loan loss provisions. These are the banks mainly from Cyprus, Greece and Italy.

The third panel includes demand-side factors affecting bank lending. The average value of GDP growth equals to 0.2%, being the lowest in 2009 for Estonia, Latvia and Lithuania while the highest of 26% for Ireland in 2015. This GDP growth is driven by companies inverting to Ireland in 2015 due to low tax rate, mostly through acquisitions and is more of an exception since the previous estimation equalled to 7.8%. The average inflation rate is roughly 1.6% while the average interest rate equals to approximately 3.9%. Interest rates have fallen significantly since the onset of the financial crisis.

To control for the effect of bank specialization, bank type variable is included in the fourth panel of the Table 4. The specialization of the bank was taken directly from the BankScope database and it turns out that banks from the sample specialize in eight different bank types. The largest share (roughly 55.6%) belongs to commercial banks, followed by cooperative banks (12.9%). The lowest share goes to clearing and custody institution where only one such bank was detected; followed by finance company where two such

banks were detected. The specialization of the banks is also taken into account when conducting further analysis.

Table 4. Summary statistics of the total sample observations for the entire period

Variables	No of observ.	Mean	Std. dev.	Min	Max
Bank specific variables					
Gross loans (þ million)	756	100,051.5	149,499.0	332.2	785,022.0
Liquid assets (þ million)	756	52,773.8	122,468.8	84.7	1,017,683.0
Deposits (þ million)	756	118,241.0	192,713.5	3.3	1,211,748.0
Total customer deposits (þ million)	756	75,366.3	126,999.6	1.5	695,116.0
Total assets (þ million)	756	219,786.4	387,861.3	1,391.1	2,202,423.0
Equity (þ million)	756	9,841.7	16,470.4	-3,955.0	98,539.0
Non-performing loans (þ million)	676	7,355.8	11,297.1	10.4	80,005.2
Net income (þ million)	756	186.9	2,044.9	-21,238.5	9,412.1
Bank specific variables from regression equation					
ê lnGL	756	0.0017194	0.0253256	-0.2686415	0.3202049
LR	756	0.1831377	0.1385226	0.0108456	0.7543745
DEP	756	0.6352080	0.1864524	0.0000921	0.9875583
TCD	756	0.4390647	0.2146029	0.0000480	0.9831128
SIZE (lnTA)	756	11.1335700	1.6070560	7.2378500	14.6050700
CAP	756	0.0647388	0.0380169	-0.0545020	0.2526194
NPL	676	0.0915139	0.0975114	0.0004210	0.5940753
ROAA	756	0.0000669	0.0166299	-0.1330394	0.0641470
Macroeconomic variables					
GDP growth	756	0.0023883	0.0372458	-0.1481416	0.2627606
Inflation rate	756	0.0159741	0.0184161	-0.0447994	0.1543052
Interest rate	756	0.0391461	0.0105146	0.0186091	0.0688500
Bank type (specialization) variables					
Bank holdings dummy	756	0.0925926	0.2900526	0	1
Commercial bank dummy	756	0.5555556	0.4972330	0	1
Savings bank dummy	756	0.0674603	0.2509836	0	1
Cooperative bank dummy	756	0.1296296	0.3361179	0	1
Real estate and mortgage bank dummy	756	0.0211640	0.1440262	0	1
Specialized governmental credit institution dummy	756	0.1097884	0.3128327	0	1
Finance company dummy	756	0.0132275	0.1143234	0	1
Clearing and custody institution dummy	756	0.0105820	0.1023909	0	1

Table 5 shows correlations (i.e. degree of relationship) between main variables. The deposit ratio and non-performing loans are significantly negatively correlated with the loan growth while profitability (measured as ROAA), GDP and inflation rate are positively correlated with loan growth. The significantly negative relationship can be seen also between deposit ratio and liquidity ratio while the size and profitability are positively correlated with liquidity. Capitalization is significantly negatively correlated with liquidity ratio and size whereas positively correlated with deposit ratio. Non-performing loans are significantly negatively correlated with size and positively correlated with deposit ratio and capitalization. Furthermore, profitability is also negatively correlated with non-performing loans and deposit ratio. On the other hand, interest rate is significantly positively correlated with inflation rate while negatively correlated with liquidity ratio, size, profitability and GDP. Although not statistically significant, the correlation between liquidity ratio and loan growth is negative.

Table 5. Correlation matrix of the main variables

Variables	ê lnGL	LR	DEP	SIZE	CAP	NPL	ROAA	GDP	INF	IR
ê lnGL	1									
LR	-0.018	1								
DEP	-0.081*	-0.125**	1							
SIZE	-0.004	0.118**	-0.427**	1						
CAP	-0.006	-0.146**	0.151**	-0.505**	1					
NPL	-0.226**	-0.186**	0.311**	-0.250**	0.222**	1				
ROAA	0.145**	0.114**	-0.118**	-0.008	0.253**	-0.436**	1			
GDP	0.093*	0.087*	-0.003	-0.040	0.207**	-0.056	0.331**	1		
INF	0.098**	-0.008	-0.003	-0.131**	-0.058	-0.260**	0.039	-0.045	1	
IR	0.039	-0.153**	0.032	-0.097**	-0.033	0.056	-0.144**	-0.234**	0.461**	1

Note. Superscripts * and ** indicate significance level of 0.05 and 0.01 respectively.

Appendix E contains table showing average bank features by country for the entire period (2008–2015). The difference between the countries is also substantial. Loan growth is the lowest and even negative on average for Estonia and highest for Malta. The liquidity ratio goes from lowest 7.7% on average for banks in Spain to highest 33.2% on average for banks in Luxembourg. The lowest deposit ratios have banks in France where majority of them could be classified as big banks dealing with derivatives and trading liabilities. The highest deposit ratios on the other hand have banks located in Cyprus where two out of three are commercial banks and one is cooperative bank. The size of the bank differs substantially not only among banks in the sample but also among countries where these banks are located. The smallest banks in the sample are located in Latvia, Lithuania, Malta and Slovenia while the biggest are located in France, Germany, The Netherlands and Spain. These are the countries that are also large compared to gross domestic product. The

highest NPL ratios have banks in Cyprus, Greece, Ireland and Slovenia. The capital-to-assets ratio is the highest for a bank in Estonia while the lowest for banks in the Netherlands. The difference among countries is taken into account when conducting robustness check. In Appendix F density plots of the main bank specific variables can be found.

4.6 Results

The following chapter reports the results of the baseline regression using random effects model with robust standard error. Table 6 presents the results for the first hypothesis for the entire sample for the period between 2008 and 2013 and according to all four models.

Table 6. Estimation results: entire sample and period between 2008 and 2013

| Variables | Equation 2 | | | |
	First model	Second model	Third model	Fourth model
Intercept	0.0011607	0.0069458	0.0074698	-0.0087821
LR	-0.0146606**	-0.0183820***	-0.0195900***	-0.0154555**
DEP	0.0057232	0.0046206	0.0048355	0.0047069
SIZE	0.0002016	-0.0000993	-0.0001034	0.0002778
CAP	0.0153193	-0.0372460	-0.0408797	-0.0335476
NPL	-0.0499612***	-0.0211457*	-0.0216495*	-0.0111876
ROAA		0.2099524***	0.1879306***	0.2012757***
GDP			0.0329989	0.0352790
INF				0.0295573
IR				0.2206275***

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

The liquidity ratio has statistically significant negative coefficient for all models indicating that the liquidity in the period of financial crisis and prior the implementation of non-standard monetary policy negatively affected loan growth. In other words, for 1 percentage point increase in liquidity ratio, loan growth decreased roughly by 0.015 percentage points looking at the last model. On the other hand, NPL ratio is not statistically significant for all models. The last model implies that non-performing loans were not the cause of low and negative loan growth in the period 2008 and 2013. Nevertheless, first three models say the opposite, since the coefficients are statistically significant, indicating that for 1 percentage point increase in non-performing loans, loan growth decreased approximately by 0.05 percentage points in the first model or 0.02 percentage points in the second and third model. Additionally, profitability ratio (measured as ROAA) has statistically significantly positive coefficient indicating that profitability had a positive influence on loan growth during the financial crisis and prior the implementation of non-standard monetary policy. The positive impact of profitability on loan growth is therefore consistent with the theory.

Adding macroeconomic factor, only the interest rate coefficient is statistically significantly positive implying that the interest rate was positively related with bank lending in the period from 2008 and 2013. Interest rates have fallen since the onset of the global financial crisis and the fall helped boosting loan growth, since lower interest rate means lower cost of borrowing for companies and households. All other coefficients are not statistically significant. Therefore, the first hypothesis that both liquidity and non-performing loans were the causes of low and negative loan growth does not hold entirely when using the last, fourth model. However, the other ones indicate that both liquidity and non-performing loans did negatively influenced bank lending in the period 2008 and 2013, which resulted in low and negative loan growth. Figure 8 shows how non-performing loans ratio has started to increase from 2008 and in 2015 the average value of it slightly declined. The opposite happened to the average value of liquidity ratio. Since 2008, it slightly decreased while in 2015 it slightly increased.

Figure 8. Box plot of liquidity ratio and non-performing loans ratio for the entire sample and from 2008 to 2015
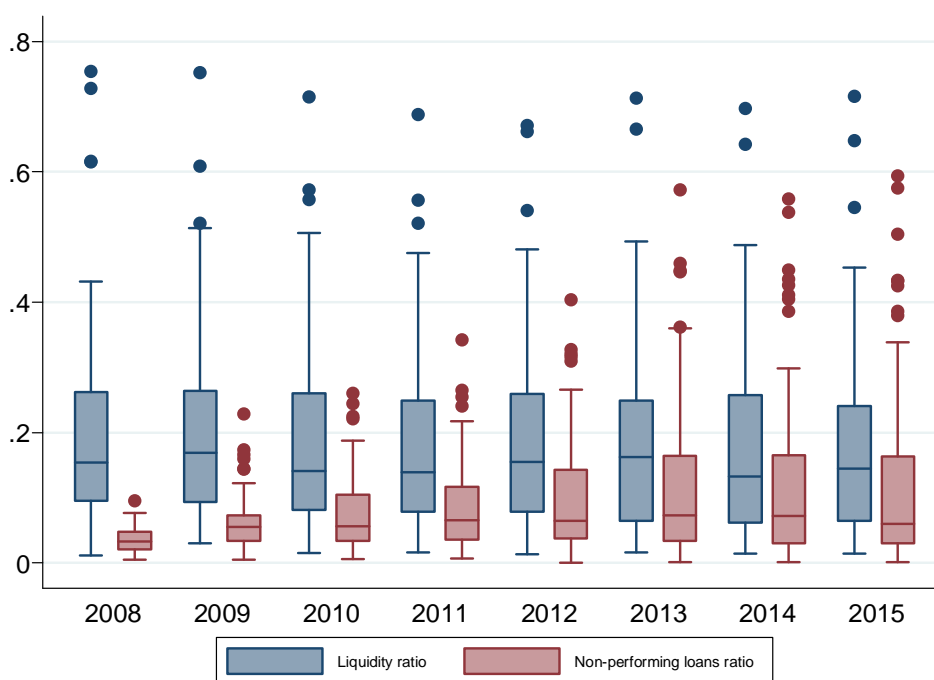
Table 7 presents the results for the period of quantitative easing (i.e. year 2015) for the entire sample. Both, liquidity ratio and deposit ratio through which quantitative easing should impact loan growth (see Figure 7), are not statistically significant for all the models. This implies that even if quantitative easing increased liquidity and increased deposits in the banks it was not correlated with higher bank lending at least in the first year of its operation. Moreover, quantitative easing did not work through bank lending channel in the euro area in the first year of its operation and looking for the entire sample. Nevertheless, capitalization negatively affected bank lending indicating that if capitalization increased by

1 percentage point, loan growth decreased approximately by 0.08 percentage points looking at the last model. On the other hand, profitability also in 2015 positively affected loan growth in the period of quantitative easing; indicating that for 1 percentage point increase in profitability, loan growth increased by roughly 0.34 percentage points for the fourth model. Moreover, GDP growth and inflation rate negatively affected loan growth, saying that macroeconomic environment in the euro area did not improve in such way to help banks granting new loans.

Table 7. Estimation results: entire sample and the period of quantitative easing (year 2015)

Variables	Equation 2			
	First model	Second model	Third model	Fourth model
Intercept	0.0128211	0.0135324	0.0109906	0.0145894
LR	-0.0026927	-0.0039624	-0.0065249	-0.0067256
DEP	0.0002943	0.0000121	0.0014560	0.0005154
SIZE	-0.0006227	-0.0006298	-0.0004375	-0.0006143
CAP	-0.0419996	-0.0716069	-0.0591028*	-0.0782305**
NPL	-0.0189302**	-0.0067974	-0.0049293	-0.0164745
ROAA		0.2419351	0.3170108**	0.3414588**
GDP			-0.0519816***	-0.0514179***
INF				-0.3363517*
IR				0.0578274

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

Further analysis of liquidity in the banks show that liquid assets increased by about 10.3% on average for the entire sample from 2014 to 2015. This implies that even though liquidity increased in the banks, banks did not pass this additional liquidity to the economy through loans. Banks might have rather kept this additional liquidity to meet certain liquidity requirements (such as the ones under Basel III regulatory framework, e.g. Liquidity Coverage Ratio). Moreover, total deposits increased roughly by 3.1% on average for the entire sample from 2014 to 2015, indicating that non-banking sector used funds obtained from the sale of securities for certain investments. This might be because interest rates on deposit for all maturities have fallen significantly, which in turn means that deposits do not generate sufficient return to deposit money in the banks. Figure 9 presents the evolution of liquidity ratio and deposit ratio in the period between 2008 and 2015. The graph also shows slight increase in average value of both ratios from 2014 to 2015; however, this increase did not reflect in higher bank lending.

Figure 9. Box plot of liquidity ratio and deposit ratio for the entire sample and from 2008 to 2015
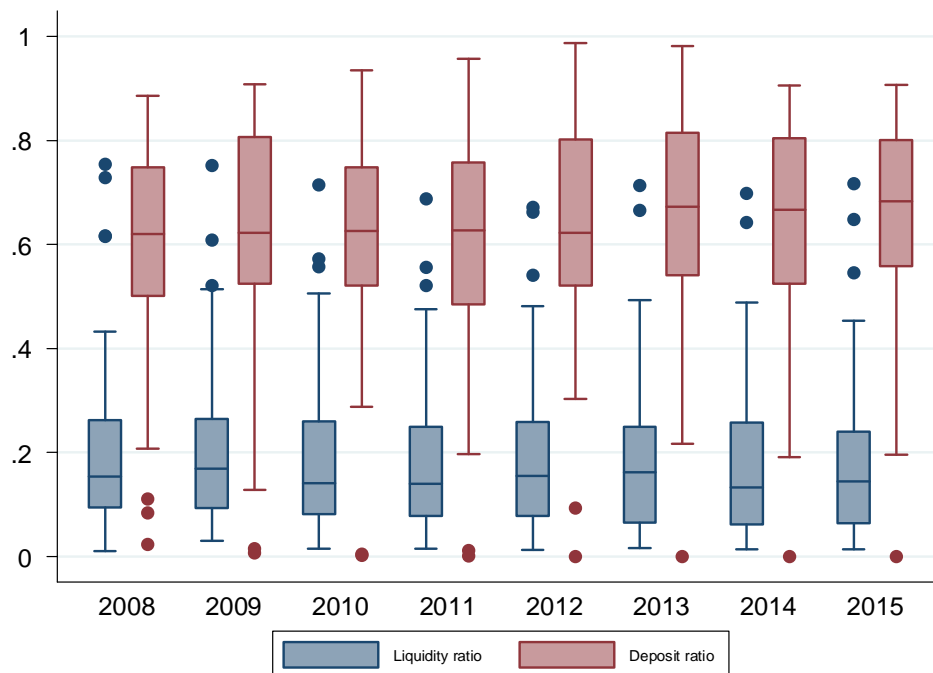
Moreover, to see the impact of quantitative easing on loan growth through deposits, the test is conducted using only total customer deposits and excluding interbank deposits from the total deposits. Quantitative easing by buying financial assets from non-banking sector influences bankøs balance sheet by increasing volume of non-bank or customer deposits. The results, which can be found in Table 8, did not change substantially.

Table 8. Estimation results: entire sample and the period of quantitative easing (year 2015) using total customer deposits

Variables	Equation 2			
	First model	Second model	Third model	Fourth model
Intercept	0.0108984	0.0133723	0.0111014	0.0140942
LR	-0.0023617	-0.0039329	-0.0062042	-0.0065304
TCD	0.0023035	0.0001768	0.0014514	0.0010767
SIZE	-0.0005214	-0.0006216	-0.0004259	-0.0005822
CAP	-0.0445697	-0.0716996	-0.0594206*	-0.0785693**
NPL	-0.0190652**	-0.0068548	-0.0049827	-0.0166592
ROAA		0.2410511	0.3104993**	0.3364589**
GDP			-0.0520282***	-0.0515612***
INF				-0.3364355*
IR				0.0568988

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

Figure 10. Box plot of liquidity ratio and total customer deposit ratio for the entire sample and from 2008 to 2015
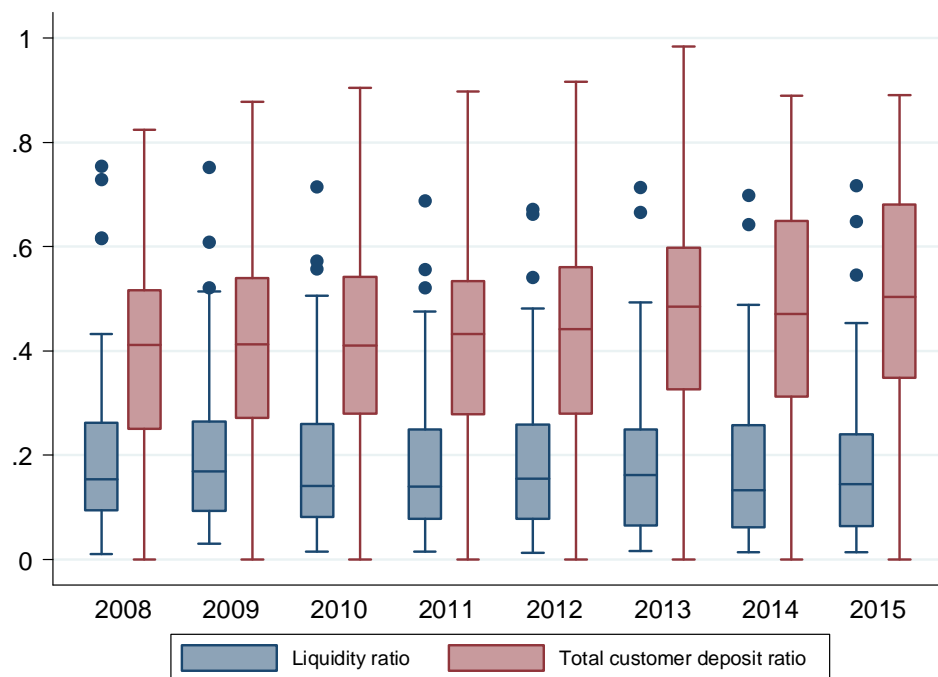
Even though the coefficient for total customer deposits over total assets is positive, it is insignificant and its effect cannot be associated with higher loan growth in 2015 in the euro area. Figure 10 shows a growth in average total customer deposit ratio in the entire period. Looking into details of the data, total customer deposits grew by approximately 4.4% in the quantitative easing period (i.e. from 2014 to 2015). From here onwards, only total customer deposits ratio is used when testing for the effect of quantitative easing on bank lending through deposits. To control and check for the effect of capital adequacy on lending, the use of tier 1 capital ratio is used instead of capitalization. Tier 1 capital is the core measure of the financial strength of a bank and is composed of the core capital. Likewise, the switch is made also between the measures of bank profitability. The return on average equity (hereinafter: ROAE) is used instead of return on average assets. This is because return on average equity shows how the investments are generating income while return on average assets measures the use of assets to generate income. This is tested for the entire sample and quantitative easing period where the results can be found in Table 9. The results do not differ substantially looking for the liquidity and deposit ratios, the coefficients are still insignificant. As in the original case, tier 1 ratio negatively, while ROAE positively affected loan growth in 2015. The difference is seen in the non-performing loans ratio since it becomes statistically negatively significant. Banks have been burdened by bad loans which inhibit the potential of granting new loans. The impact of the macroeconomic environment is the same as in the original model. Because there are

no major changes in the results, the use of ROAA and the use of capital-to-assets ratio are used further on.

Table 9. Estimation results: entire sample and the period of quantitative easing (year 2015) using tier 1 capital ratio and return on average equity

Variables	Equation 2			
	First model	Second model	Third model	Fourth model
Intercept	0.0002450	0.0030202	0.0006343	0.0068147
LR	0.0008421	-0.0001225	-0.0027776	-0.0017270
TCD	0.0026256	-0.0003953	0.0019780	0.0008756
SIZE	0.0003165	0.0001269	0.0002839	0.0001056
TIER1	-0.0214712	-0.0286198	-0.0214335	-0.0345703**
NPL	-0.0188217**	-0.0071733	-0.0057180	-0.0216406*
ROAE		0.0236732*	0.0269391**	0.0271605**
GDP			-0.0523803**	-0.0485694**
INF				-0.4547217***
IR				0.0139313

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

Table 10 shows results for the subsamples of banks located in those countries where national central banks contribute the most in the capital of ECB. Because the allocation of monthly assets purchases has been split among euro area countries according to capital keys, it is expected that the impact of quantitative easing on bank lending would be larger for countries with national central banks contributing the most in the capital of ECB. For the purpose of brevity, only the results under fourth model, which includes all variables, are presented. The results under first three models do not differ substantially and are similar to the results under fourth model.

For the banks located in core countries, only non-performing loans ratio is statistically significant coefficient. It is negative, saying that for 1 percentage point increase in non-performing loans ratio, loan growth decreased approximately by 0.04 percentage points in 2015. For the banks located in the periphery, liquidity ratio negatively affected bank lending in 2015, while total customer deposits coefficient is positively significant. The data indicate that it was actually the opposite and quantitative easing impact can be seen on banksø balance sheets in periphery countries and not the core countries. Quantitative easing is correlated with an increase in total customer deposits in banks located in periphery countries, which then helped increase bank lending in these countries. For banks in the periphery, there are also capitalization, profitability, GDP growth and inflation rate that are statistically significant and are consequently associated with loan growth in 2015. Capitalization of the banks in periphery countries negatively affected loan growth in 2015, while profitability did the opposite and affected loan growth positively. For 1 percentage

point increase in capitalization, loan growth decreased roughly by 0.13 percentage points, and for 1 percentage point increase in profitability, bank lending increased approximately by 0.41 percentage points in 2015. The macroeconomic environment in periphery countries (GDP and inflation rate) negatively affected bank lending.

Table 10. Estimation results for the core and periphery countries: the period of quantitative easing (year 2015)

	Equation 2	
Variables	Core	Periphery:
Intercept	-0.0182915	0.0270322
	(0.517)	*(0.213)*
LR	-0.0018179	-0.0237452*
	(0.842)	*(0.060)*
TCD	-0.0085686	0.0100836*
	(0.244)	*(0.100)*
SIZE	0.0008420	-0.0016057
	(0.356)	*(0.261)*
CAP	0.0072406	-0.1259155***
	(0.912)	*(0.003)*
NPL	-0.0379291**	-0.0184465
	(0.032)	*(0.180)*
ROAA	0.1006773	0.4084461**
	(0.386)	*(0.019)*
GDP	-0.0827791	-0.0452428**
	(0.837)	*(0.021)*
INF	-0.4367218	-0.4744131*
	(0.738)	*(0.053)*
IR	0.7775267	0.0080966
	(0.339)	*(0.971)*

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively. Core denotes banks located in Germany, France, Italy and Spain, while Periphery denotes all other banks. In parentheses and italics the p-values are provided.

Looking more into details, the liquid assets of the banks located in core countries increased by 4.8% on average from 2014 to 2015. However, this increase in liquid assets was not correlated with higher loan growth in 2015 in the core countries. Even though total customer deposits of the banks in core countries increased (by 5.7% on average from 2014 to 2015); the same conclusion can be made as with the liquidity ratio since the coefficient is again insignificant. Looking for the liquidity and deposits for the periphery countries, the coefficients are statistically significantly negative and statistically significantly positive respectively; indicating that liquidity negatively affected loan growth in the periphery countries while deposits positively affected loan growth. In other words, for 1 percentage point increase in liquidity ratio, loan growth decreased approximately by 0.02 percentage

points and for 1 percentage point increase in total customer deposit ratio, loan growth increased approximately by 0.01 percentage points in the periphery countries. Although liquid assets of the banks in the periphery countries increased (on average by 15.6% from 2014 to 2015), most of the additional liquidity was not used to grant loans or is not associated with higher bank lending in these countries. Total customer deposits increased as well (by 3.1% on average from 2014 to 2015) and this increase was correlated with higher bank lending in 2015 in the periphery countries. Figure 11 shows the graphical presentation of liquidity ratio and total customer deposit ratio of banks split between core and periphery countries. The average liquidity ratio and total deposit ratio of banks located in periphery countries both increased, while the average liquidity ratio of banks in core countries decreased and total customer deposit ratio increased from 2014 to 2015.

Figure 11. Box plot of liquidity ratio and total customer deposit ratio for the core and periphery countries; period from 2008 to 2015
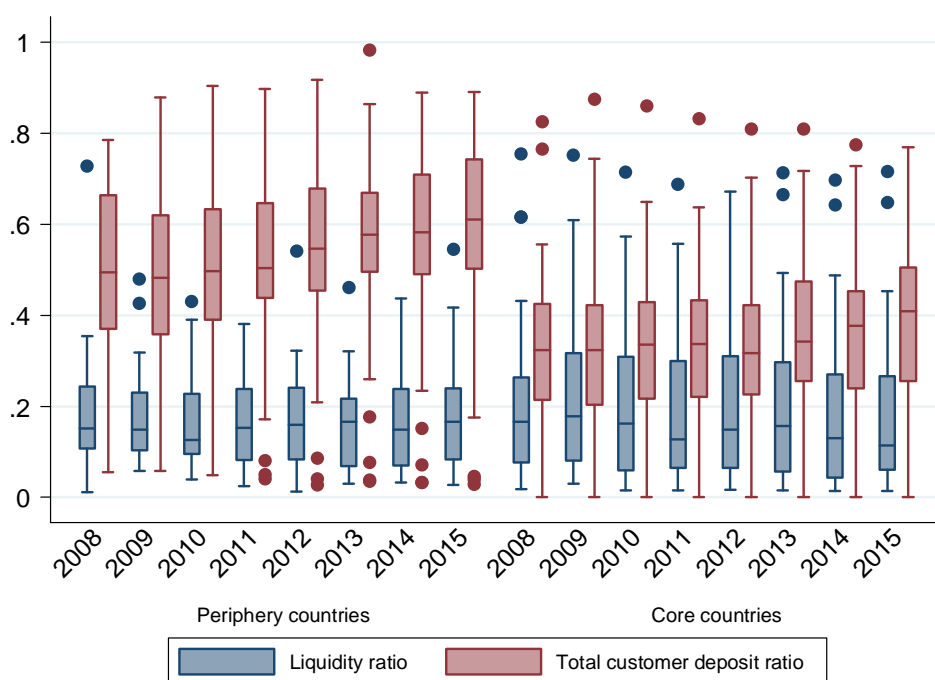
4.7 Endogeneity problem

A possible limitation to the estimation of how did quantitative easing affect loan growth in the first year of its operation is that the situation in the banking sector can as well influence macroeconomic environment and consequently monetary policy decisions. Moreover, banks may acquire additional liquidity beforehand if they intend to increase lending. On the other hand, banks may collect deposits only after they have identified lending opportunities (Bowman et al., 2011, p. 7; Gambacorta & Marques-Ibanez, 2011, p. 160; Joyce & Spaltro, 2014, p. 15). To mitigate this potential problem and correct for potential biases related to endogeneity of the dependent variable the estimation of the baseline

model is additionally tested using the dynamic panel data model tested with Generalized Method of Moments (hereinafter: GMM) estimator, similar to the technique used by Gambacorta and Marques-Ibanez. The dynamic panel data model is tested using the GMM procedure developed by Arellano and Bond (1991, p. 278) since their technique is used to control endogeneity problem in panel data with small T and large N. Moreover, it was further developed by Blundell and Bond (1998, p. 116). The model is the following:

$$\hat{e}\, lnGL_{i,t} = {}_{i} + {}_{1}\hat{e}\, lnGL_{i,t-1} + {}_{2}\hat{e}\, lnGL_{i,t-2} + {}_{1}LR_{i,t} + LR_{i,t-1} + {}_{2}TCD_{i,t} + {}_{3}SIZE_{i,t} +$$
$$ {}_{4}CAP_{i,t} + {}_{5}NPL_{i,t} + {}_{6}ROAA_{i,} + {}_{7}GDP_{t} + {}_{8}INF_{t} + {}_{9}IR_{t} + u_{i} + {}_{i,t} \quad (3)$$

where variables are the same as in baseline estimating equation (2), only the inclusion of the lagged dependent variable (i.e. using two lags) is added to the equation as well as the lagged liquidity ratio (i.e. using one lag) because if banks intend to increase lending, they might acquire additional liquidity beforehand. The GMM estimator provides efficiency and consistency if the model and overidentifying conditions are correctly specified. This is tested using Sargan test. Accordingly, applying Arellano-Bover/Blundell-Bond linear dynamic panel-data estimation the following results are obtained in Table 11 for the period of quantitative easing and entire sample:

Table 11. Estimation results using GMM procedure with p-values: entire sample and the period of quantitative easing (year 2015)

Variables	Equation 3	
	Coefficient	P-value
Intercept	0.0232078	0.624
GL_{t-1}	-0.1152276	0.222
GL_{t-2}	-0.0862889	0.115
LR	0.0053656	0.837
LR_{t-1}	0.0412300*	0.052
TCD	-0.0012722	0.932
SIZE	-0.0009944	0.794
CAP	-0.1763804***	0.005
NPL	-0.0087682	0.593
ROAA	0.1779885***	0.000
GDP	0.0081228	0.770
INF	-0.1073091	0.333
IR	-0.1736213*	0.097

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively. Sargan test indicates that the null hypothesis of valid overidentifying restrictions cannot be rejected.

The results obtained differ slightly to the ones obtained using random effects model with robust standard errors. The coefficient for lagged liquidity ratio is statistically positively significant. This suggests that liquidity, banks obtained in the previous year, was

associated with higher loan growth in the next year, at least to some extent. In other words, the results say that for 1 percentage point increase in liquidity in 2014, loan growth increased approximately by 0.04 percentage points in 2015. ECB started with two programmes (CBPP3 and ABSPP) at the end of 2014. Although not in such quantities as it then started with additional programmes (PSPP and CSPP), the two programmes are nevertheless according to the results related to a certain increase in bank lending in the 2015. These results actually imply on the delays in the effectiveness of quantitative easing; it takes time for quantitative easing to work through bank lending channel and boost bank lending. The statistically positively significant coefficient for profitability is consistent with the one obtained under random effects model, although its impact is a little smaller than under random effects model. Capitalization was also correlated with bank lending in 2015, although in negative way.

Although the main critique of using lagged variables is that they do not fully resolve endogeneity problem and that the bankøs decision to grant loans is based mainly on future expectations, not the past ones, it is still widely used in the bank lending channel literature. For example, Ehrmann et al., (2001, p. 23) use GMM methodology when exploring the effects of monetary policy on bank lending.

4.8 Data reliability and validity

The reliability and validity of the data have already been taken into account. Heteroscedasticity has been controlled by using random effects model with robust standard errors. The potentiality of endogeneity problem has been checked by resorting to dynamic panel data model tested with GMM procedure. Therefore, it remains only to check for the multicollinearity. Figure 12 shows graphically that the data for variables used in the model are quite dispersed and therefore suggesting that there is no multicollinearity. Nonetheless, to test formally that there is no multicollinearity among the data the variance inflation estimator is used. Variance inflation estimator (VIF) accordingly tests the severity of multicollinearity in the analysis. Based on the results of the test there is no multicollinearity detected among the data since the mean variance inflation estimator obtained equals to 1.50. The results for individual variable can be found in Table 12.

Table 12. Results for the variance inflation estimator

Variable	VIF
SIZE	1.76
CAP	1.68
NPL	1.66
ROAA	1.65
INF	1.50
IR	1.45
TCD	1.43
GDP	1.23
LR	1.14

Figure 12. Dispersion chart for variables in the model
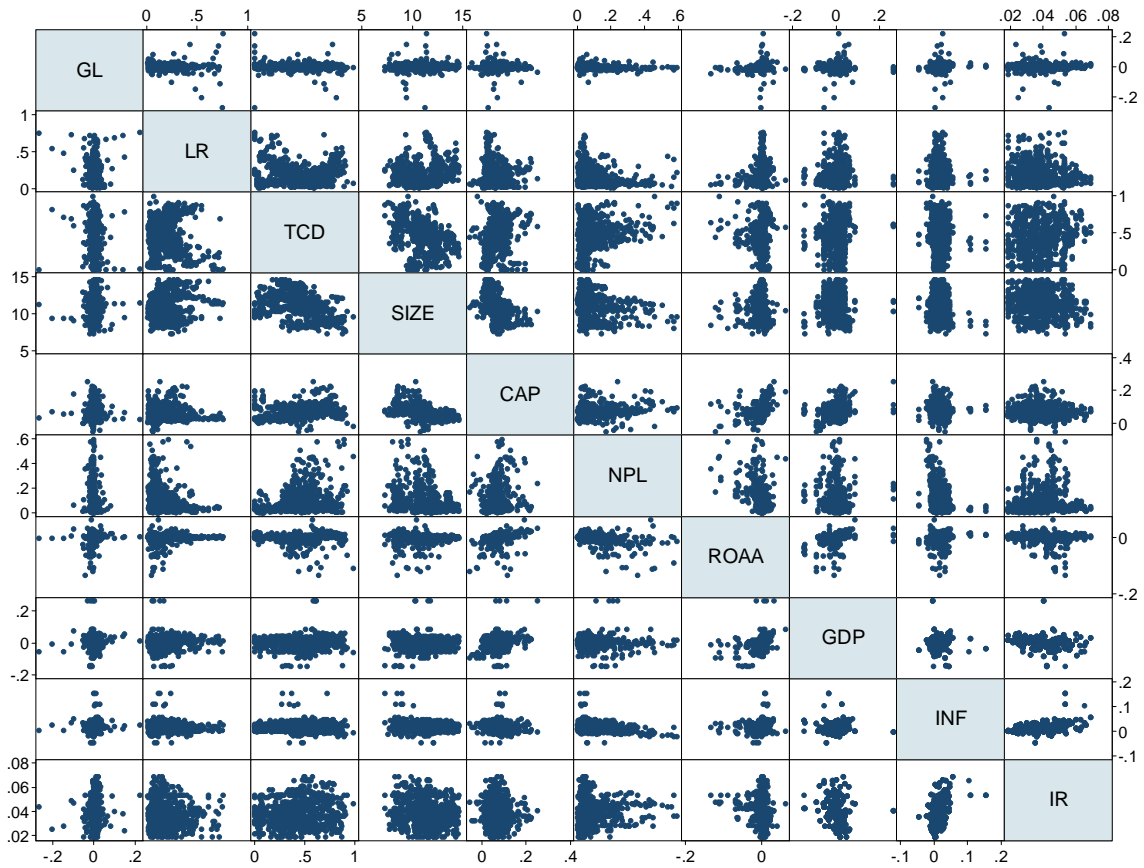
4.9 Robustness checks

Because the sample consist of banks that vary substantially in terms of size, liquidity ratio, capital etc. as well as different geographical location, several robustness checks are conducted to show the influence of this kind of the impact of quantitative easing on bank lending. Robustness checks are implemented on the basis of:

- subsample of banks according to the size
- subsample of banks according to the specialization
- subsample of banks depending on the location of the bank

The robustness checks are tested using only random effects with robust standard error including all the variables (equation 2, fourth model) and only for the period of quantitative easing, for the purpose of brevity. The results under first three models are similar and do not differ substantially to the ones obtained under fourth model.

4.9.1   Subsample of banks according to the size

Bank size plays an important role for the loan growth. Bank size affects the ability of banks to access financial market and obtain additional funding. Moreover, it shows the ability to diversify the riskiness of its assets and to diversify in different segments and different regions. Bank size also plays an important role in achieving certain economies of scale and scope. Because the size of the banks in the sample varies substantially it might be that the findings on the impact of quantitative easing on bank lending are limited to the size of banks.

Accordingly, banks in the sample are split into three subsamples (small, medium and big banks) based on the total assets in 2015. There are 34 banks in the subsample of small banks (total assets up to þ35,538 million), 33 banks in the subsample of medium banks (total assets between þ35,834 and þ125,145 million) and finally 33 banks in the subsample of big banks (total assets equal to and above þ130,960 million).

Looking at the coefficients of liquidity ratio and total customer deposit ratio in Table 13 for all three subsamples the coefficients are statistically insignificant. This indicates that quantitative easing was not correlated with higher bank lending through an increase in liquidity or an increase in deposits while taking into account the size which differs substantially between banks in the sample. For small banks in the sample the impact on bank lending in 2015 was through capitalization; moreover this impact was negative. For 1 percentage point increase in capitalization, loan growth decreased roughly by 0.12 percentage points. As it is now already usual, profitability of small banks was associated positively with an increase in bank lending because the coefficient is statistically positively significant. Meaning that for 1 percentage point increase in return on average assets, loan growth increased approximately by 0.46 percentage points. All other coefficients are statistically insignificant; therefore, the conclusion of their impact on loan growth cannot be made.

Table 13. Estimation results with p-values: subsamples according to size and the period of quantitative easing (year 2015)

Variables	Equation 2		
	Small banks	Medium banks	Big banks
Intercept	0.0581281	-0.0662456	-0.0297105*
	(0.219)	*(0.176)*	*(0.068)*
LR	-0.0202411	-0.0060527	-0.0044247
	(0.143)	*(0.237)*	*(0.677)*
TCD	-0.0126718	0.0032404	0.0067687
	(0.106)	*(0.666)*	*(0.268)*
SIZE	-0.0028625	0.0075385*	0.0022418*
	(0.428)	*(0.098)*	*(0.057)*
CAP	-0.1194995**	-0.0031980	-0.0239080
	(0.014)	*(0.952)*	*(0.778)*
NPL	-0.0073685	0.0416480	-0.0343178*
	(0.674)	*(0.205)*	*(0.073)*
ROAA	0.4619281**	0.4033396	0.3520695
	(0.034)	*(0.179)*	*(0.338)*
GDP	-0.0396338	-0.1204088**	-0.0288263
	(0.181)	*(0.013)*	*(0.358)*
INF	-0.351172	0.0213818	-0.525737
	(0.222)	*(0.949)*	*(0.133)*
IR	-0.1991671	-0.8372992**	0.1588056
	(0.626)	*(0.021)*	*(0.668)*

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively. In parentheses and italics the p-values are provided.

Medium sized banks have statistically significant three coefficients; size, GDP growth and interest rate. The size as in theory positively influenced loan growth in 2015. On the contrary, GDP growth and interest rate affected bank lending negatively, since for 1 percentage point increase in GDP growth and interest rate, bank lending decreased by about 0.12 and 0.84 percentage points, respectively. The macroeconomic environment was negatively correlated with bank lending. These are mainly banks located in Germany, Spain, France and Italy. Lastly, the big banks in the sample have statistically significant coefficients for size and non-performing loans ratio. Consistent with the theory non-performing loans of these banks negatively influenced loan growth while the size was positively related to loan growth. All other coefficients are statistically not significant; meaning that their influence on bank lending cannot be evident and detected. Graphic illustration can be found in Appendix G Figure 2.

4.9.2 Subsample of banks according to the specialization

Robustness check is also performed on the basis of specialization of banks in the sample. Majority of the banks (around 55% of the sample) are commercial banks, the rest are

distributed among others specialization (cooperative banks, savings banks, etc., see Table 4 for their share in the sample). Accordingly, the second robustness check is performed for two groups; commercial banks and the rest of them.

Table 14 presents the results for the subsamples according to specialization. The results are largely unchanged. The liquidity ratio is for the both subsamples insignificant while the total customer deposit ratio is negatively significant for other banks and insignificant for commercial banks. The specialization of the banks again does not play a major role in detecting the influence of quantitative easing on bank lending. Looking at the coefficients for other variables, results are again not largely changed. Commercial banksø lending was affected by the capitalization and profitability of banks, GDP growth and inflation rate. Regarding bank specific factor, capitalization negatively and conversely profitability positively affected loan growth. For 1 percentage point increase in capitalization or profitability, bank lending declined by roughly 0.13 and grew by approximately 0.55 percentage points in 2015, respectively.

Table 14. Estimation results with p-values: subsamples according to specialization and the period of quantitative easing (year 2015)

Variables	Equation 2	
	Commercial banks	Other banks
Intercept	-0.0013633	0.0197471
	(0.930)	*(0.267)*
LR	-0.0084887	0.0072137
	(0.359)	*(0.273)*
TCD	0.0076762	-0.0111600**
	(0.298)	*(0.044)*
SIZE	0.0004844	-0.0024861*
	(0.563)	*(0.085)*
CAP	-0.1300129***	0.1543784***
	(0.001)	*(0.003)*
NPL	-0.0199579	-0.0290264
	(0.121)	*(0.185)*
ROAA	0.5522112***	0.1564333
	(0.004)	*(0.246)*
GDP	-0.067389***	-0.0790508***
	(0.008)	*(0.004)*
INF	-0.5908512***	-0.0619912
	(0.002)	*(0.840)*
IR	0.2199817	0.3214666
	(0.391)	*(0.362)*

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively. In parentheses and italics the p-values are provided.

On the other hand, lending of other banks in the sample was affected by total customer deposits, size, capitalization and GDP growth looking only the period of the implementation of quantitative easing. The size of the bank negatively influenced loan growth, although the coefficient is rather small, so the effect of it on bank lending even tough negative was small in 2015. However, opposite to the commercial banks the effect of capitalization on loan growth was positive in 2015, implying that for 1 percentage point increase in capitalization the loan growth increased by about 0.15 percentage points. Similar as to commercial banks GDP growth was negatively correlated with loan growth in 2015 for other banks. Graphic illustration is shown in Appendix G Figure 3.

4.9.3   Subsample of banks depending on the location of the bank

Last robustness checks performed is the check on the subsamples based on the geographical location of the bank to see if diversity among countries is the reason on how quantitative easing affected loan growth in 2015. Due to the lack of observations of banks per countries (i.e. for Estonia only 1 bank is in the sample), the regression estimation per country cannot be applied; accordingly the countries are grouped into regions. Countries are divided into 3 regions according to their geographical location and consequently cultural characteristics. If the countries would be split according to their gross domestic product (i.e. big countries, small countries), the countries would be divided the same as dividing groups by core and periphery countries.

Table 15 presents the estimation results for the three regions. Looking at the coefficients for liquidity ratio and total customer deposit ratio through which quantitative easing should impact bank lending, there is only total customer deposit ratio for banks in Central Europe that is statistically significant. Moreover, it is negative, saying that it was negatively correlated with loan growth of banks in Central Europe in 2015. For 1 percentage point increase in total customer deposit ratio, bank lending declined by almost 0.05 percentage points in 2015. On the other hand, coefficients for profitability, GDP growth, inflation rate and interest rate are statistically significantly positive of the banks located in Central Europe in 2015. This means that they were positively correlated with bank lending in 2015.

For the banks located in Western Europe, four coefficients are statistically significant; moreover three of them are negative and one positive. Capitalization and non-performing loans of these banks reduced loan growth since for 1 percentage point increase in capitalization or NPL, bank lending declined by about 0.1 or 0.07 percentage points in 2015. However, profitability was positively related to bank lending in 2015. For 1 percentage point increase in profitability, loan growth increased by almost 0.43 percentage points. On the demand side factors, inflation rate was the determinant that negatively influenced loan growth. For the banks located in Southern Europe, none of the coefficients are statistically significant. Graphic illustration can be found in Appendix G Figure 4.

Table 15. Estimation results with p-values: subsamples according to geographical location and the period of quantitative easing (year 2015)

Variables	Equation 2		
	Central Europe	Western Europe	Southern Europe
Intercept	-0.0898978*	0.0082887	0.0115136
	(0.056)	*(0.617)*	*(0.562)*
LR	-0.0123970	-0.0024188	0.0026984
	(0.321)	*(0.805)*	*(0.872)*
TCD	-0.0483997**	0.0079888	-0.0158310
	(0.028)	*(0.352)*	*(0.116)*
SIZE	0.0031194*	-0.0000987	-0.0004607
	(0.095)	*(0.918)*	*(0.728)*
CAP	-0.0090442	-0.1034814*	0.0670531
	(0.914)	*(0.059)*	*(0.398)*
NPL	-0.0098847	-0.0711644*	0.0070025
	(0.742)	*(0.099)*	*(0.712)*
ROAA	0.4941215*	0.426927*	0.2855852
	(0.098)	*(0.091)*	*(0.133)*
GDP	1.496843***	-0.184172	0.1318251
	(0.009)	*(0.516)*	*(0.368)*
INF	1.820443*	-0.6383556**	0.0527041
	(0.061)	*(0.040)*	*(0.844)*
IR	2.151855*	-0.0068607	-0.209723
	(0.074)	*(0.980)*	*(0.619)*

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively. In parentheses and italics the p-values are provided.

4.10 Cross-sectional differences

Even though several robustness checks are performed to control for factors that vary substantially there can still be certain bank specific characteristics that affect the impact of monetary policy across banks. For example, Kashyap and Stein (2000, p. 407) study the impact of monetary policy on lending behaviour and come to a conclusion that there are various cross-sectional differences in the way that banks with different bank specific characteristics respond differently to policy shocks. Moreover, they show that the impact of monetary policy on bank lending is stronger for those banks that have less liquid balance sheets. Furthermore, Hosono (2006, p. 380) finds that the impact of monetary policy on bank lending is stronger for banks that are smaller, less liquid and having higher levels of bank capital. Consequently, the similar strategy as of Bowman et al. (2011) is adopted to test and control for the effect of various bank specific characteristics on the sensitivity of bank lending, more specifically the sensitivity of bank loan supply to the liquidity provided from ECB in 2015. To perform this last test the interaction terms between the liquidity ratio and size, capitalization, non-performing loans ratio and

profitability are added to the baseline estimating equation. Accordingly, the estimating equation is as follows:

$$\hat{e}\,lnGL_{i,t} = \alpha_i + \beta_1 LR_{i,t} + \phi'(LR_{i,t} * X_{i,t}) + \beta_2 TCD_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CAP_{i,t} + \beta_5 NPL_{i,t} +$$
$$\beta_6 ROAA_{i,t} + \beta_7 GDP_t + \beta_8 INF_t + \beta_9 IR_t + u_i + \varepsilon_{i,t} \tag{4}$$

where variables are the same as in baseline estimating equation (2), the additonal ø is coefficient vector and $X_{i,t}$ is a matrix of bank specific variables (i.e. size, capitalization, non-performing loans ratio and profitability).

The results are shown in Table 16. The results show that size, non-performing loans ratio and profitability have a positive, while capitalization a negative influence on liquidity; however none of the coefficients are statistically significant. Therefore, the effect of certain bank specific factor on liquidity could not be detected. Moreover, liquidity ratio and total customer deposit ratio coefficients are still insignificant. Statistically significant coefficients are obtained for non-performing loans ratio and GDP growth, where both of them are negative and accordingly negatively associated with loan growth in 2015.

Table 16. Results of the test for cross-sectional differences: entire sample and the period of quantitative easing (year 2015)

Variables	Equation 4	
	Coefficient	P-value
Cons	0.0216890	0.391
LR	-0.0626925	0.554
LR*SIZE	0.0052989	0.524
LR*CAP	-0.2615502	0.321
LR*NPL	0.0979542	0.191
LR*ROAA	1.3215930	0.411
TCD	0.0019412	0.696
SIZE	-0.0015196	0.465
CAP	-0.0140615	0.854
NPL	-0.0385831*	0.067
ROAA	0.1239799	0.650
GDP	-0.0577204***	0.010
INF	-0.3047446	0.129
IR	0.0930645	0.691

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

4.11 Findings and further research

Taking into consideration all the estimation results the study finds that:

- Shortage of liquidity and an increase in non-performing loans were the causes of low and negative loan growth in the period between 2008 and 2013. The ECBøs decision to use unconventional measures to address the liquidity in the banking sector was in the right way. However, the design of these measures differed depending on what has been their focus; subsequently their impact on bank lending is differing as well. For example, TLTROs are targeted operations where the amount that bank can borrow is linked to the loans it provides to non-financial corporations, while quantitative easing works mainly through interest rates and asset prices. On the other hand, banks have in this period been burdened by bad loans due to the consequences of the global financial crisis of 2007 and housing bubble burst followed by certain aftershocks (i.e. euro area sovereign crisis of 2011).

- According to the results obtained, quantitative easing conducted by ECB did not work through bank lending channel, at least in 2015. As opposed to theory, coefficients for liquidity ratio and total customer deposit ratio are statistically insignificant. As theory states, the transmission of quantitative easing through bank lending channel should be seen through an increase in liquidity and an increase in deposits. However, even though liquidity and deposit increased from 2014 to 2015, their impact and consequently impact of quantitative easing on higher loan growth could not be detected in 2015.

- The liquidity in the banks increased from 2014 to 2015; nevertheless banks did not pass the majority of this liquidity to the economy in the form of loans in the first year of expanded APP. Banks used the liquidity obtained through quantitative easing either to reduce liquidity risk, to meet liquidity requirements or to shore up their balance sheet and regain the profitability. Total customer deposit ratio is positive, although insignificant. Therefore, the impact of quantitative easing through growth in deposits is not evident as well.

- Testing the design of quantitative easing (i.e. allocation of the purchases according to capital keys) shows that loan growth due to quantitative easing was not higher for the banks located in core countries as was expected. On the other hand, quantitative easing is associated with higher bank lending through total customer deposits of the banks in the periphery countries. Nonetheless, how much of the increase in deposits is attributable to the quantitative easing programme, is under question.

- The coefficient for profitability is statistically positive, saying that profitability was correlated with an increase in bank lending in 2015. Although consistent with the theory, the problem of causality arises. On one hand, increased bank lending generates higher interest income that leads to an improvement in profitability; on the other hand, as theory states sound profitability gives a bank great access to financing needs and therefore positive relationship to lending. Profitability, measured as ROAA, improved in 2015 because many banks reduced their balance sheet sizes.

- Capitalization is another bank specific factor that was related to bank lending; however, its effect was negative in 2015 because the coefficient for capitalization is statistically significantly negative. The capital-to-assets ratio improved for many banks

in 2015. This improvement is seen through a reduction in the balance sheet sizes. Since the global financial crisis the decline in the asset sizes was led by the shrinking of loans and trading books. Recently, the shrinking of the asset sizes has been led by new capital Basel rules. Moreover, these risk-based capital requirements could be a potential reason, why banks did not boost lending in 2015 and consequently they weakened bankøs potential lending capacity.

- GDP growth and inflation rate, both, were negatively associated with bank lending in 2015 in the euro area. Although, the macroeconomic environment improved since the onset of the crisis, the lack of demand for loans continued. Moreover, the inflation rate in 2015 was still far beyond the targeted level of below, but close to 2%.

- Investigating further, by resorting to dynamic panel data model to control for endogeneity problem, the results show that lagged liquidity ratio was correlated with lending in 2015. Banks obtained additional liquidity in the previous year, also through two programmes of the APP (CBPP3 and ABSPP that started in 2014), and to some extent used it for lending activities. Although, this was also the year when ECB started with TLTRO, of which effect might be hidden in the coefficient for liquidity ratio. Nonetheless, the results obtained clearly state that there is a certain delay in the effectiveness of quantitative easing to influence lending through bank lending channel.

- Several robustness checks were performed for the validation of the results because certain variables differ substantially among banks, which could affect the results. The liquidity ratio is statistically insignificant for all the subsamples, while the total customer deposit ratio is significant for other banks depending on the specialization and banks located in Central Europe. Both coefficients were negatively related with bank lending in 2015.

- In comparison to other studies, similar results for the deposits are obtained as in Butt et al. (2014). This is that there is no evidence in a boost in lending due to increased deposits in banks from quantitative easing. Although, Joyce and Spaltro (2014) obtain different results, this effect is small. Difference to the US results obtained by Rodnyansky and Darmouni (2014) might arise due to the magnitude of the purchases conducted by Federal Reserve. Moreover, they focused the research on the banks with significant holdings of MBS.

- To compare also with the research of Carpinelli and Crosignani (2016), the impact of 3-year LTRO on bank credit supply is also conducted. While Carpinelli and Crosignani (2016) obtain positive effect of the liquidity injections on Italian bank credit supply, the results of the euro area banks provide negative effect of liquidity injections on bank credit. The results can be found in Appendix H. The liquidity ratio is statistically negatively significant, implying that the liquidity injections in the forms of VLTRO conducted by ECB at the end of 2011 were negatively correlated with bank credit supply for the entire sample of banks in the euro area. The results differ because Italian banks were the largest users of the funds, while they only form a part of the sample used in this research.

The effect of quantitative easing on bank's balance sheet, mainly loan growth, could not be detected in the year 2015. Nevertheless, this does not prove that there would not be a bank lending channel from quantitative easing in the future. Further research on how quantitative easing works through banks' balance sheets is needed. This is because in the first place even policymakers expected that quantitative easing would first work through asset prices and interest rates. Secondly, it takes time for a quantitative easing to work through bank lending channel. This can be seen also through statistically significant coefficient for lagged liquidity ratio, which means that liquidity banks obtained in 2014, used for granting loans in 2015 to a certain extent. Accordingly, the shortcoming of this study is in the short time series to study the effect of quantitative easing through banks' balance sheet since quantitative easing strengthen lending with a certain lag. Perhaps the sample of banks should also be extended and should include also banks that are not under direct supervision of ECB. Nevertheless, it is important to evaluate the impact of quantitative easing on bank lending in its first year to see if it needs to be adjusted and consequently improved. ECB adjusted the programme several times by extending the duration of it and the amount intended for the purchases of securities.

On the other hand, the boost in bank lending might not be seen in 2015 because banks have still been burdened by bad loans and toxic assets and should act to clean up their balance sheets. Banks have been flushed with new obligatory requirements (such as the ones under Basel Accord) which can tie a bank's ability to extend loans to the desired level. In addition, banks have been faced with increased competition, for example the ones using peer-to-peer lending model and FinTech companies. Even though euro area economy is highly dependent on bank financing, banks will need to make certain IT investment to be able to compete with non-bank intermediaries. Nonetheless, the main objective (i.e. price stability) of the central bank is improving; therefore the ECB needs to start thinking about credible exit from this monetary policy stimulus and avoid or at least reduce the risks associated with the exit.

CONCLUSION

The impact of quantitative easing on asset prices, interest rates, inflation and output growth has been investigated in the literature. Most of the analysis focused on the impact on financial markets while less attention has been put on bank lending and the transmission through bank lending channel. Accordingly, this study has tested whether quantitative easing provided boost in bank lending in the euro area. The approach used was to evaluate whether variation in liquidity and variation in deposits due to quantitative easing caused a rise in loan growth.

To test this relationship of quantitative easing and bank lending through liquidity and deposits a panel dataset on euro area banks was used while also controlling for the demand side effect by using macroeconomic factors, such as GDP growth and interest rate. The

analysis suggests that even if quantitative easing increased liquidity or deposits, this increase was not reflected in higher loan growth in 2015. Moreover, the work of quantitative easing in the first year of its operation through bank lending channel in the euro area was not detected. Even policymakers expected that quantitative easing influence on bank lending would be small since banksø have been actively participating in deleveraging process and that quantitative easing takes time to work through bank lending channel. However, when resorting to dynamic panel data model to control for endogeneity, statistically positive lagged liquidity ratio indicated that there is actually a delay in the effectiveness of quantitative easing and that it takes time for such measure to work through bank lending channel.

Applying several robustness checks to see whether certain bank specific characteristics or geographical location are the causes of different responses to bank lending of euro area banks. However, the results obtained were the same. Variation in liquidity and variation in deposits if increased by quantitative easing did not help boosting loan growth. Only when looking the different responses to bank lending between banks in core and periphery countries, the increase in deposits of banks in periphery countries actually helped increasing loan growth.

The main question of the study on what is the effect of quantitative easing on bank lending can be answered that quantitative easing did not work through bank lending channel and it did not affect loan growth in 2015. Although, lagged liquidity ratio implies that quantitative easing needs time to boost bank lending. However, since quantitative easing did work through other transmission channels and consequently helped GDP growth and inflation rate, the expectation could be that quantitative easing helped loan growth implicitly through demand side factors. This can be accepted when looking strong economies (i.e. Central Europe) with strong banks while other countries have been struggling with banks faced with bad loans, which have driven down loan growth.

Overall, this study helps theoretically understand the influence of quantitative easing on bank lending and in addition provides empirical evidence that quantitative easing did not boost lending in 2015 in the euro area. However, further research on the impact of quantitative easing on bank lending needs to be conducted since quantitative easing works with a delay through bank lending channel. Nevertheless, the main objective of price stability is improving and policymakers should start thinking about credible reversibility to get back to normal state.

POVZETEK

Odziv na globalno finan no krizo 2007 je bil brez primere. Kot je leta 2009 rekel Ben Bernanke: »Izredni asi zahtevajo izredne ukrepe«. Centralne banke po svetu so se sprva odzvale na krizo z uporabo konvencionalnih oz. standardnih orodji monetarne politike. Ko

pa so kratkoro ne obrestne mere dosegle ni elno spodnjo mejo, so se centralne banke obrnile k nestandardnim orodjem monetarne politike, da bi zajezile padec v ekonomski rasti in inflaciji. Eden izmed teh nestandardnih orodij je tudi kvantitativno spro– anje.

Ve ina opravljenih –tudij se je osredoto ila na raziskovanje vpliva kvantitativnega spro– anja na obrestne mere, cene sredstev, povpra–evanja, ekonomsko rast in inflacijo. Manj pozornosti se je namenilo vplivu kvantitativnega spro– anja na ban no posojanje. To je predvsem posledica dejstva, da so fle oblikovalci monetarne politike pri akovali, da bo kvantitativno spro– anje vplivalo na povpra–evanje preko cen sredstev in da bo u inek preko ban nega posojanja majhen zaradi aktivnega sodelovanja bank v procesu razdolflevanja in zmanj–evanja bilanc v asu krize. Le nekatere –tudije so raziskale vpliv kvantitativnega spro– anja na ban no posojanje v Veliki Britaniji, Zdruflenih drflavah in na Japonskem. Za evroobom je, kjer je Evropska centralna banka (v nadaljevanju ECB) kot zadnja implementirala tovrsten ukrep, take –tudije do zdaj –e ni. V skladu s tem je cilj zapolniti to vrzel in empiri no raziskati ban no posojilno vedenje v lu i nestandardnih ukrepov monetarne politike, natan neje kvantitativnega spro– anja, v evrskem obmo ju.

Kvantitativno spro– anje vklju uje nakup finan nih sredstev od poslovnih bank in drugih zasebnih institucij, s imer se pove a denarna osnova. Gre za zamenjavo enega varnega sredstva za drugega (tj. izmenjava dolgoro nih drflavnih obveznic za ban ne rezerve). Kvantitativno spro– anje je mogo e razumeti tudi kot konvencionalno nekonvencionalno politiko, saj centralna banka kupuje kratkoro ne drflavne vrednostne papirje fle, ko izvaja operacije odprtega trga. Razlika je v tem, da pri kvantitativnem spro– anju centralna banka kupuje dolgoro ne drflavne vrednostne papirje kot tudi pove a obseg teh nakupov. Centralna banka z nakupom dolgoro nih sredstev ustvarja dodaten denar, ki ga posreduje gospodarstvu in s tem pove uje porabo. Kvantitativno spro– anje vpliva na bilanco stanja centralne banke tako, da –iri njene obveznosti. Z izdajo rezerv se pove a bilanca stanja, hkrati pa se spremeni tudi kompozicija na strani sredstev s pove anjem ro nosti odkupljenih obveznic (nakupi dolgoro nih vrednostnih papirjev). Na drugi strani poslovna banka pridobi nove rezerve, e so vrednostni papirji kupljeni direktno od nje. e pa so vrednosti papirji kupljeni od neban nega sektorja, pa banka pridobi nove depozite, saj je neban ni sektor v zameno za vrednostne papirje pla an v obliki depozitov pri koresponden ni banki. Tako se pove a likvidnost bank, pove ana likvidnost pa naj bi spodbudila banke k pove anju svoje osnovne, kreditne dejavnosti.

Razvile so se tudi razli ne teorije, kak–na sredstva naj centralna banka odkupuje. Po Woodford-u (2012) narava sredstev ni tako zelo pomembna, kot je pove anje njenih obveznosti. Landau (2014) pravi, da bi centralna banka morala kupovati tvegane papirje, saj je svet zapadel v past varnih sredstev, medtem ko Joyce, Miles, Scott in Vayanos (2012) pravijo, da centralna banka lahko kupuje drflavne vrednostne papirje ali sredstva izdana s strani privatnega sektorja. Pri nakupih sredstev je pomembna le koli ina in sprejemljivo pla ilno sredstvo za nakup te koli ine sredstev. Kot pravita Bernanke in

Reinhart (2004) pri kvantitativnem sproščanju gre za povečanje velikosti bilance stanja centralne banke ne pa tudi za spreminjanje sestave bilance stanja centralne banke kot je to pri kreditnem sproščanju.

Kvantitativno sproščanje vpliva na gospodarstvo in inflacijo preko različnih transmisijskih kanalov. Gre za to kako kvantitativno sproščanje preko teh kanalov vpliva na obrestne mere, le te pa potem vplivajo na investicijsko obnašanje podjetij, njihovo pripravljenost za zaposlovanje, pripravljenost posameznikov na potrošnjo in pripravljenost bank na posojanje. Posledično te spremembe nato vplivajo na gospodarsko rast in stopnjo inflacije. Kanali, preko katerih kvantitativno sproščanje vpliva na porabo, posojila in naložbe so:

- Denarni kanal, ki vodi v bančno posojilni kanal. Centralna banka z zamenjavo denarja za finančna sredstva poveča ponudbo denarja bankam in izboljša likvidnost bančnega sektorja. Z izboljšanjem in povečanjem likvidnosti v bančnem sektorju pa se pričakuje, da bodo banke to uporabile za odobritev novih posojil, kar bi vodilo v povečano potrošnjo.
- Centralna banka s kvantitativnim sproščanjem zagotavlja informacije o prihodnji poti denarne politike vsem udeležencem na trgu preko signalizacijskega kanala. Zaveza centralne banke, da doseže ciljno inflacijo, lahko vodi v pričakovanje, da se bodo nizke obrestne mere ohranile tudi po tem, ko si bo gospodarstvo opomoglo, da se centralna banka izogne izgubam v bilanci stanja.
- Centralna banka z nakupi velike količine sredstev spreminja sestavo kupljenih sredstev. Ker denar, ki ga izda centralna banka za nakup teh sredstev, in kupljena sredstva preko kvantitativnega sproščanja niso popolni substituti, je želja prodajalcev teh sredstev uravnotežiti svoj portfelj z nakupi sredstev, ki so bližnji substituti prodanih sredstev (tj. sredstva, ki imajo podobne lastnosti). Kvantitativno sproščanje tako preko kanala uravnoteženja portfelja vpliva na cene sredstev, ki so bližnji substituti od kupljenih s strani centralne banke.
- Centralna banka preko likvidnostnega kanala z izvajanjem kvantitativnega sproščanja poveče likvidnost investitorjev, saj so rezerve bolj likvidna sredstva od dolgoročnih vrednostnih papirjev.
- Zadnji kanal je kanal zaupanja. Kvantitativno sproščanje vpliva na izboljšanje gospodarskih obetov in ima zato širši vpliv na zaupanje, saj neposredno poveče zaupanje potrošnikov, ki ima lahko za posledico povečanje potrošnje in spodbujanje investicij.

Preko teh kanalov centralna banka zvišuje cene kupljenih sredstev hkrati pa vpliva tudi na devizni tečaj. Višje cene sredstev tako povečajo bogastvo imetnikov teh sredstev na drugi strani pa se zmanjšajo stroški zadolževanja za podjetja in gospodinjstva. Oboje naj bi tako pomagalo pri povečanju potrošnje, da bi se dosegel inflacijski cilj, spodbudila realna gospodarska rast in zmanjšala stopnja brezposelnosti.

Kvantitativno spro– anje v evroobomo ju

Preden je ECB implementirala kvantitativno spro– anje je vpeljala druge nestandardne ukrepe. ECB je spremenila strukturo ro nosti operacij pove anja likvidnosti za re–evanje nelikvidnosti na denarnih trgih evroobmo ja in zlasti zaostrenih pogojih financiranja dalj–e ro nosti. Hkrati je raz–irila tudi operacije dolgoro nega refinanciranja, izpolnjevala zahteve po likvidnosti za banke z zavarovanjem, raz–irila seznam premoflenja primernega za zavarovanje pri kreditnih poslih. ECB je uvedla tudi program nakupa kritih obveznic, denominiranih v evrih in izdane v obmo ju evra. Uvedla je tudi program trga vrednostnih papirjev, kjer je ECB odkupovala drflavne obveznice na sekundarnih trgih. Ti ukrepi so zagotavljali proflno likvidnost ban nemu sistemu in niso bili namenjeni spreminjanju naravnanosti denarne politike. Vendar vsi ti ukrepi niso uspeli zajeziti vztrajno nizke inflacije, gospodarske rasti in kreditne dinamike. Zato je uvedla ciljne operacije dolgoro nej–ega refinanciranja, negativne obrestne mere za odprto ponudbo mejnega depozita in rezerve, ki presegajo zahteve po obveznih rezervah, ter kvantitativno spro– anje. Konec leta 2014 je ECB za ela z izvajanjem programa nakupa kritih obveznic in vrednostnih papirjev zavarovanih s premoflenjem. Ampak –ele 22. januarja 2015 je ECB napovedala ogromno raz–iritev programa za nakupe sredstev, ki je za el delovati marca istega leta z dodatnim programom za nakupe sredstev javnega sektorja.

Nakupom je bilo sprva namenjeno þ60 milijard na mesec kot tudi da bo program deloval do septembra 2016 oz. ko se bo videla trajna prilagoditev inflacije cilju. A je bilo trajanje programa odkupa vrednostnih papirjev ve krat podalj–ano. Na zadnjem Svetu ECB so program podalj–ali do decembra 2017 ali pa dlje dokler se ne bo videlo izbolj–anje v stopnji inflacije. Kvantitativno spro– anje je bilo sprva strukturirano tako, da je bilo þ10 milijard namenjeno nakupu kritih obveznic in vrednostnim papirjem zavarovanih s premoflenjem, þ50 milijard pa namenjeno programu nakupa sredstev javnega sektorja. Obveznice se odkupujejo na sekundarnem trgu in morajo imeti preostalo dospelost 2 do 30 let, denominirane v evrih in morajo izpolnjevati pogoje za zavarovanje pri operacijah denarne politike. Marca 2016 je Svet ECB povi–al vi–ino namenjenih nakupom na þ80 milijard do marca 2017. ECB je junija 2016 objavila program nakupa vrednostnih papirjev korporativnega sektorja. Gre za nakupe podjetni–kih obveznic, denominirane v evrih. Nakupi v vi–ini þ80 milijard bodo potekali do marca 2017, medtem ko se bodo do decembra 2017 nadaljevali v vi–ini þ60 milijard. Zmanj–ali so tudi najnifljo dospelost obveznic iz 2 na 1 leto, hkrati pa lahko odkupujejo obveznice z donosnostjo, ki je niflja od obrestne mere za odprto ponudbo mejnega depozita, ki je trenutno -0,40%.

U inki in tveganja kvantitativnega spro– anja v evroobmo ju

Kvantitativno spro– anje naj bi vplivalo na agregatno povpra–evanje, inflacijo in realno gospodarsko rastjo preko sprememb v spremenljivkah finan nega trga. To pomeni, da

kvantitativno spro– anje povzro i padec dolgoro nih obrestnih mer, depreciacijo evra in potencialno z dolo enim zamikom okrepi kreditno aktivnost, potro–njo in gospodarsko rast. Kvantitativno spro– anje je v evroobmo ju vplivalo na obrestne mere in jih zniflalo, hkrati pa je vplivalo tudi na pri akovanja glede prihodnjih obrestnih mer kot tudi stopnjo inflacije in gospodarske rasti.

Poleg pozitivnih u inkov pa kvantitativno spro– anje prina–a dolo ena tveganja in neflelene u inke. Andrade et al. (2016) jih je razvrstil v 3 skupine: tveganje za finan no stabilnost, dejavniki, ki omejujejo u inkovitost kvantitativnega spro– anja in tveganja povezana z izgubami v bilanci stanja ECB.

Kvantitativno spro– anje s pove anjem inflacije in proizvodnje in s tem vzdrflnosti javnega dolga pomaga oz. koristi finan ni stabilnosti. Kljub temu pa lahko ohlapna monetarna politika v dalj–em asovnem obdobju uvede dolo ene izzive za finan ne institucije, da se vklju ijo v bolj tvegane dejavnosti in ima tako negativen vpliv na finan no stabilnost. Zmanj–anje obrestnih mer je negativno vplivalo na obrestne marfle bank, kar lahko ogrozi finan no stabilnost bank, ki se soo ajo s kapitalskim primanjkljajem.

Obmo je evra se prav tako soo a z dodatnimi izzivi z usklajevanjem denarnih in fiskalnih politik. Okolje nizkih obrestnih mer spodbuja drflave k skraj–evanju zapadlosti novo izdanih obveznic, kar omejuje u inkovitost kvantitativnega spro– anja. Na drugi strani pa izhajajo tveganja v bilanci stanja ECB zaradi potencialnih izgub iz portfelja odkupljenih sredstev. Eden od vzrokov za tveganje izhaja iz moflnosti prestrukturiranja dolga, kjer bi vrednost sredstev v bilanci stanja ECB v tem primeru ob utno padla. Drugi vir tveganja pa izhaja iz izpostavljenost glede trajanja programa. V asu okrevanja bi ECB morala pove ati obrestne mere, kar bi seveda imelo negativen u inek na njeno bilanco stanja. Ta u inek bo mo nej–i, e je portfelj sestavljen predvsem iz dolgoro nih obveznic z nizkim donosom. Poleg tega pa je Buiter (2009) opozarjal, da obstaja potreba po izhodni strategiji, le ta pa bo v evroobmo ju odvisna od inflacijskih in gospodarskih razvojev kot tudi trajanja kvantitativnega spro– anja.

Ban no posojanje

Ban no posojanje je srce ban nega poslovanja. Banke kot finan ni posredniki zbirajo depozite na eni strani, ki jih potem preoblikujejo v posojila. Banke imajo ve inoma nelikvidna sredstva, ki se financirajo predvsem z depoziti, eprav se uporabi samo dolo en odstotek depozitov za odobravanje posojil. Kreditiranje je tako najpomembnej–a dejavnost, ki jo izvajajo banke, krediti pa predstavljajo prevladujo i vir prihodkov in so dragoceno sredstvo, ki prispevajo k finan nemu zdravju banke preko obrestnih prihodkov. Posojanje je proces, ki vklju uje pridobivanje informacij o netransparentnih posojilojemalcih. Banke s sprejemanjem depozitov strank in nato odobravanjem posojil pri akujejo, da bodo ustvarile donos na posojila, ki je vi–ji od pla anih obresti na depozite. Banke igrajo

pomembno vlogo pri rasti gospodarstva in omogočajo financiranje dejavnosti, ki jih ni mogoče financirati preko trga obveznic. Zato imajo bančna posojila poseben status. Če je finančno posredništvo zmanjšano, to lahko vpliva na agregatno ponudbo in povpraševanje. Šoki, ki vplivajo na ponudbo bančnih posojil, še posebej, če ne obstajajo dobri substituti, lahko vplivajo na potrošnjo posojilojemalcev.

Če so nekateri posojilojemalci odvisni od posebne vloge, ki jo imajo banke, potem le ti ne morejo enostavno preiti na alternativne oblike zunanjega financiranja in zato tudi ne bodo imeli dostopa do kreditnih trgov, če se ne zadolžujejo pri bankah. Če ni popolne zamenljivosti vlog oz. depozitov z drugimi viri sredstev, potem bančno posojilni kanal deluje na sledeči način: ekspanzivna monetarna politika povečuje bančne rezerve in bančne depozite, ki vodijo do povečanja količine bančnih posojil, ki so na voljo. Ker imajo banke posebno vlogo kot posojilodajalci, bo to povzročilo povečanje razpoložljivosti bančnih posojil od bank odvisnih posojilojemalcev, kar posledično pomeni večjo potrošnjo in tudi naložbe. Delovanje preko kanala bančnega posojanja je shematično prikazano v enačbi (1):

$$M \Rightarrow depoziti \Rightarrow posojila \Rightarrow I \Rightarrow Y \tag{1}$$

kjer M pomeni povečanje ponudbe denarja, I označuje rast investicij in Y pomeni rast povpraševanja in gospodarsko rast.

Vpliv bančnega posojanja na agregatno povpraševanje je predvsem odvisno od finančnega stanja v bančnem sektorju, zato lahko dobro kapitaliziran bančni sektor vedno izpolni povpraševanje po posojilih. Poleg tega pa imajo kapitalske omejitve pomemben učinek na bančno posojanje.

Na transformacijski proces (tj. zbiranje depozitov in dajanje posojil) vpliva več dejavnikov, ki jih lahko razvrstimo v dejavnike specifične za banko, specifične za industrijo in makroekonomske dejavnike. Na drugi strani so lahko dejavniki razvrščeni tudi v notranje in zunanje oz. dejavniki na strani povpraševanja in dejavniki na strani ponudbe. Med notranje dejavnike štejemo velikost banke, kapital, volumen depozitov, likvidnost, kreditno tveganje in donosnost, medtem ko med zunanje dejavnike štejemo stopnjo inflacije in gospodarsko rast ter obrestne mere. Bančno posojanje se je v času krize zelo zmanjšalo in je rast posojil postala celo negativna v nekaterih državah (npr. Ciper, Grčija, Italija, Irska, Portugalska, Španija).

Vpliv kvantitativnega sproščanja na bančno posojanje v evroobmočju

Kakšen je vpliv monetarne politike kvantitativnega sproščanja na bančno posojanje v evroobmočju v 2015? Glavno vprašanje študije, katerega odgovor pokaže ali je kvantitativno sproščanje delovalo tudi preko transmisijskega kanala bančnega posojanja. Gre za odgovor ali je kvantitativno sproščanje vplivalo na bilance stanja bank v letu 2015

(tj. pove anje likvidnosti in pove anje depozitov, ki naj bi se odrazilo v pove ani kreditni dejavnosti).

Za empiri no preverbo so vzeti podatki bank, ki se nahajajo v evroobmo ju, za sestavo kar najbolj reprezentativnega vzorca bank pa je vzet seznam pomembnih nadzorovanih subjektov v okviru enotnega nadzornega mehanizma. Finan ni podatki so vzeti iz baze BankScope na konsolidirani osnovi. Za ohranjanje konsistentnosti in primerljivosti so vzeti podatki tistih bank, ki poro ajo v okviru mednarodnih standardov ra unovodskega poro anja. Glede na te prilagoditve in ker za dolo ene banke ni na voljo podatkov, je kon ni seznam sestavljen iz 100 bank od 127 iz seznama pomembnih nadzorovanih subjektov iz 19 drflav evroobmo ja. Makroekonomski podatki (gospodarska rast, stopnja inflacije in obrestne mere) so vzeti iz baze Svetovne banke in podatkovnega skladi– a ECB. Oblikovano je razmerje med rastjo posojil, likvidnostjo in depoziti hkrati pa je uvedena kontrola –e za druge ban no specifi ne in makroekonomske dejavnike. Empiri ni model je zasnovan tako, da se lahko pojasni odziv rasti posojil na spremembe v likvidnosti in obsegu depozitov. Za analizo je uporabljena panelna regresija, in sicer model s slu ajnimi u inki.

Opisna statistika

Povpre na velikost posojil bank v vzorcu zna–a þ100.051 milijona, kar zna–a nekoliko manj kot 50% celotnih sredstev od povpre no velike banke. Slaba posojila v povpre ju zna–ajo þ7.356 milijona, kar je manj kot 10% od celotnih bruto posojil. Povpre na vrednost aktive, kot pribliflek za velikost banke, zna–a þ219.786 milijona, vendar pa se velikost bank v vzorcu bistveno razlikuje. Povpre na vrednost likvidnih sredstev zna–a þ52.774 milijona, kar prinese povpre ni likvidnosti koli nik 18,3%. Povpre na vrednost lastni–kega kapitala zna–a þ9.842 milijona.

Glede makroekonomskih dejavnikov oz. dejavnikov, ki vplivajo na povpra–evanje po posojilih, pa povpre na vrednost rasti BDP zna–a 0,2%, povpre na stopnja inflacije 1,6% in povpre na obrestna mera pribliflno 3,9%. Glede specializacije bank v vzorcu najve ji delefl (55,6%) pripada poslovnim bankam, ki jim sledijo zadrufne banke (12,9%).

Rezultati

- Likvidnost in slaba posojila so v obdobju 2008 do 2013 negativno vplivala na kreditno dejavnost.
- Likvidnostni koli nik in koli nik depozitov nista statisti no zna ilna, kar nakazuje, da kvantitativno spro– anje s pove anjem likvidnosti in obsega depozitov ni bistveno vplivalo na kreditno dejavnost v letu 2015 v evroobmo ju.

Ker pa obstaja potencialni problem, da bodo banke likvidnost, ki so jo pridobile v prej–njem obdobju, uporabile za dajanje kreditov v naslednjem obdobju, se testiranje izvede tudi z uporabo dinami nega modela. Tu se pokafle, da likvidnost, ki so jo banke pridobile v letu 2014, so uporabile, vsaj do neke mere, v letu 2015 za izvajanje svoje osnove dejavnost - kreditiranje (koeficient je statisti no pozitivno zna ilen). Konec leta 2014 sta zaflivela dva programa odkupov sredstev. Vsi drugi testi pa ne prinesejo bistveno druga nih rezultatov od osnovnega modela.

Ob upo–tevanju vseh rezultatov –tudije se ugotavlja, da:

- Pomanjkanje likvidnost in pove anje nedonosnih posojil sta bila eden izmed vzrokov za nizko in celo negativno rast posojil v obdobju med letoma 2008 in 2013. Odlo itev ECB za uporabo nekonvencionalnih ukrepov, ki so obravnavale likvidnost v ban nem sektorju, je bila na pravem mestu. Po drugi strani pa so bile banke v tem obdobju obremenjene s slabimi posojili zaradi posledic finan ne krize.
- Glede na pridobljene rezultate, kvantitativno spro– anje ni delovalo preko ban no posojilnega kanala v letu 2015. V nasprotju s teorijo, sta likvidnostni koli nik in koli nik depozitov statisti no nezna ilna. Kot pravi teorija, bi kvantitativno spro– anje delovalo preko ban no posojilnega kanala, tako da bi pove alo likvidnost na eni strani in depozite na drugi strani.
- eprav se je likvidnost v bankah pove ala od leta 2014 do 2015, se ve ina te likvidnosti ni uporabila za pove anje posojilne dejavnosti. Banke so to likvidnost ohranile bodisi za zmanj–anje likvidnostnega tveganja bodisi za izpolnjevanje obveznih zahtev po likvidnosti.
- Pri testiranju oblike programa odkupa vrednost papirjev glede na banke locirane v osrednjih in obrobnih drflavah po kapitalskem klju u, je koli nik likvidnosti in koli nik depozitov statisti no zna ilen za banke iz obrobnih drflav, ne pa tudi osrednjih drflav. Koli nik likvidnosti je bil negativno povezan z rastjo posojil (koeficient je statisti no negativno zna ilen). Na drugi strani se lahko u inek kvantitativnega spro– anja vidi preko depozitov, saj je ta pozitivno vplival na ban na posojila v 2015 za banke obrobnih drflav. Koliko od tega pove anja depozitov je mo pripisati vplivu kvantitativnega spro– anja, pa je pod vpra–ajem.
- Koeficient donosnosti je statisti no pozitiven, kar pomeni, da je dobi konosnost pozitivno povezana s kreditno aktivnostjo bank v letu 2015. eprav je to v skladu s teorijo, pa se tu pojavi problem vzro nosti. Na eni strani pove ano kreditiranje ustvarja vi–je prihodke od obresti, kar vodi v izbolj–anje donosnosti, na drugi strani pa bolj–a donosnost omogo a dostop bankam do ve jega financiranja njihovih potreb, kar nakazuje na pozitiven odnos s posojilno dejavnostjo. Ne glede na to, se je donosnost v letu 2015 izbolj–ala, saj so mnoge banke zmanj–ale velikost svojih bilanc.
- Kapitalski koli nik je prav tako vplival na kreditno aktivnost v 2015, a negativno. eprav se je le ta izbolj–al za mnoge banke v letu 2015, se to izbolj–anje ni odrazilo v

povečani rasti posojil. Gre za izboljšanje na račun zmanjšanja velikosti sredstev na eni strani in izboljšanje kapitalskih količnikov kot posledica povečanih kapitalskih zahtev v okviru novih regulativnih zahtev.

- Rast BDP in inflacija sta negativno vplivala na rast posojil v letu 2015 v evrskem območju.

- Nadaljnja raziskava, preko dinamičnega modela je pokazala, da je količnik likvidnosti iz predhodnega obdobja statistično pozitiven. Gre za pridobitev likvidnosti v preteklem letu tudi preko dveh programov kvantitativnega sproščanja, ki sta se začela v 2014, ki jo banke uporabijo za kreditiranje v naslednjem letu. To pokaže, da tovrsten ukrep vpliva na kreditiranje z zamikom. Vendar pa je ECB v tem letu uporabila več ukrepov, ki so tudi ciljali likvidnost in s tem morebiti pomagali pri povečani kreditni dejavnosti.

- V vseh pregledih rezultatov glede na podvzorce, se rezultati niso bistveno spremenili in ostajata količnik likvidnosti in količnik depozitov statistično neznačilna.

Nadaljnja analiza o vplivu kvantitativnega sproščanja na bančno posojanje je vsekakor potrebna. Predvsem zato ker je potreben določen čas, da bi kvantitativno sproščanje lahko delovalo preko bančnega posojilnega kanala. Skladno s tem je pomanjkljivost te studije kratka časovna serija, da bi se lahko temeljito preučil učinek kvantitativnega sproščanja na bilance bank. Na drugi strani pa bi bilo morda potrebno razširiti vzorec in vključiti tudi tiste banke, ki niso pod neposrednim nadzorom banke. Kljub temu pa je pomembno, da se oceni vpliv kvantitativnega sproščanja na kreditno aktivnost že v prvem letu zaradi različnih prilagoditev, ki bi jih bilo potrebno uvesti na program in s tem izboljšati njegovo delovanje. Na drugi strani pa učinek na kreditno aktivnost v 2015 ni bil razviden tudi zato, ker so banke še vedno obremenjene s slabimi posojili in so aktivno vključene v čiščenje svojih bilanc. Banke so prav tako obremenjene z novimi obveznimi zahtevami, hkrati pa se soočajo tudi s povečano konkurenco. Ne glede na to, pa se glavni cilj (tj. stabilnost cen) postopoma izboljšuje. Zato je pomembno, da se ne dovolj zgodaj razmišljati o verodostojnem izhodu, da bi se izognili ali vsaj zmanjšali tveganja povezana s tem.

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APPENDIXES

TABLE OF APPENDIXES

APPENDIX A: List of commonly used abbreviations

ABSPP	Asset-backed Securities Purchase Programme
APP	Asset Purchase Programme
CBPP	Covered Bond Purchase Programme
CSPP	Corporate Sector Purchase Programme
DM	Debt Monetisation
EA	Euro area
ECB	European Central Bank
ESM	European Stabilization Mechanism
EU	European Union
Fed	Federal Reserve
FG	Forward Guidance
FRFA	Fixed-rate, full allotment
GAAP	Generally Accepted Accounting Principles
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
IDD	Independently and Identically Distributed
LSAP	Large-scale Asset Purchase
LTRO	Long-term Refinancing Operation
MBS	Mortgage-Backed Securities
MMT	Modern Monetary Theory
NCB	National Central Bank
NIR	Negative Interest Rate
NPL	Non-performing Loans
OMF	Overt Monetary Financing
OMT	Outright Monetary Transactions
PSPP	Public Sector Purchase Programme
QE	Quantitative Easing
SDW	Statistical Data Warehouse
SMP	Securities Market Programme
SSM	Single Supervisory Mechanism
TLTRO	Targeted Longer-term Refinancing Operation
UK	United Kingdom
US	United States
VLTRO	Very Long-term Refinancing Operation

APPENDIX B: Accounting rules for the purpose of reporting loans

The definition of the accounting rules for the purpose of statistical reporting (including loans) is provided in the Article 8 of the Regulation (EU) No 1071/2013 of the European Central Bank of 24 September 2013 concerning the balance sheet of the monetary financial institutions sector (recast) (ECB/2013/33).

Article 8 defines that:

- loans shall be reported at their principal amount outstanding at the end of the month,
- write-offs and write-downs as determined by the relevant accounting practices shall be excluded from this amount,
- loans shall not be netted against any other assets or liabilities,
- all financial assets shall be reported on a gross basis for statistical purposes.

APPENDIX C: List of banks in the sample

Table 1. List of significant entities under SSM regulation used in the sample

No.	Bank name	Country	Grounds for significance
1.	Erste Group Bank AG	Austria	Size (total assets: þ200 bn)
2.	Raiffeisen-Landesbanken-Holding GmbH	Austria	Size (total assets: þ138 bn)
3.	Raiffeisen-Holding Niederösterreich-Wien reg.Gen.mbH	Austria	Size (total assets: þ29 bn)**
4.	Sberbank Europe AG	Austria	Significant cross-border assets
5.	AXA Bank Europe S.A.	Belgium	Size (total assets: þ31 bn)
6.	Belfius Banque S.A.	Belgium	Size (total assets: þ177 bn)
7.	Dexia S.A.	Belgium	Size (total assets: þ230 bn)
8.	KBC Group NV	Belgium	Size (total assets: þ252 bn)
9.	Banque Degroof Petercam S.A.	Belgium	Significant cross-border assets
10.	Bank of Cyprus Public Company Ltd	Cyprus	Total assets above 20 % of GDP
11.	Cooperative Central Bank Ltd	Cyprus	Total assets above 20 % of GDP
12.	Hellenic Bank Public Company Limited	Cyprus	Total assets above 20 % of GDP
13.	Aareal Bank AG	Germany	Size (total assets: þ52bn)
14.	Bayerische Landesbank	Germany	Size (total assets: þ216 bn)
15.	Commerzbank AG	Germany	Size (total assets: þ533 bn)
16.	DekaBank Deutsche Girozentrale	Germany	Size (total assets: þ108 bn)
17.	Deutsche Bank AG	Germany	Size (total assets: þ1,629 bn)
18.	DZ Bank AG Deutsche Zentral-Genossenschaftsbank	Germany	Size (total assets: þ408 bn)
19.	Deutsche Pfandbriefbank AG	Germany	Size (total assets: þ67 bn)
20.	HSH Nordbank AG	Germany	Size (total assets: þ97 bn)
21.	Landesbank Baden-Württemberg	Germany	Size (total assets: þ234 bn)
22.	Landesbank Hessen-Thüringen Girozentrale	Germany	Size (total assets: þ172 bn)
23.	Landwirtschaftliche Rentenbank	Germany	Size (total assets: þ93 bn)
24.	Norddeutsche Landesbank óGirozentrale	Germany	Size (total assets: þ181 bn)
25.	Volkswagen Financial Services AG	Germany	Size (total assets: þ121 bn)
26.	SEB AG	Germany	Size (total assets: þ22 bn)**
27.	Banco Bilbao Vizcaya Argentaria, S.A.	Spain	Size (total assets: þ750 bn)
28.	Banco de Sabadell, S.A.	Spain	Size (total assets: þ209 bn)
29.	Banco Mare Nostrum, S.A.	Spain	Size (total assets: þ41 bn)
30.	Banco Popular Español, S.A.	Spain	Size (total assets: þ159 bn)
31.	Banco Santander, S.A.	Spain	Size (total assets: þ1,340 bn)
32.	Bankinter, S.A.	Spain	Size (total assets: þ59 bn)
33.	Ibercaja Banco, S.A.	Spain	Size (total assets: þ59 bn)
34.	Criteria Caixa S.A.U.	Spain	Size (total assets: þ356 bn)
35.	Kutxabank, S.A.	Spain	Size (total assets: þ58 bn)
36.	Liberbank, S.A.	Spain	Size (total assets: þ42 bn)
37.	Unicaja Banco, S.A.	Spain	Size (total assets: þ35 bn)
38.	BFA Tenedora De Acciones S.A.U.	Spain	Size (total assets: þ214 bn)
39.	OP Financial Group (OP Osuukunta)	Finland	Size (total assets: þ125 bn)

(table continues)

Table 1. List of significant entities under SSM regulation used in the sample

40.	Danske Bank Plc	Finland	Size (total assets: þ30 bn)
41.	Kuntarahoitus Oyj	Finland	Size (total assets: þ34 bn)
42.	Nordea Pankki Suomi Oyj	Finland	Size (total assets: þ302 bn)
43.	BNP Paribas	France	Size (total assets: þ1,994 bn)
44.	Bpifrance S.A. (Banque Publique dØInvestissement)	France	Size (total assets: þ45 bn)
45.	BPCE S.A.	France	Size (total assets: þ724 bn)
46.	Crédit Agricole S.A.	France	Size (total assets: þ1,529 bn)
47.	La Banque Postale	France	Size (total assets: þ219 bn)
48.	RCI Banque SA	France	Size (total assets: þ37 bn)
49.	SFIL S.A.	France	Size (total assets: þ84 bn)
50.	Société générale S.A.	France	Size (total assets: þ1,334 bn)
51.	Agence Francaise de Developpement	France	Size (total assets: þ36 bn)
52.	HSBC France	France	Size (total assets: þ168 bn)
53.	Alpha Bank, S.A.	Greece	Size (total assets: þ69 bn)
54.	Eurobank Ergasias, S.A.	Greece	Size (total assets: þ74 bn)
55.	National Bank of Greece, S.A.	Greece	Size (total assets: þ111 bn)
56.	Piraeus Bank, S.A.	Greece	Size (total assets: þ88 bn)
57.	Allied Irish Banks, public limited company	Ireland	Size (total assets: þ103 bn)
58.	permanent tsb Group Holdings plc	Ireland	Size (total assets: þ29 bn)**
59.	The Governor and Company of the Bank of Ireland	Ireland	Size (total assets: þ131 bn)
60.	Ulster Bank Ireland Limited	Ireland	Size (total assets: þ31 bn)
61.	Banca Carige S.p.A. ó Cassa di Risparmio di Genova e Imperia	Italy	Size (total assets: þ30 bn)
62.	Banca Monte dei Paschi di Siena SpA	Italy	Size (total assets: þ169 bn)
63.	Banca popolare dellØEmilia Romagna Società Cooperativa	Italy	Size (total assets: þ61 bn)
64.	Banca Popolare di Milano - Società Cooperativa a responsabilità Limitata	Italy	Size (total assets: þ50 bn)
65.	Banca Popolare di Sondrio, Società Cooperativa per Azioni	Italy	Size (total assets: þ36 bn)
66.	Banca Popolare di Vicenza Società per Azioni	Italy	Size (total assets: þ40 bn)
67.	Banco Popolare ó Società Cooperativa	Italy	Size (total assets: þ121 bn)
68.	Credito Emiliano Holding S.p.A.	Italy	Size (total assets: þ37 bn)
69.	ICCREA Holding S.p.A.	Italy	Size (total assets: þ49 bn)
70.	Intesa Sanpaolo S.p.A.	Italy	Size (total assets: þ677 bn)
71.	Mediobanca ó Banca di Credito Finanziario S.p.A.	Italy	Size (total assets: þ70 bn)
72.	UniCredit S.p.A.	Italy	Size (total assets: þ860 bn)
73.	Unione di Banche Italiane Società per Azioni	Italy	Size (total assets: þ117 bn)

(table continues)

(continued)

74.	Veneto Banca S.p.A.	Italy	Size (total assets: þ33 bn)
75.	Banque et Caisse dǿEpargne de lǿEtat, Luxembourg	Luxembourg	Size (total assets: þ43 bn)
76.	Precision Capital S.A.	Luxembourg	Size (total assets: þ33 bn)
77.	RBC Investor Services Bank S.A.	Luxembourg	Total assets above 20 % of GDP
78.	ABLV Bank, AS	Latvia	Among the three largest credit institutions in the Member State
79.	AS SEB Banka	Latvia	Among the three largest credit institutions in the Member State
80.	Swedbank AS	Latvia	Total assets above 20 % of GDP
81.	Bank of Valletta plc	Malta	Total assets above 20 % of GDP
82.	HSBC Bank Malta p.l.c.	Malta	Total assets above 20 % of GDP
83.	Medifin Holding Limited	Malta	Among the three largest credit institutions in the Member State
84.	ABN AMRO Group N.V.	Netherlands	Size (total assets: þ390 bn)
85.	Coöperatieve Rabobank U.A..	Netherlands	Size (total assets: þ670 bn)
86.	ING Groep N.V.	Netherlands	Size (total assets: þ842 bn)
87.	Bank Nederlandse Gemeenten N.V.	Netherlands	Size (total assets: þ150 bn)
88.	Banco BPI, S.A.	Portugal	Size (total assets: þ41 bn)
89.	Banco Comercial Português, S.A.	Portugal	Size (total assets: þ75 bn)
90.	Caixa Geral de Depósitos, S.A.	Portugal	Size (total assets: þ101 bn)
91.	Nova Kreditna Banka Maribor, d.d.	Slovenia	Among the three largest credit institutions in the Member State
92.	Nova Ljubljanska Banka, d.d.	Slovenia	Total assets above 20 % of GDP
93.	Abanka d.d.	Slovenia	Among the three largest credit institutions in the Member State
94.	Swedbank AS	Estonia	Total assets above 20 % of GDP
95.	AB DNB bankas	Lithuania	Among the three largest credit institutions in the Member State
96.	AB SEB bankas	Lithuania	Among the three largest credit institutions in the Member State
97.	šSwedbankö, AB	Lithuania	Among the three largest credit institutions in the Member State
98.	Slovenská sporite a, a.s.	Slovakia	Among the three largest credit institutions in the Member State
99.	Tatra banka, a.s	Slovakia	Among the three largest credit institutions in the Member State
100.	V–eobecná úverová banka, a.s.	Slovakia	Among the three largest credit institutions in the Member State

Legend:

**   entities directly supervised pursuant to the three years-rule according to SSM Framework Regulation

-    total assets as of 2015 in billion

Source: ECB (n.d.): *Banking Supervision.*

APPENDIX D: Definition and the source of variables

Table 2. Definition and the source of variables in the estimation model

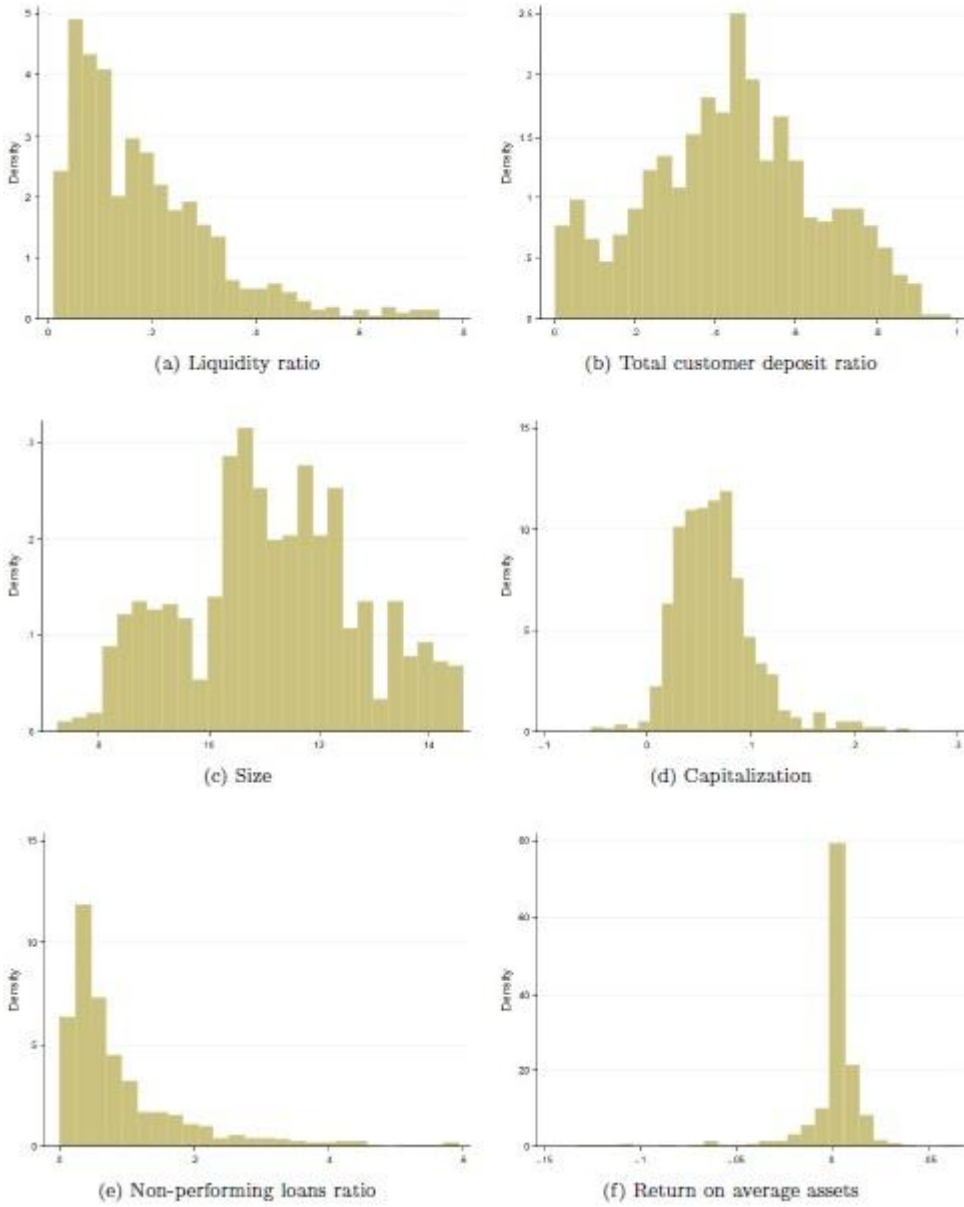| Variable	Definition	Data source
Endogenous variable		
ê lnGL	The growth of the natural logarithm of gross loans	BankScope
Bank specific variables		
LR	Liquidity ratio It is calculated as: liquid assets/total assets	BankScope
DEP	The ratio of deposits and short term borrowing to total assets. It is calculated as: (deposits + short term borrowing)/total assets Deposits + short term borrowing include: total customer deposits, deposits from banks, other deposits and short term borrowing.	BankScope
TCD	The ratio of total customer deposits to total assets	BankScope
SIZE	The natural logarithm of total assets representing a proxy for the size of bank.	BankScope
CAP	A measure of capitalization representing the ability to absorb losses. It is calculated as: total equity/total assets	BankScope
NPL	Non-performing loans ratio representing a measure of credit risk. It is calculated as: non-performing loans/total gross loans	BankScope
ROAA	One of the measures of the profitability of the bank. Return on average assets. It is calculated as: net income/average assets	BankScope
Macroeconomic variables		
GDP	Annual percentage growth rate of GDP at market prices based on constant local currency.	World Bank
INF	Inflation rate measured by the consumer price index; reflecting the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services.	World Bank
IR	A measure of composite cost of borrowing indicator for long-term loans to both households and non-financial corporations.	ECB SDW
Bank type (specialization) variables		
Bank holdings dummy	Takes the value of 1 if the bank is a bank holdings else 0	BankScope
Commercial bank dummy	Takes the value of 1 if the bank is a commercial bank else 0	BankScope
Savings bank dummy	Takes the value of 1 if the bank is a savings bank else 0	BankScope
Cooperative bank dummy	Takes the value of 1 if the bank is a cooperative bank else 0	BankScope
Real estate and mortgage bank dummy	Takes the value of 1 if the bank is a real estate and mortgage bank else 0	BankScope
Specialized governmental credit institution dummy	Takes the value of 1 if the bank is a specialized governmental credit institution else 0	BankScope
Finance company dummy	Takes the value of 1 if the bank is a finance company else 0	BankScope
Clearing and custody institution dummy	Takes the value of 1 if the bank is a clearing and custody institution else 0	BankScope

APPENDIX E: Average bank features by country for the entire period

Table 3. Average bank features by country for the entire period (2008ó2015)

| Country	Number of banks	ê Gross loans (annual growth rate)	LR (% of total assets)	DEP (% of total assets)	SIZE (þ millions)	CAP (%of total assets)	NPL (% of total gross loans)	ROAA (% of average assets)
Austria	4	3.8	22.7	73.1	98,618	7.9	10.4	-0.1
Belgium	5	1.4	21.3	64.3	190,647	4.5	3.4	0.2
Cyprus	3	1.0	18.3	87.3	19,446	6.7	27.5	-1.6
Estonia	1	-9.7	23.8	77.6	14,112	15.5	6.0	1.2
Finland	4	6.8	16.3	53.2	112,375	5.1	1.4	0.4
France	10	8.0	28.8	44.2	635,061	6.1	4.2	0.4
Germany	14	5.8	28.7	48.8	326,191	3.9	4.4	0.1
Greece	4	5.3	8.0	83.7	81,258	4.9	22.6	-1.3
Ireland	4	-5.4	11.0	68.7	102,812	8.2	20.5	-1.3
Italy	14	3.0	13.3	57.7	172,435	7.4	11.2	-0.1
Latvia	3	-4.3	25.8	80.7	4,183	10.9	10.6	0.5
Lithuania	3	-1.5	20.3	84.9	5,646	10.9	11.3	0.3
Luxembourg	3	4.4	33.2	81.4	27,055	7.5	2.0	0.4
Malta	3	9.1	19.6	84.5	5,987	6.7	5.1	1.0
The Netherlands	4	1.4	13.7	52.9	588,058	3.6	2.3	0.2
Portugal	3	-0.9	9.6	69.4	81,855	5.1	4.3	0.1
Slovakia	3	8.7	9.8	79.2	10,993	9.6	5.5	1.3
Slovenia	3	-3.0	9.4	75.5	8,217	8.7	21.4	-2.0
Spain	12	1.2	7.7	66.3	260,910	6.0	8.2	0.2

APPENDIX F: Density plots of the main bank specific variables

Figure 1. Density plots of the main bank specific variables (i.e. LR, TCD, SIZE, CAP, NPL and ROAA)

(a) Liquidity ratio

(b) Total customer deposit ratio

(c) Size

(d) Capitalization

(e) Non-performing loans ratio

(f) Return on average assets

APPENDIX G: Graphical illustration of the data for the subsamples in robustness checks

Figure 2. Box plot of liquidity ratio and total customer deposit ratio based on the subsamples according to size, period from 2008 to 2015
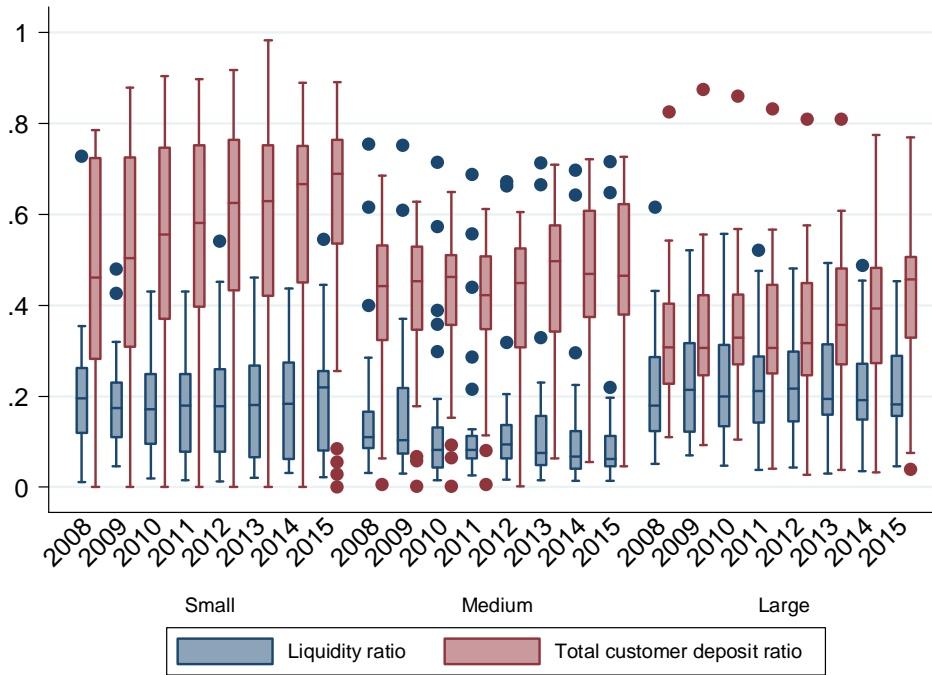
Figure 3. Box plot of liquidity ratio and total customer deposit ratio based on the subsamples according to specialization, period from 2008 to 2015
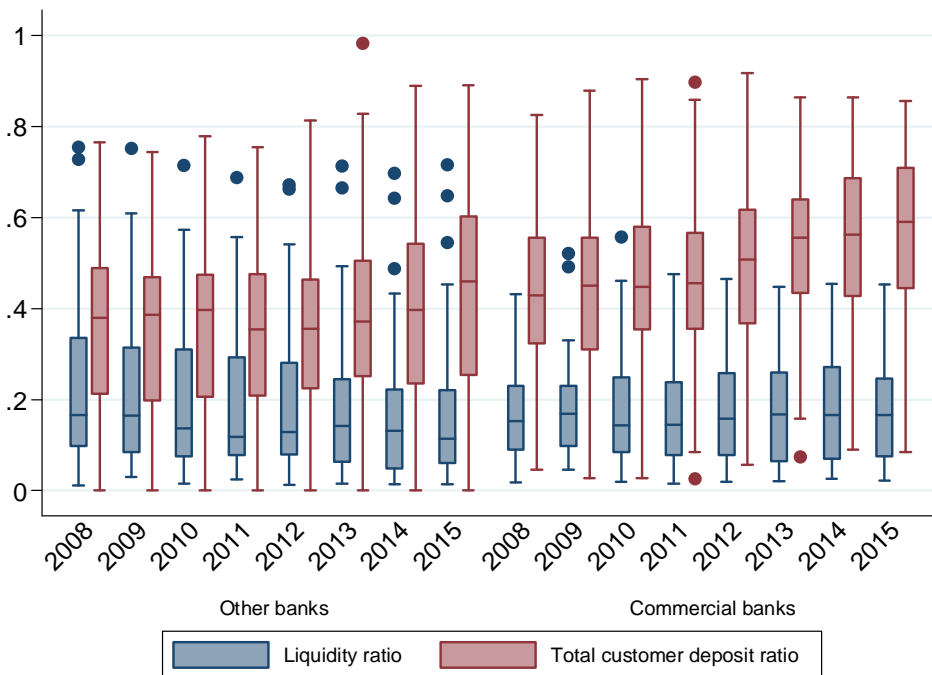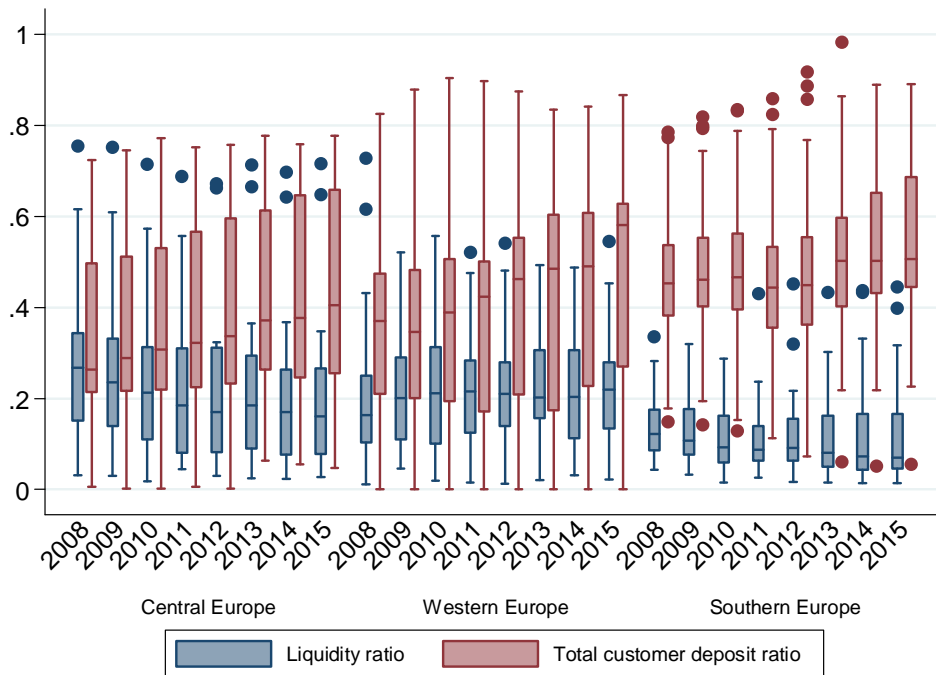
Figure 4. Box plot of liquidity ratio and total customer deposit ratio based on the subsamples according to geographical location, period from 2008 to 2015

APPENDIX H: Results for the effect of 3-year LTRO on bank credit supply

Table 4. Estimation results of the effect of 3-year LTRO on bank credit supply

Variables	Equation 2			
	First model	Second model	Third model	Fourth model
Intercept	-0.0040192	0.0018782	0.0027799	0.0154138
LR	-0.0172330*	-0.0207210**	-0.0192132*	-0.0223004**
TCD	0.0059165	0.0051989	0.0049620	0.0052152
SIZE	0.0002670	-0.0000493	-0.0001523	-0.0003684
CAP	0.0360445	-0.0186854	-0.0137125	-0.0202937
NPL	-0.0254916*	-0.0000482	-0.0017354	-0.0058025
ROAA		0.2056108***	0.2123675***	0.1883746***
GDP			-0.0264300	-0.0260446
INF				-0.0868233
IR				-0.1815764

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.

Table 5. Estimation results of the effect of 3-year LTRO on bank credit supply using tier 1 capital ratio and return on average equity

Variables	Equation 2			
	First model	Second model	Third model	Fourth model
Intercept	-0.0113397	-0.0048536	-0.0031779	0.0218658*
LR	-0.0119954	-0.0134945*	-0.0118972	-0.0163995*
TCD	0.0118642*	0.0102126*	0.0099406*	0.1046630*
SIZE	0.0009028	0.0007739	0.0006045	0.0001546
TIER1	-0.0194042	-0.0517030**	-0.0489962**	-0.0725962***
NPL	-0.0190932	-0.0137038	-0.0161429	-0.0190244**
ROAE		0.0040919***	0.0042339***	0.0040526***
GDP			-0.0289829	-0.0419522
INF				-0.0735713
IR				-0.3663784**

Note. Superscripts *, ** and *** indicate significance levels of 10%, 5% and 1% respectively.