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Comparison of monetary policy effects on lending channel in EMU and non-EMU countries: Evidence from period 1999-2012

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Abstract

Tomáš Heryán, Iveta Palečková, Nemanja Radić: **Comparison of monetary policy effects on lending channel in EMU and non-EMU countries: Evidence from period 1999-2012.**

Current study has focused on the bank lending channel of monetary transmission in EU countries. The aim of the paper is to carry out an empirical investigation of the bank lending channel of monetary transmission in EMU and non-EMU countries. As estimation method we use GMM model with pooled annual data as it was used in previous studies. Our estimation period is from 1999 to 2012. Contribution of the study is in three major ways: (i) we investigated independently panel of EMU and non-EMU countries; (ii) we examined the interaction terms between the bank characteristics and both monetary policy indicators, short-term interest rates and monetary aggregate M2; (iii) we discussed about possible quantitative easing by the European Central Bank. We have proved some differences between the bank lending channels of monetary transmission of both, the EMU and non-EMU. It has also been proved a higher impact of M2 development than a development of short-term interest rates. Finally, there are definitely some monetary policy implications, too.

Key words

monetary policy, bank landing channel, EMU countries, non-EMU countries, GMM

JEL: E52, C51

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Introduction

The European banking sector has undergone many significant changes in last two decades. While at the micro-level it passed through many mergers and acquisitions that change some selected banks into large international financial groups, at macro-level it passed through the establishing of common currency and whole euro area, which was connected with some monetary policy changes for European countries, as well. Undoubtedly, banks do their business under pressure of monetary rules and they must exist in some macroeconomic environment. Therefore we have to pay attention to a development of particular macroeconomic variables i.e. inflation, key interest rates as well as monetary aggregates, too.

The main objective of this study is to carry out an empirical investigation of the bank lending channel of monetary transmission in EMU and non-EMU countries. We summarize the contribution of this study as follows. Firstly, we investigate independently panel of EMU and non-EMU countries. This comparison should reveal particular differences existing due to common euro currency. Secondly, we examine the interaction terms between the bank characteristics and both monetary policy indicators, short-term interest rates and monetary aggregate M2. Due to the gap in literature we would like to compare relations which exist between credit market and either short-term interest rates (see Kashyap and Stein, 1995, 2000; Ehrmann et al., 2003; Gambacorta, 2005; Matousek and Sarantis, 2009; Akinci et al., 2013), or also nowadays non-existing monetary aggregate M2 to find its relevance for the transmission mechanism. Thirdly, we employ discussion about possible quantitative easing by the European Central Bank and its possible positives as well as future risks.

Tsionas et al. (2015) argue that research focusing on the performance of European banks has attracted considerable attention over the last two decades. Altunbaş et al. (2002) argued while there is a widespread agreement that banks play a part in the transmission of monetary policy, there is considerable controversy over the precise role that banks play. The Eurosystem (comprising the European Central Bank and the national central banks of Member States which adopted the euro) has assumed the task of conducting the single monetary policy for the euro area. Monetary policy, however, cannot directly control euro area price developments, but has to operate through a complex transmission process (ECB, 1999).

In general, the level of banking sector concentration increased in EU markets between 1993 and 2001 as the largest banks increased market share; within the EU concentration tends to be highest in the smaller countries (Teplý et al., 2010). Heterogeneity in management quality in banks operating in the EU highlights bank regulators' role in monitoring foreign subsidiaries and financial flows across markets and institutions, argue Barros et al. (2007). Their evidence supports arguments that competitive, well regulated markets and the promotion of private property rights and contractual rights help banks realize efficiency advantages that can be exported successfully. On average, the best performing banks are larger, considerably more loans intensive, profit efficient and cost efficient than their worst performing counterparts. Location does not convey any performance-related advantage due to them. Whilst the probability of worst performance is explained by location, the evidence concerning the microeconomic determinants of bank performance is ambiguous. Performance, however, is explained by balance sheet structure and size.

The remainder of this paper is organized as follows. Section 1 discusses the contemporary issues and main changes within European monetary policy in last two decades. Sections 2 and 3 provide the literature review and describe the data and methodology. Section 4 discusses

the empirical results and then it has been made particular policy implications for monetary policy in section 5. Finally, last section concludes findings and results.

1. European monetary policy: an overview from past two decades

Current study does not focus on the financial crises problematic. We skip both crises, the global financial crisis and the euro crisis in whole article, even whether the global economy suffered from that in this period. Nonetheless, we investigate some related studies connected with the current problematic and the financial crisis issue (see e.g. Tsionas et al., 2015; Fungáčová et al., 2014). We only reported monetary policy changes from the Global financial crisis period in this section. Although our research is concentrated on all EU countries, we have targeted our interest only on the EMU, just in the rest of this section, to do not make this section a bit confusing, too.

On 22 December 1998 the Governing Council of the ECB announced the ECB interest rates to be applied under the new regime (ECB, 1999). The primary objective of the ECB's monetary policy is to maintain price stability (as defined in Article 105 of the Treaty). The ECB aims at inflation rates of below, but close to, 2% over the medium term. Governing Council in October 1998 defined price stability as a year-on-year increase in Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%. Price stability is to be maintained over the medium term. This 2% inflation target is considered optimal for promoting growth and employment. ECB (2000, p. 43) presents detailed information about the monetary transmission mechanism in the euro area. Inflation growth is important for GDP growth and due to that for lending channel, as well.

Euro area HICP inflation was, on average, 2.04% over the period from January 1999 to the onset of the financial crisis in August 2007. Especially, long-term inflation expectations in the euro area have, since 1999, fluctuated in the range of 1.8% - 2%, and, from 2003 to 2007, in the narrower range of 1.9% - 2%. Until 2008, a number of cyclical and structural factors worked together in the emergence and persistence of inflation differentials. In particular, mispricing of risk, overly optimistic expectations concerning future income prospects and inappropriate national policies played a role. By contrast, since 2008, developments in inflation differentials appear to be mostly related to changes in national policies aimed at reducing imbalances (ECB, 2012).

In 1999 the ECB managed to steer short-term money market rates by means of the interest rate which was applied to the main refinancing operations. The overnight interest rate, as measured by the EONIA (the euro overnight index average), was generally very close to the rate applied to the main refinancing operations. The volatility of the EONIA rate was relatively low. Other money market rates were equally stable. After the announcement of the decision of the Governing Council to reduce ECB interest rates in April 1999, money market rates declined further (ECB, 2001). Consistent with an assessment that pointed to the existence of upward risks to price stability, the key ECB interest rates were increased in 2000 and 2001.

The monetary policy decisions taken in 2002 were in the light of the significant reduction in the key ECB interest rates (by a total of 150 basis points). In June 2003 the key ECB interest rates were also lowered (by 50 basis points). It reflected the overall assessment in the first half of the year 2003 that medium-term inflationary pressures were moderating (ECB, 2003). Therefore it is assumed that there should be a relation between inflation, short-term interest rates and lending channel, too.

Developments in key ECB interest rates in 2008 reflected the evolution of risks to price stability over the medium term, which were strongly influenced by two global phenomena: developments in international commodity prices, particularly energy and food prices; and the economic impact of the ongoing financial turmoil, which intensified in mid-September 2008. In 2009, in response to subdued inflationary pressures in the context of a severe economic downturn in the euro area and elsewhere, the Governing Council further reduced the key ECB interest rates substantially. The Governing Council lowered the rate on the main refinancing operations to a level not seen in recent history in the countries of the euro area.

As it was highlighted, there is some gap among existing literature and none of that use monetary aggregate to estimate relations within lending channel. Narrow money (M1) includes currency, i.e. banknotes and coins, as well as balances that can immediately be converted into currency or used for cashless payments, i.e. overnight deposits. “Intermediate” money (M2) comprises narrow money and deposits with maturities of up to two years and deposits redeemable at notice of up to three months. Broad money (M3) comprises M2 and marketable instruments issued by the MFI sector (ECB, 1999).

Since monthly fluctuations in monetary data may be volatile, the Governing Council of the ECB analyses monetary developments on the basis of a three-month moving average of twelve month growth rates of M3. The significant increase in the rate of growth of M3 in January 1999 mainly reflected the acceleration of overnight deposits. As a result of the large (seasonally adjusted) expansion of the sum of currency in circulation and overnight deposits in the first half of year 1999, the annual growth rate of the narrow monetary aggregate M1 increased. In 1999 the annual growth rate of M1, M2 and M3 rose.

The annual rate of growth of M3 increased to 9.7% in December 2006. M1 decreased in December 2007 and it was decreasing during the whole year 2008. The annual rate of growth of M1 decreased to 0.5% in July 2008. Despite moderating, the annual growth rate of the monetary aggregate M3 remained vigorous. A number of temporary factors, particularly the relatively flat yield curve, suggested that M3 growth was overstating the pace of the underlying monetary expansion. In January 2009 the annual rate of growth of M3 decreased to 5.9%, on the other hand the annual rate of growth of M1 increased to 5.2%.

2. Literature Review

Numerous studies have been published, driven by the international importance of European banks, and the recent economic challenges, which forced additional performance improvements in banking operations, both in terms of containing operational costs, and increasing revenue sources. But it was firstly shown by Bernanke and Blinder (1992), macroeconomic time series are not helpful in identifying a lending channel that is actually the sub-channel of a credit channel. Aggregate data do not allow us to distinguish between supply and demand factors that affect bank lending activities. Disaggregated data on banks, on the other hand, may effectively capture the distributional effects of monetary policy through a bank lending channel (BLC).

The presence of a lending channel is typically tested by assuming three bank characteristics. Kashyap and Stein (1995, 2000) and Kishan and Opiela (2000) consider the size of banks as one of these characteristics. It is assumed that small banks are more prone to the problem of information asymmetry than large banks and that large banks can issue market instruments such as certificate of deposits. This implies a higher sensitivity of small banks to monetary policy shocks. The second bank characteristic is liquidity. Evidence provided by

Kashyap and Stein (2000) and Ehrmann et al. (2003) shows that liquid banks can insulate their loan portfolios by reducing their liquid assets, while less liquid banks are unable to do so. Finally, bank capitalization is another characteristic used in some BLC models. Peek and Rosengren (1995) and Kishan and Opiela (2000, 2006) argue that poorly capitalized banks reduce their loan supply more than well capitalized banks after a monetary contraction, due to their limited ability to tap into uninsured sources of funds. Hence, the size, liquidity and capitalization of banks are all expected to be positively correlated with bank loans.

Two approaches have been employed in the empirical literature for testing the bank lending channel. One is to divide banks by size, capitalization and liquidity (e.g. Kashyap and Stein, 1995, 2000; Kishan and Opiela, 2000, 2006; Altunbaş et al., 2002). This approach requires a large number of banks, which is not a problem for the USA. The alternative approach is to use a panel data model that allows the reaction of bank loans to monetary policy to become dependent on the bank characteristics, as in Ehrmann et al. (2003). This approach avoids the above problem associated with the number of banks, and this is used in our paper. The authors develop a model of the loans market that draws upon Bernanke and Blinder (1988). The solution of their model yields an equation for bank loans that relates the response of bank loans to monetary policy both directly (via the money channel) and to bank characteristics (through the bank lending channel).

Arestis and Sawyer (2002) showed and summarized a new approach to monetary policy where monetary policy becomes identified with interest rate policy with little or no reference to the stock of money. Monetary policy can be seen as aggregate demand policy in that the interest rate set by the Central Bank is seen to influence aggregate demand which in turn is thought to influence the rate of inflation. They suggested that empirical results point to a relatively weak effect of interest rate changes on inflation. They showed that monetary policy can have long-run effects on real magnitudes. This particular result does not fit comfortably with the theoretical basis of current thinking on monetary policy.

There is several empirical literature sources regarding the monetary policy in Eurozone, as well. Stated Arghyrou (2009), following the launch of the European Economic and Monetary Union (EMU) in 1999 the focus of attention of the empirical literature on monetary policy in Europe has gradually been shifting from modelling national monetary policies towards that of the European Central Bank (e.g. Gerlach and Schnabel, 2000; Mihov, 2001; Domenech et al., 2002; Surico, 2003; Surico, 2007; Clausen and Hayo, 2005; Hayo and Hofmann, 2006 or Siklos et al., 2011). Some authors compare monetary policy before and after joined EMU. Arghyrou (2009) examined e.g. monetary policy in the 1990s in Greece, he focused on monetary policy before and after the Euro. Bleich and Fendel (2012) analysed monetary policy conditions in Spain before and after the changeover to the Euro as the single European currency they found that it contributed to stabilizing the Spanish economy. They also found that the monetary policy stance of the European Central Bank since 1999 which was appropriate for the euro area as a whole was too expansionary for Spain's economy.

It has been proved in Berger (2003) that the implementation of the European Monetary Union (EMU) may also increase cross-border consolidation by improving trade, reducing the currency conversion costs, and lowering the costs to consumers and businesses of purchasing services from foreign institutions. He investigated also the effects of consolidation of financial institutions on the supply of relationship lending services to informationally opaque small businesses. He argue, the consolidation of the banking industry into large, international banking organizations may result in disruptions in the supply of relationship credit to small businesses and the loss of relationship information built up over time.

As was also argued in Fungáčová et al. (2014), monetary tightening may force some banks to reduce their loan supply. These reductions will however differ across banks. Banks with less access to alternative funding sources will probably be hit harder and thus cut their lending more than will the other banks. Access to alternative funding sources may depend not only on individual bank characteristics such as bank size, capitalization and liquidity, but also on the structure of the banking sector and the market power of individual financial institutions (see Kashyap and Stein, 1995, 2000; Ehrmann et al., 2003; Gambacorta, 2005; Matousek and Sarantis, 2009; Akinci et al., 2013).

Teplý et al. (2010) argue that the mergers and acquisitions (M&A) in the 1998 – 2007 wave within the European banking sector contributed to a consolidation process. Further consolidation efforts are expected due to their opinion, the rise of M&A activity was forerun by fundamental changes in external environment, such as deregulation, introduction of euro, technological progress and changing customer demand. These external factors undoubtedly induced the M&A wave, as they increased the potential profitability of merging and acquiring. Due to them the M&A deal values, as well as the average deal value, increased sharply since 1997. The wave peaked in 2000 and slowed down since then with deceleration of overall economic activity. They noted, the introduction of single European currency and releasing FSAP in 1999 had strong impact on deepening the financial service market integration, as well. A notable decline in M&A activity since 2001 was in line with an overall economic recession. Since 2004, the number and value of banking transactions has been on rise again.

Drudi et al. (2012) described the actions taken by the European Central Bank during each phase (the crisis from August 2007 can be divided into three main phases: the financial turmoil from August 2007 to the collapse of Lehman Brothers; the global financial crisis from September 2008 until spring 2010; and the Eurozone sovereign debt crisis from spring 2010 to the current period) and explained the rationale for such measures. They also discussed the need to strengthen further the economic union in order to guarantee the sustainability of the monetary union of the Eurozone. It is argued that the recent institutional adjustments made at the European Union level would have been necessary independently of the financial crisis.

Lessons from the recent financial crisis for the monetary policy described Mishkin (2011). Some of lessons are e.g. that there is a stronger case for monetary policy to lean against credit bubbles, rather than just cleaning up after the bubble has burst (more information about assets price bubbles and monetary policy is described in ECB, 2005). Next, the financial crisis has made it clear that the interactions between the financial sector and the aggregate economy imply that monetary policy and financial stability policy are closely intertwined.

3. Data and methodology

Data on banks were obtained from Bankscope, main statistical database of bank data in Europe. The analysis includes all 28 countries from the European Union. Annual data on all commercial banks from these EU28 countries that are listed in Bankscope are included in our empirical investigation. Total number was 1137 banks with its annual frequency data from period 1997 to 2012. Selected macroeconomic data were also obtained from World Bank statistical database. We use nominal GDP in current prices, inflation, and monetary aggregate as percentages from GDP for all European countries. Short-term interest rates were obtained from Eurostat for each country. Even whether EMU countries do not have their monetary aggregates because they do not have their own currencies, we can tested M2 due to data published by World Bank. While using of short-terms interest rates is usual in previous studies,

using of M2 could discover some strong attributes or weaknesses of using euro currency due to particular relations among credit market. With that comparison of both results the current study contributes, as well.

GMM model with pooled data allows endogenous regressors including lagged response variables. Models with lagged response variables in the regressors are said to be dynamic. The development of endogenous may sometimes truly depend on the development of its lagged values. Using of least squares estimation includes a problem with this model-differencing approach, however, and all time-constant regressors are removed and consequently their effect then cannot be assessed (Lee, 2010).

The empirical specification (based on Gambacorta, 2005; Matousek and Sarantis, 2009; Akinci et al., 2013) is designed to test whether banks react differently to monetary policy shocks. Current study contributes with using two kinds of variables among models to compare relations between development of credit market and the both, short term interest rates and monetary aggregate M2. The model is given by the following equation (1), which includes interaction terms that are the product of the monetary policy indicator and a bank-specific characteristic:

$$\Delta \log(L_{it}) = \alpha_{it} + \sum_{j=0}^{1} \beta \Delta \log(L_{i(t-1)}) + \sum_{j=0}^{1} \vartheta \Delta C_{t-j} \sum_{j=0}^{1} \delta \Delta \log(GDP_{t-j}) + \sum_{j=0}^{1} \gamma \Delta CPI_{t-j} + \sum_{k=1}^{3} \varphi Z_{kit-1} + \sum_{k=1}^{3} \sum_{j=0}^{1} \omega Z_{kit-1} \Delta C_{t-j} + \sum_{k=1}^{2} \sum_{h=k+1}^{3} \sum_{j=0}^{1} \xi Z_{kit-1} Z_{hit-1} \Delta C_{t-j} + \varepsilon_{it}, \quad (1)$$

where L_{it} means gross loans of *i ={1,…,N}* number of EU banks in time *t={1,…, T}*. Exogenous variable ΔC_{t-j} is either a growth of short-term interest rates in the first case, or a growth of monetary aggregate M2. Next regressors are GDP_{t-j} and CPI_{t-j}, which means GDP and inflation in selected EU countries. Last three exogenous represent combination of Z_k denotes *k=1,2,3* bank specific characteristic variables (see below) and ΔC_{t-j}. Constant and residuals means variable α_{it} and ε_{it}. We do not use fixed period effects across all selected EU banks. We estimate three kinds of models, first for all 28 EU countries, second for EMU countries, and third for non-EMU countries.

To follow Gambacorta (2005); Matousek and Sarantis (2009); Akinci et al., (2013), the following bank characteristics, size S_{it}, liquidity Liq_{it} and capitalisation Cap_{it}, are applied to test the presence of the distributional effects of monetary policy among banks:

$$S_{it} = \log(A_{it}) - \frac{\sum \log(A_{it})}{N_t}, \quad (2)$$

$$Liq_{it} = \frac{LA_{it}}{A_{it}} - \frac{1}{T} \sum_t \left(\frac{1}{N_t} \sum_i \frac{LA_{it}}{A_{it}} \right), \quad (3)$$

$$Cap_{it} = \frac{EQ_{it}}{A_{it}} - \frac{1}{T} \sum_t \left(\frac{1}{N_t} \sum_i \frac{EQ_{it}}{A_{it}} \right), \quad (4)$$

where A_{it} means assets of all EU banks, LA_{it} means only its liquid assets (i.e. cash, interbank lending and securities), and EQ_{it} is bank capital and reserves (total equity).

The baseline equation is that on lending. Loan growth is regressed on changes of the interest rate controlled by the monetary authority, and on its interaction with three bank-specific characteristics (size, liquidity and capitalization). The regression (1) also includes inflation and GDP growth to control for demand effects. The introduction of these two variables allows us to capture cyclical movements and serves to isolate the monetary policy component of interest rate changes. This will allow us to gain further insight on the interbank lending channel by reporting the effects of changes in the interest rates on these other items of banks' balance sheet (Gambacorta, 2005). Moreover, we employ growth of monetary aggregate M2 to compare, what will have a greater impact on the development of credit market, whether short-term interest rates or M2.

Akinci et al. (2013) argue, the two-step coefficient estimator is asymptotically efficient and robust to whatever heteroscedasticity, autocorrelation and cross-correlation is modelled by the new variance–covariance matrix. The rule of thumb is to keep the number of instruments below the number of cross-sections to ensure valid inference. We therefore use also the dependent variable lagged two periods and deeper as "collapsed" GMM-style instruments to keep their number down and avoid over fitting the endogenous variable (collapsing instruments in this way does come at the loss of some efficiency). Due to them we also restrict instruments to be the same for each model, being the current value and first lag of each of our regressors. To avoid multicollinearity problems we apply a pseudo general-to-specific model reduction method in our application of the GMM estimator due to them, as well. The pseudo general model includes the current and first lagged value of variables C_{t-j}, GDP_{t-j}, CPI_{t-j} as well as the first lag of eachbank characteristic, $S_{i(t-1)}$, $Liq_{i(t-1)}$ and $Cap_{i(t-1)}$.

Lags of the bank characteristics were excluded from the IV-style instrument set to keep the number of instruments below the number of cross-sectional units (see Akinci et al., 2013). All Arellano and Bond tests show that the first order statistic is statistically significant, whereas the second order statistic is not, which is what we would expect if the model error terms are serial uncorrelated in levels. So, we reject the presence of significant serial correlation in all countries, thus implying that GMM estimators are consistent. In the case of bank characteristics, we estimated the model with each characteristic separately, then with all possible pairs of characteristics, and finally with all three characteristics together (Matousek and Sarantis, 2009). The results of the models presented in Tables 1–4 were produced using EViews 8.0.

The model does not allow for random effects. The model is specified in stationary differences to avoid the problem of spurious correlations among variables that are likely to be non-stationary (Gambacorta and Mistrulli, 2004). If the lagged dependent variable is excluded from (1) the model would not need to be instrumented and estimation by the standard fixed-effects method would be appropriate (unless there were other endogenous covariates). Further, if the fixed-effects are redundant as well (1) can be estimated by pooled-OLS (see Akinci et al., 2013). Nevertheless, we employ only the GMM estimator that ensures consistent parameter estimates by choosing instruments for the lagged dependent variable so that the sample correlations between the instruments and the model's error term are as close to zero as possible. In addition, Gambacorta (2005) investigated relations within Italian credit market, Matousek and Sarantis (2009) investigated lending channels of each country in Visegrad group and compare that with channel in Baltic States, and Akinci et al. (2013) investigated credit market in Turkey. We investigate whole EU and it is definitely wrong use fixed effects in period due to the fact, that there cannot be relations between many countries (e.g. the Czech credit market and Greek credit market). Even whether many banks are subsidiaries from financial

corporations in abroad (i.e. in the Czech Republic), we cannot use that period effects, because we differ between EMU and non-EMU countries, as well (e.g. all parent companies of Czech banks are from EMU but the Czech Republic have its own currency, Czech Koruna). In the case of EMU countries we could allow period fixed effects e.g. for some macroeconomic variables but definitely not for the development of bank gross loans. Finally, therefore we do not allow for fixed effects across EU banks. However, within using EViews 8.0 there is still impossible to test whether panel GMM model allows for period effects. Nonetheless, for more conclusive argumentation we report estimation output with period fixed effects with very similar results in Appendix part.

4. Discussion on empirical results

Looking at the bank characteristics results we notice as the first that bank size is significant in all cases. Its unexpectedly negative sign of the coefficient supports the hypothesis of Matousek and Sarantis (2009) that small banks that have started their activities almost from scratch have higher dynamic of lending activities compared to large, established banks. Even though they confirmed that within Visegrad countries as well as within Baltic States, we confirm that among all European Union countries. Moreover, when two or even three characteristics enter simultaneously, bank size becomes significant in all cases, though the pattern on the coefficient sign remains. While in the case of short-term interest rates a negative sign of bank size impacts more on EMU countries, in the case of monetary aggregate M2 it has been proved higher impact on the credit market development of non-EMU countries.

As the second we confirm in all cases, the liquidity of banks have a significant impact on the development of the European credit market. Its positive sign would be expected due to some existing regulatory rules among banks (i.e. the Basel committee rules). It means that mostly liquid banks lend financial sources through bank loans. A much higher impact was proved in cases with M2 than in cases with short-term interest rates. In the case of using only a calculated monetary aggregate of EMU countries (as percentages from GDP published by World Bank) we see opposite negative impact, but it can be caused by non-existence of this aggregate in EMU countries. Nevertheless, in the case of using short-term interest rates it has been proved a higher impact among non-EMU countries.

It has also been proved significant effect of the bank capital only in cases with short-term interest rates as the third. Although, estimated impact of bank capital is positive among EMU countries, among non-EMU countries it is negative, vice versa. Even despite that fact, we can see the second biggest effect within bank capital. Our findings could also be interpreted as an argument for future creating a BASEL III rules to emphasis more stress on the bank capital problematic. While banks from the EMU increased loans granted are mostly in good shape simultaneously in view of their capital, banks from non-EMU countries which increased loans granted are undercapitalized under the average. On the other hand, Šútorová and Teplý (2013) focused later on practical aspects of the new framework for banking regulation in the European Union as defined by Basel III. Despite the fact that Basel III represents an improvement on the Basel II capital accord, they concluded that the Basel III regulation is not sufficient and will not protect financial markets from future crises due to its expected calibration, its delayed implementation, and strong pressure from banks' lobbyists.

Tab. 1: GMM models' output for EMU countries from period 1999-2012 – CASE with short-term rates

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.3275 [a]	0.4304 [a]	0.4792 [a]	0.3298 [a]	0.3599 [a]	0.4274 [a]	0.3647 [a]
Rate	-0.0111	-0.0002	-0.0018	-0.0117	-0.0039	-0.0016	-0.0029
Rate(1)	0.0323 [a]	0.0028	0.0020	0.0307 [a]	0.0292 [a]	0.0029	0.0279 [a]
GDP	0.6512 [a]	0.8066 [a]	0.7040 [a]	0.6603 [a]	0.5504 [a]	0.7751 [a]	0.5826 [a]
GDP(1)	-0.3360 [a]	-0.1839 [a]	-0.1593 [a]	-0.3816 [a]	-0.3307 [a]	-0.1309 [b]	-0.3873 [a]
CPI	0.0035	0.0005	0.0074 [b]	0.0000	0.0060 [b]	0.0013	0.0025
CPI(1)	0.0122 [a]	0.0014	0.0047 [b]	0.0103 [a]	0.0129 [a]	0.0018	0.0103 [a]
Size(1)	-0.1404 [a]			-0.1537 [a]	-0.1322 [a]		-0.1442 [a]
Size(1) * Rate	0.0036			0.0044	-0.0029		-0.0003
Size(1) * Rate(1)	-0.0067 [b]			-0.0067 [b]	-0.0091 [a]		-0.0078 [a]
Liq(1)		0.4898 [a]		0.4115 [a]		0.4883 [a]	0.4806 [a]
Liq(1) * Rate		0.0702 [a]		0.1128 [a]		0.0690 [a]	0.0710 [a]
Liq(1) * Rate(1)		-0.0540 [b]		-0.0915 [b]		-0.0602 [a]	-0.0672 [a]
Capital(1)			1.2096 [a]		1.1550 [a]	0.8849 [b]	0.9778 [b]
Capital(1) * Rate			-0.0387		-0.0617	-0.0574	-0.0957 [c]
Capital(1) * Rate(1)			-0.0683		-0.0720	0.0198	-0.0673
Size(1) * Liq(1) * Rate				-0.0230			
Size(1) * Liq(1) * Rate(1)				0.0174			
Size(1) * Capital(1) * Rate					-0.0422		
Size(1) * Capital(1) * Rate(1)					-0.0305		
Liq(1) * Capital(1) * Rate						0.3499	
Liq(1) * Capital(1) * Rate(1)						0.0267	
Total No. of panel observations	5170	5170	5170	5170	5170	5170	5170

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

However, in order to assess the distributional effects of monetary policy, we need to examine the coefficients of the interaction terms between the bank characteristics and the monetary policy indicator (see Matousek and Sarantis, 2009). As Kayshap and Stein (2000) noted, one might be tempted to argue that the effects of monetary policy would be more accurately measured by the small-bank/big-bank differentials. Firstly, in the specifications with bank size only, we find its term with interest rates to be statistically significant only among non-EMU countries, which use its own interest rates (i.e. LIBOR), not just EURIBOR. We proved just very weak interaction between bank size and interest rates, the both lagged by one year.

On the other hand what have to be highlighted, all our statistically significant results are close to zero. More than ten times higher interaction have been estimated between bank size and monetary aggregate M2. In contrast with the evidence for Italian banks (Gambacorta, 2005), interaction terms between bank size and monetary policy is significant. Our results support Kashyap and Stein (1995) with their significant evidence for US banks. Nonetheless, due to the fact that our coefficients are approaching the zero value, these results are rather consistent with Ehrmann et al. (2003) where size does not emerge as a useful indicator for distributional effect of monetary policy not only for Italy but also in France, Germany and Spain.

Tab. 2: GMM models' output for EMU countries from period 1999-2012 – CASE with monetary aggregate M2

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.2231 [a]	0.3334 [a]	0.2909 [a]	0.2995 [a]	0.2682 [a]	0.3408 [a]	0.2927 [a]
M2	0.1183	0.2555 [a]	0.2494 [a]	0.1321	0.0415	0.2629 [a]	0.0868
M2(1)	0.2659 [b]	0.2498 [a]	0.2586 [a]	0.2226 [c]	0.2769 [b]	0.2072 [a]	0.2628 [b]
GDP	0.3811 [a]	0.5457 [a]	0.5152 [a]	0.3209 [a]	0.3839 [a]	0.4833 [a]	0.3649 [a]
GDP(1)	-0.3018 [a]	-0.4710 [a]	-0.3830 [a]	-0.3738 [a]	-0.3415 [a]	-0.4009 [a]	-0.3917 [a]
CPI	0.0013	0.0008	0.0019	0.0001	0.0019	0.0021	0.0018
CPI(1)	0.0138 [a]	0.0104 [a]	0.0115 [a]	0.0139 [a]	0.0150 [a]	0.0108 [a]	0.0141 [a]
Size(1)	-0.5559 [b]			-0.6165 [b]	-1.0167 [a]		-0.8465 [a]
Size(1) * M2	0.0891 [a]			0.0765 [b]	0.1020 [a]		0.0838 [b]
Size(1) * M2(1)	-0.0724 [b]			-0.0578 [c]	-0.0684 [c]		-0.0564
Liq(1)		-2.5953 [a]		-1.1792		-1.4599 [b]	-1.7886 [b]
Liq(1) * M2		0.5891 [b]		0.2648		0.0288	0.3725 [c]
Liq(1) * M2(1)		-0.4798 [b]		-0.1976		0.0410	-0.2928
Capital(1)			-0.1004		-0.2998	0.7716	-0.2457
Capital(1) * M2			-0.4690		-0.6796	-0.5705	-0.1832
Capital(1) * M2(1)			0.4767		0.6936	0.5463	0.1919
Size(1) * Liq(1) * M2				0.0637			
Size(1) * Liq(1) * M2(1)				-0.0685			
Size(1) * Capital(1) * M2					0.1655		
Size(1) * Capital(1) * M2(1)					-0.1677		
Liq(1) * Capital(1) * M2						-10.1541 [a]	
Liq(1) * Capital(1) * M2(1)						10.2542 [a]	
Total No. of panel observations	4816	4816	4816	4816	4816	4816	4816

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

Secondly, total different results we have in the case of interactions between monetary policy indicator and bank liquidity. We proved higher significant impacts just in all cases with short-term interest rates. Results in cases with monetary aggregate M2 tend to be insignificant in the majority of cases. What is interesting, while within the case with short-term interest rates it was estimated positive and then negative impact with lagged rates by one year among EMU countries, among non-EMU countries it was estimated negative and then positive effect with lagged interest rates, vice versa. It means that banks with higher liquidity ratio among EMU countries are better able to buffer their lending activity from changes in monetary policy, which is consistent result with previous studies (Ehrmann et al., 2003; Gambacorta, 2005). Otherwise, our results show that among non-EMU countries less liquid banks are better able to respond to changes in monetary policy on the contrary.

Finally, bank capital coefficient within the interaction terms between the bank characteristics and the monetary policy indicator would be explain as a partial only among non-EMU countries. In the case with short-term interest rates our results confirmed just two significant results in combination with bank size, a positive with current rates and negative with interest rates lagged by one year. It is caused by sings of bank size coefficients, so it means

Tab. 3: GMM models' output for non-EMU countries from period 1999-2012 – CASE with short-term rates

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.3791 [a]	0.3911 [a]	0.2812 [a]	0.4313 [a]	0.3471 [a]	0.3344 [a]	0.3882 [a]
Rate	-0.0298 [a]	-0.0113 [a]	-0.0152 [a]	-0.0220 [a]	-0.0283 [a]	-0.0091 [a]	-0.0194 [a]
Rate(1)	0.0223 [a]	-0.0032 [b]	0.0002	0.0208 [a]	0.0245 [a]	-0.0030 [c]	0.0210 [a]
GDP	0.9262 [a]	0.7789 [a]	0.9230 [a]	0.7561 [a]	0.8910 [a]	0.8397 [a]	0.7837 [a]
GDP(1)	-0.0824 [a]	0.2408 [a]	0.2128 [a]	0.0281	-0.0456	0.2674 [a]	0.0446
CPI	0.0066 [a]	0.0026	0.0050 [b]	0.0006	0.0067 [a]	0.0037 [c]	0.0021
CPI(1)	-0.0003	-0.0021	-0.0009	-0.0019	0.0008	-0.0015	-0.0012
Size(1)	-0.0455 [a]			-0.0576 [a]	-0.0556 [a]		-0.0625 [a]
Size(1) * Rate	0.0043 [a]			0.0065 [a]	0.0055 [a]		0.0056 [a]
Size(1) * Rate(1)	-0.0066 [a]			-0.0086 [a]	-0.0081 [a]		-0.0090 [a]
Liq(1)		0.6558 [a]		0.7628 [a]		0.5650 [a]	0.6897 [a]
Liq(1) * Rate		-0.0771 [a]		-0.0490 [a]		-0.0482 [a]	-0.0736 [a]
Liq(1) * Rate(1)		0.0594 [a]		0.0651 [a]		0.0230 [a]	0.0536 [a]
Capital(1)			-0.6087 [a]		-0.3496 [b]	-0.5142 [a]	-0.4350 [b]
Capital(1) * Rate			-0.0388 [b]		0.1074 [b]	0.0040	-0.0216
Capital(1) * Rate(1)			0.0263		-0.1354 [a]	0.0057	0.0167
Size(1) * Liq(1) * Rate				-0.0117			
Size(1) * Liq(1) * Rate(1)				-0.0028			
Size(1) * Capital(1) * Rate					-0.0689 [a]		
Size(1) * Capital(1) * Rate(1)					0.0621 [a]		
Liq(1) * Capital(1) * Rate						-0.5912 [a]	
Liq(1) * Capital(1) * Rate(1)						0.5868 [a]	
Total No. of panel observations	2598	2598	2598	2598	2598	2598	2598

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

that larger banks in good shape in terms of their capital respond faster to monetary policy than smaller and in average undercapitalized banks among non-EMU countries. Without bank size characteristic only undercapitalized banks respond to changes in interest rates. Nonetheless, an impact of changes in monetary aggregate M2 is much higher than influence of short-term interest rates among non-EMU countries. We can clearly see that only non-EMU banks in good shape in terms of their capital respond to changes of M2 concurrently (with approximately ten times higher significant coefficient in all cases). Undercapitalized banks from non-EMU countries respond to M2 lagged by one year in all cases. Gambacorta and Mistrulli (2004) argue that insignificant bank capital with monetary policy could be because the simple capital to asset ratio, generally used by literature, poorly approximates the relevant measure of capital constraint under the Basel standards. Ehrmann et al. (2003) noted that this is opposed to findings for the US, where small and lowly capitalized banks show a disproportionately strong response to monetary policy.

We should highlight some differences against some related studies. Even whether Fungáčová et al. (2014) concluded a similar results in their investigation just for EMU countries. They also argue, they find evidence that the effect of monetary policy changes on

Tab. 4: GMM models' output for non-EMU countries from period 1999-2012 – CASE with monetary aggregate M2

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.3737 [a]	0.4252 [a]	0.3112 [a]	0.4152 [a]	0.3692 [a]	0.3457 [a]	0.3850 [a]
M2	0.1925 [a]	0.3638 [a]	0.3488 [a]	0.1164	0.0687	0.3434 [a]	0.0886
M2(1)	-0.1363 [c]	-0.0904 [b]	-0.0502	-0.1247	-0.1034	-0.0328	-0.1398 [c]
GDP	0.5942 [a]	0.5691 [a]	0.6459 [a]	0.5280 [a]	0.6237 [a]	0.6199 [a]	0.6096 [a]
GDP(1)	0.0455	0.0699	0.0497	0.0791	0.0311	0.0657	0.0845
CPI	-0.0063 [a]	-0.0119 [a]	-0.0103 [a]	-0.0098 [a]	-0.0051 [a]	-0.0115 [a]	-0.0091 [a]
CPI(1)	0.0000	-0.0002	-0.0001	-0.0001	-0.0002	-0.0002	-0.0001
Size(1)	-0.8970 [a]			-1.3347 [a]	-1.1217 [a]		-1.1354 [a]
Size(1) * M2	0.0467 [b]			0.0761 [a]	0.0753 [a]		0.0650 [b]
Size(1) * M2(1)	-0.0156			-0.0293	-0.0363		-0.0262
Liq(1)		2.3627 [a]		4.0321 [a]		1.6079 [c]	2.8913 [a]
Liq(1) * M2		0.5082 [a]		0.2308		0.4066 [b]	0.5869 [a]
Liq(1) * M2(1)		-0.5748 [a]		-0.3451		-0.4496 [a]	-0.6734 [a]
Capital(1)			-0.3473		-0.1579	-0.2781	-2.9451 [c]
Capital(1) * M2			1.1528 [a]		2.5616 [a]	1.0769 [a]	1.6215 [a]
Capital(1) * M2(1)			-1.1640 [a]		-2.5592 [a]	-1.0841 [a]	-1.5330 [a]
Size(1) * Liq(1) * M2				0.2025			
Size(1) * Liq(1) * M2(1)				-0.2083			
Size(1) * Capital(1) * M2					-0.2600		
Size(1) * Capital(1) * M2(1)					0.2446		
Liq(1) * Capital(1) * M2						-2.9711	
Liq(1) * Capital(1) * M2(1)						2.9740	
Total No. of panel observations	2610	2610	2610	2610	2610	2610	2610

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

loan growth has the expected negative sign. The coefficient of monetary policy is significant and negative in all the estimations. An increase (decrease) in interest rates leads to a decrease (increase) in loan growth rate. We find the same result within Table 1, but on the other hand we find that higher impact on the lending channel of EMU countries have growth of short-term interest rates lagged by one year. They found also that the monetary policy interaction terms for capitalization and liquidity are not significant, meaning that these bank-specific characteristics do not influence the manner in which bank lending reacts to monetary-policy changes. We can agree with their results for bank capital, but our results are inconsistent within bank liquidity. However, we find the monetary policy interaction terms for bank liquidity significant in all cases among EMU countries, even whether in cases lagged by one year.

Nevertheless, the study made by Fungáčová et al. (2014) should be discussed from the other point of view, as well. They investigated monetary effects on lending channel in EMU countries using panel regression model without lagged endogenous dependent variable. They mentioned, the dynamic panels is typically estimated by the difference GMM method developed by Arellano and Bond (1991). But in their case the results indicate that the lagged value of loan growth is not significant, which even casts serious doubt on the benefits of using

difference or system GMM. They argue, they use annual (instead of quarterly) data, so their result is not entirely surprising. Due to them, there clearly could be cogent reasons as to why lending in the previous quarter might influence current lending, but it would be more challenging to produce an economic rationale for why last-year's lending should influence current lending. We cannot agree with this statement because annual rate of growth means simply average of growth rates in quarterly frequency. Moreover, GMM models with annual data were employed not just in current study, but also in Ehrmann et al. (2003), Matousek and Sarantis (2009). We find the lagged value of loan growth as a significant in all estimations, which supported our rejection of their arguments. Moreover, we have some doubts of using panel regression with annual data to compare periods 2002-2006 and 2007-2010 in Fungáčová et al. (2014), as well. It means working with only four and even three differences within estimations. It is too less to run regression model due to our opinion. They do not report also Durbin Watson stats for example, as it is usual.

5. Macroeconomic relations and policy implications

Our study clearly prove that predominantly just smaller banks interact with monetary policy among all EU countries. This problem is more serious within banks in non-EMU countries. While more liquid banks react with delay on monetary policy in EMU countries, it differs in non-EMU countries. There is the same result only in the case with monetary aggregate M2, whereas in the case with short-term interest rates there is opposite trend and less liquid banks react with one year delay. Results for bank capitalization may be quite bit misleading in average. It is caused by the fact that only it is insignificant sometimes in whole sample. Nonetheless, it was logically proved that just more capitalized banks interact with monetary policy with one year delay against less liquid banks in the case with monetary aggregate M2 in non-EMU countries. On the other hand, we have not found significant results in other cases. Therefore we could not make any argumentation or policy implication in average bank capitalization terms.

Our investigation has focused also on comparison effects of monetary policy caused by short-term interest rates and monetary aggregate M2. It was clearly proved within lending channel that M2 really allows central banks of non-EMU countries to do their monetary policy more efficiently than just through changes in short-term interest rates. Ehrmann et al. (2003) noted whether is assumed that central banks can control the quantity of money. Once the supply of transactions accounts has been adjusted following the central bank's reserve injection, interest rates respond in a predictable manner. When more transactions balances become available to households, the valuation of these balances falls and money becomes cheaper to hold than before. That means, nominal interest rates fall. For this change in nominal rates to matter, one must assume that prices do not adjust instantly to the change in the money supply. Then with more money, people will have more real purchasing power, and the nominal interest decline will correspond to a lower real interest rate.

Due to our results above as well as due to past mergers and acquisitions in the EU we recommend the European central bank target its monetary policy more on bigger banks. But our suggestion is much more serious within central banks in non-EMU countries. Due to the problem that less liquid banks react with some delay on monetary policy in the case of short-term interest rates, we also recommend target more on M2 monetary aggregate, especially in the EMU. We argue that promoting changes in M2 monetary aggregate is more efficient within European bank lending channel than using just short-term interest rates in whole EU

(moreover nowadays, when rates are close to zero). Therefore our suggestion is also addressed to non-EMU countries, again.

In our opinion, possible quantitative easing used by the ECB would be appropriate for the bank lending channel of monetary transmission in EU countries and whole economy in the EU. Of course, it could miss positive effect whether the ECB would not communicate the details of their policy with other central bankers enough, or if they would give way due to bigger EU economies which do not suffer from recent financial crises, no longer. Discussing the details of their future monetary interventions with other countries is the most important aspect to ensure healthy growth of inflation in all European countries. Nevertheless, after quantitative easing it can be definitely bigger scope to use monetary aggregates more efficiently. Even short-term interest rates could grow up slightly.

Conclusion

There was many major changes in European banking in last two decades. Whether we are talking about microeconomic mergers and acquisitions in banking industry and establishing large financial companies, or about macroeconomic major changes in creating the EMU, whole financial environment in the Europe has changed very much. Credit market does not play key role just in the case of economic growth, it plays key role in financial wealth among all European countries. The European Central Bank as well as central banks of all European countries are still challenging problems exist due to recent financial crises, nowadays. Therefore, it is very important to pay attention to the issue of the bank lending channel of monetary transmission in EU countries.

Our results proved some differences but on the other hand, it discovered also some identical risks within lending channels in EMU and non-EMU countries. All European countries are forced to challenge with ventures of less efficiency in monetary policy impacts on a bigger banks in average. While in euro area there is monetary policy more efficient for less liquid banks, there is totally opposite result in the rest of the EU. It was also clearly proved that more efficient is using of monetary aggregate M2 than short-term interest rates among all European countries. Moreover, interest rates could not increase rapidly in very short period.

Major suggestion from current study for the European Central Bank is in higher and more flexible usage with monetary aggregates, even whether some countries would not to do that. It is the best way how the ECB could positively affect European economy which still suffer from recent financial crises. Nonetheless, higher surveillance and compliance all rules of the game should be on the first place. Because information asymmetry could negatively affect whole situation, as we could have not seen only in a history.

References

[1] Akinci, D.A., Matousek, R., Radić, N. and C. Stewart, 2013. Monetary policy and the banking sector in Turkey. Jour*nal of International Financial Markets, Institutions and Money*, vol. 27, pp. 269-285.

[2] Altunbaş, Y., Fazylov, O. and P. Molyneux, 2002. Evidence on the bank lending channel in Europe. *Journal of Banking and Finance*, vol. 26, no. 11, pp. 2093-2110.

[3] Arestis, P. and M. C. Sawyer, 2002. *Can Monetary Policy Affect the Real Economy?* Levy Economics Institute Working Paper 355.

[4] Arghyrou, M. G., 2009. Monetary policy before and after the euro: Evidence from Greece. *Empirical Economics*, vol. 36, no. 3, pp. 621-643.

[5] Barros, C.P., Ferreira, C. and J. Williams, 2007. Analysing the determinants of performance of best and worst European banks: A mixed logit approach. *Journal of Banking and Finance*, vol. 31, no. 7, pp. 2189-2203.
[6] Berger, A.N., 2003. The efficiency effects of a single market for financial services in Europe. *European Journal of Operational Research*, vol. 150, no. 3, pp. 466-481.
[7] Bernanke, B.S. and A. Blinder, 1988. Credit, money and aggregate demand. *American Economic Review*, vol. 78, pp. 435–439.
[8] Bernanke, B.S. and A. Blinder, 1992. The Federal funds rate and the channels of monetary transmission. *American Economic Review*, vol. 82, pp. 901–921.
[9] Bleich, D. and R. Fendel, 2012. Monetary Policy Conditions in Spain before and after the Changeover to the Euro: A Taylor Rule Based Assessment. *Review of applied economics*, vol. 8, no. 1, pp. 51-67.
[10] Clausen, V. and B. Hayo, 2005. Monetary policy in the euro area – lessons from the first years. *International Economics and Economic Policy*, vol. 1, pp. 349-364.
[11] Domenech, R., Ledo, M. and D. Taguas, 2002. Some new results on interest rate rules in EMU and in the US. *Journal of Money, Credit and Banking*, vol. 35, pp. 545-556.
[12] Drudi, F., Durré, A. and F. P. Mongelli, 2012. The Interplay of Economic Reforms and Monetary Policy: The Case of the Eurozone. *JCMS: Journal of Common Market Studies*, vol. 50, no. 6, pp. 881-898.
[13] ECB, 1999. Monthly Bulletin January 1999. Frankfurt am Main: European Central bank. [online]. [2015-04-02]. Available from: https://www.ecb.europa.eu/pub/pdf/mobu/mb199901en.pdf.
[14] ECB, 2000. Monthly Bulletin July 2000. Frankfurt am Main: European Central bank. [online]. [2015-04-02].Available from: https://www.ecb.europa.eu/pub/pdf/mobu/mb200007en.pdf.
[15] ECB, 2001. Annual report 2001. Frankfurt am Main: European Central bank. [online]. [2015-04-02]. Available at https://www.ecb.europa.eu/pub/pdf/annrep/ar2001en.pdf.
[16] ECB, 2005. Monthly Bulletin April 2005. Frankfurt am Main: European Central bank. [online]. [2015-04-02]. Available from: https://www.ecb.europa.eu/pub/pdf/mobu/mb200504en.pdf.
[17] ECB, 2003. Annual report 2003. Frankfurt am Main: European Central bank. [online]. [2015-04-02]. Available from: https://www.ecb.europa.eu/pub/pdf/annrep/ar2003en.pdf.
[18] ECB, 2012. Annual report 2012. Frankfurt am Main: European Central bank. [online]. [2015-04-02]. Available from: https://www.ecb.europa.eu/pub/pdf/annrep/ar2012en.pdf.
[19] Gerlach, S. and G. Schnabel, 2000. The Taylor rule and interest rates in the EMU area. *Economics Letters*, vol. 67, pp. 165-171.
[20] Ehrmann, M., Gambacorta, L., Martinez Page´ s, J., Sevestre, P. and A. Worms, 2003. In: Angeloni, I. et al. (Eds.), Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area.
[21] Fungáčová, Z., Solanko, L. and L. Weill, 2014. Does competition influence the bank lending channel in the euro area? *Journal of Banking and Finance*, vol. 49, pp. 356-366.
[22] Gambacorta, L., 2005. Inside the bank lending channel. *European Economic Review*, vol. 49, no. 7, pp. 1737-1759.
[23] Gambacorta, L. and P. Mistrulli, 2004. Does bank capital affect lending behavior? *Journal of Financial Intermediation*, vol. 13, no. 4, pp. 436-457.

[24] Hayo, B. and B. Hofmann, 2006. Comparing monetary policy reaction functions: ECB versus Bundesbank. *Empirical Economics*, vol. 31, pp. 654-662.

[25] Kashyap, A. K. and J. C. Stein, 1995. The impact of monetary policy on bank balance sheets. *Carnegie Rochester Conference Series on Public Policy*, vol. 42, pp. 151–195.

[26] Kashyap, A. K. and J. C. Stein, 2000. What do a million observations on banks say about the transmission of monetary policy. *American Economic Review*, vol. 90, no. 3, pp. 407–428.

[27] Kishan, R. P. and T. P. Opiela, 2000. Bank size, bank capital, and the bank lending channel. *Journal of Money Credit and Banking*, vol. 32, pp. 121–141.

[28] Kishan, R. P. and T. P. Opiela, 2006. Bank capital and loan asymmetry in the transmission of monetary policy. *Journal of Banking and Finance*, vol. 30, pp. 259–285.

[29] Lee, M., 2010. *Micro-econometrics – Methods of Moments and Limited Dependent Variables*. 2nd ed. London: Springer.

[30] Matousek, R. and N. Sarantis, 2009. The bank lending channel and monetary transmission in Central and Eastern European countries. *Journal of Comparative Economics*, vol. 37, no. 2, pp. 321-334.

[31] Mihov, I., 2001. Monetary policy implementation and transmission in the European Monetary Union. *Economic Policy*, vol. 16, pp. 369-406.

[32] Mishkin, F.S., 2011. *Monetary policy strategy: Lessons from the crisis*. Working Paper 16755. Cambridge: National Bureau of Economic Research.

[33] Peek, J. and E. Rosengren, 1995. The capital crunch: neither a borrower nor a lender be. *Journal of Money Credit and Banking*, vol. 27, pp. 625–638.

[34] Siklos, P. L., Bohl, M. T. and M. E. Wohar, 2011. *Challenges in Central Banking. The Current Institutional Environment and Forces Affecting Monetary Policy*. New York: Cambridge University Press.

[35] Surico, P., 2003. Asymmetric reaction functions for the euro area. O*xford Review of Economic Policy*, vol. 19, pp. 44-57.

[36] Surico, P., 2007. The monetary policy of the European Central Bank. *The Scandinavian Journal of Economics*, vol. 109, no. 1, pp. 115-135.

[37] Šútorová, B. and P. Teplý, 2013. The Impact of Basel III on Lending Rates of EU Banks. *Czech Journal of Economics and Finance,* vol. 63, no. 3, pp. 226-243.

[38] Teplý, P., Stárová, H. and J. Černohorský, 2010. Value Creation of European Bank Mergers and Acquisitions in the 1998 – 2007 Period. *Journal of Economics*, vol. 5, pp. 458-470.

[39] Tsionas, E.G., Assaf, A.G. and R. Matousek, 2015. Dynamic Technical and Allocative Efficiencies in European Banking. *Journal of Banking and Finance*, vol. 52, pp. 130-139.

Appendix

Only significant coefficients from the same estimations with period fixed effects (significant differences against results without effects are highlighted)

Tab. 5: GMM models' output for EMU countries from period 1999-2012 – CASE short-term rates (PERIOD FIXED EFFECTS)

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.4528 [a]	0.4978 [a]	0.5385 [a]	0.4517 [a]	0.4634 [a]	0.5846 [a]	0.5076 [a]
Rate		0.0192 [a]					
Rate(1)							
GDP	0.9170 [a]	0.9221 [a]	0.8661 [a]	0.7875 [a]	0.8095 [a]	0.6241 [b]	0.7110 [b]
GDP(1)	-0.4539 [c]						
CPI							
CPI(1)	0.0046 [c]				0.0056 [b]		
Size(1)	-0.2276 [a]			-0.2092 [a]	-0.1975 [a]		-0.2151 [a]
Size(1) * Rate	0.0065 [b]			0.0060 [c]			
Size(1) * Rate(1)							
Liq(1)		0.5026 [a]		0.4549 [a]		0.5836 [a]	0.5549 [a]
Liq(1) * Rate		0.0574 [b]		0.0910 [a]		0.0601 [a]	0.0552 [a]
Liq(1) * Rate(1)							-0.0386 [c]
Capital(1)			0.9108 [a]		0.5864 [c]		
Capital(1) * Rate							
Capital(1) * Rate(1)							
Size(1) * Liq(1) * Rate							
Size(1) * Liq(1) * Rate(1)							
Size(1) * Capital(1) * Rate							
Size(1) * Capital(1) * Rate(1)							
Liq(1) * Capital(1) * Rate						0.7148 [a]	
Liq(1) * Capital(1) * Rate(1)							
Total No. of panel observations	5170	5170	5170	5170	5170	5170	5170
Sargan test (p-values)	0.1365	0.3282	0.2054	0.2504	0.0853	0.4079	0.2512
Arellano Bond (p-AR1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Arellano Bond (p-AR2)	0.4727	0.4307	0.3807	0.4633	0.4471	0.3157	0.4552

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

Tab. 6: GMM models' output for EMU countries from period 1999-2012 – CASE with M2 (PERIOD FIXED EFFECTS)

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.3979 [a]	0.4257 [a]	0.4620 [a]	0.4090 [a]	0.4067 [a]	0.5411 [a]	0.4548 [a]
M2		0.1860 [b]			0.2280 [c]		0.2641 [b]
M2(1)	0.2108 [c]	0.1903 [b]	0.2360 [a]	0.2223 [c]		0.1728 [b]	
GDP	0.6187 [b]	0.7972 [a]	0.6989 [a]	0.5776 [b]	0.6287 [b]	0.7214 [a]	0.5878 [b]
GDP(1)		-0.4730 [b]	-0.3726 [c]	-0.5764 [b]	-0.4062 [c]	-0.4959 [a]	-0.5380 [b]
CPI							
CPI(1)	0.0064 [b]	0.0046 [c]		0.0068 [c]	0.0068 [b]	0.0049 [c]	0.0070 [b]
Size(1)							
Size(1) * M2							
Size(1) * M2(1)							
Liq(1)		-1.6485 [b]				-1.4220 [c]	-1.6563 [b]
Liq(1) * M2							
Liq(1) * M2(1)							
Capital(1)							
Capital(1) * M2							
Capital(1) * M2(1)							
Size(1) * Liq(1) * M2							
Size(1) * Liq(1) * M2(1)							
Size(1) * Capital(1) * M2							
Size(1) * Capital(1) * M2(1)							
Liq(1) * Capital(1) * M2							
Liq(1) * Capital(1) * M2(1)						4.0937 [c]	
Total No. of panel observations	4816	4816	4816	4816	4816	4816	4816
Sargan test (p-values)	0.3445	0.4356 .0.0000	0.5696	0.4692	0.4266	0.856	0.6158
Arellano Bond (p-AR1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Arellano Bond (p-AR2)	0.3998	0.2626	0.2635	0.3019	0.3166	0.2111	0.2439

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

Tab. 7: GMM models' output for non-EMU countries from period 1999-2012 – CASE short-i rates (PERIOD FIXED EFFECTS)

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.5021 [a]	0.6930 [a]	0.6469 [a]	0.5071 [a]	0.4820 [a]	0.7253 [a]	0.5519 [a]
Rate	-0.0448 [a]	-0.0108 [a]	-0.0115 [a]	-0.0401 [a]	-0.0421 [a]		-0.0367 [a]
Rate(1)							-0.0010 [c]
GDP	0.6914 [a]	0.5715 [a]	0.5558 [a]	0.6555 [a]	0.6406 [a]	0.5098 [a]	0.6067 [a]
GDP(1)		-0.1887 [b]	-0.2034 [a]				
CPI			0.0044 [c]				
CPI(1)							
Size(1)				-0.1131 [c]			-0.0989 [c]
Size(1) * Rate	0.0088 [a]			0.0092 [a]	0.0087 [a]		0.0087 [a]
Size(1) * Rate(1)							
Liq(1)		0.8619 [a]		0.6104 [a]		1.0214 [a]	0.7401 [a]
Liq(1) * Rate		-0.0387 [c]		-0.0424 [b]			-0.0472 [a]
Liq(1) * Rate(1)		0.0408 [b]		0.1092 [a]			0.0481 a
Capital(1)			**0.5180 [b]**			**1.0883 [a]**	**0.5206 [b]**
Capital(1) * Rate			-0.0590 [b]			-0.0889 [a]	-0.0519 [c]
Capital(1) * Rate(1)						0.0445 [c]	0.0450 [c]
Size(1) * Liq(1) * Rate				-0.0188 [a]			
Size(1) * Liq(1) * Rate(1)							
Size(1) * Capital(1) * Rate							
Size(1) * Capital(1) * Rate(1)							
Liq(1) * Capital(1) * Rate							
Liq(1) * Capital(1) * Rate(1)							
Total No. of panel observations	2598	2598	2598	2598	2598	2598	2598
Sargan test (p-values)	0.3318	0.174	0.3265	0.1206	0.2433	0.1414	0.1097
Arellano Bond (p-AR1)	0.0000	0.0000	0.0000	0.0005	0.0003	0.0001	0.0003
Arellano Bond (p-AR2)	0.3995	0.3748	0.3683	0.3763	0.3376	0.3004	0.3266

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation

Tab. 8: GMM models' output for non-EMU countries from period 1999-2012 – CASE with M2 (PERIOD FIXED EFFECTS)

	Size	Liq	Capital	Size Liq	Size Capital	Liq Capital	Size Liq Capital
Loans(1)	0.6090 [a]	0.6699 [a]	0.6540 [a]	0.6374 [a]	0.6087 [a]	0.6955 [a]	0.6744 [a]
M2	0.2143 [b]			0.2104 [a]			
M2(1)		0.2273 [a]	0.2924 [a]		0.1820 [b]	0.2832 [a]	
GDP	0.6485 [a]	0.6103 [a]	0.6398 [a]	0.5835 [a]	0.6203 [a]	0.5662 [a]	0.5722 [a]
GDP(1)	-0.5997 [a]	-0.5839 [a]	-0.6294 [a]	-0.5707 [a]	-0.6116 [a]	-0.5965 [a]	-0.6083 [a]
CPI	-0.0074 [a]	-0.0096 [a]	-0.0053 [a]	-0.0102 [a]	-0.0057 [a]	-0.0084 [a]	-0.0090 [a]
CPI(1)							
Size(1)	-0.6179 [a]			-0.9302 [a]	-0.6826 [a]		-1.0050 [a]
Size(1) * M2	-0.0732 [a]			**-0.0869 [a]**			
Size(1) * M2(1)	0.0910 [a]			**0.1128 [a]**			0.0744 [b]
Liq(1)				2.0664 [c]			2.0412 [b]
Liq(1) * M2		**0.3883 [b]**		0.6829 [c]			
Liq(1) * M2(1)		**-0.4204 [b]**		-0.7259 [c]			-0.3072 [b]
Capital(1)						**-3.3260 [b]**	**-4.5589 [b]**
Capital(1) * M2			1.6202 [a]			1.3499 [a]	1.5996 [a]
Capital(1) * M2(1)			-1.5389 [a]			-1.2019 [b]	-1.4159 [a]
Size(1) * Liq(1) * M2				-0.7259 [c]			
Size(1) * Liq(1) * M2(1)							
Size(1) * Capital(1) * M2							
Size(1) * Capital(1) * M2(1)							
Liq(1) * Capital(1) * M2							
Liq(1) * Capital(1) * M2(1)							
Total No. of panel observations	2610	2610	2610	2610	2610	2610	2610
Sargan test (p-values)	0.1963	0.2992	0.3998	0.283	0.4627	0.2687	0.3593
Arellano Bond (p-AR1)	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000	0.0002
Arellano Bond (p-AR2)	0.4742	0.4169	0.4203	0.5116	0.4276	0.3748	0.4644

Note: Symbol [a], [b] or [c] indicates significance at 1%, 5% or 10%.

Source: Authors' calculation