

The Role of Banks in the Monetary Policy Transmission in the New EU Member States*

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- *Preliminary version* -

Abstract

This paper aim to enrich the knowledge about the monetary policy transmission mechanism in the new European Union member states, with empirical evidence on the impact of monetary policy on bank lending. We provide a brief overview of the theory and the empirical approaches used to investigate the existence of bank lending channel. From the existing methods, we use the generally applied approach suggested by Kashyap and Stein (1995), which relies on discovering asymmetries in changes in the amount of loans due to monetary actions, in order to isolate supply and demand effects. We estimate the model by the Generalized Method of Moments, the asymmetric effects being captured by interaction-terms. We find significant asymmetric adjustment of loan quantities along certain bank characteristics. The existence of bank lending channel can explain these asymmetries. Based on our results, we can conclude for the existence of a bank lending channel in several, but not in all the analyzed countries.

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1 Introduction

A correct assessment of the monetary transmission mechanism is crucial for understanding and foreseeing the effects of the monetary conditions on the real economy. A comprehensive view on about the monetary policy transmission necessitates extensive evidence on the reaction of each sector of the economy to policy changes.

In this work, we provide empirical evidence on the effect of monetary policy changes on bank lending, at microeconomic level, in the new EU member states during the period 1998-2006.

The analysis of the differences in the monetary transmission mechanisms is very important in Central and Eastern European Countries (CEECs), both in the context of their forthcoming full euro-area participation (e.g. Slovenia - member of the euro area starting 2007) and, in that of the existing gap in the financial sector development compared to the euro area. Their banking sectors have undergone massive transformation processes over the last decades, marked by numerous bank failures and the accumulation of huge amounts of non-performing loans (in the early phase of economic transition). They have witnessed, at the same time, the privatisation of a large number of state-owned banks, which contributed to the increasing efficiency of their banking sectors (Bonin and Wachtel, 2002; Weill, 2003).

On 1st May 2004, ten new member states joined the European Union: eight CEECs (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia), along with Cyprus and Malta. Bulgaria and Romania became EU members in 2007. After joining the EU, new members must abide by the *acquis communautaire*, i.e. the same EU laws and rules that apply to the older members. The single currency project is part of these regulations. New EU member countries are expected to adopt the euro at some future date; some of them have already expressed their willingness to join the euro area as soon as possible¹.

There are considerable differences in the monetary transmission mechanisms among the EMU countries, mainly in intensity, but also in timing (Ehrmann, 1998); they are mainly explained by the differences in the financial structure. Cecchetti (1999) shows that the monetary transmission mechanisms vary across eleven EU countries, as the size, the concentration and the health of their banking systems are different. In this context, the enlargement of the monetary union is thought to increase the heterogeneity of the financial structures in the euro area, so that ECB decisions in terms of monetary policy are likely to have a different impact across countries.

We consider all these aspects and we proceed to the analysis of monetary policy transmission mechanisms in the new EU member states. The large majority of studies in this area focus on the interest and exchange rate channel analysis and little attention is paid to the

¹While Slovenia joined the euro area on 1st of January 2007, most of the new member states still fight to conform with the admission conditions concerning inflation, budget deficit, exchange rate stabilisation and legal compatibility. They have all postponed their entry into the euro area; Slovak Republic preserves its deadline - 2009; the demand of Lithuania has been rejected, as its inflation rate is too dubious; Estonia and Latvia postponed their plan of adopting the euro for the same reasons; the Baltic countries admitted the reduced probability of adopting the single currency before 2010. The remaining countries do not intend to adopt the euro before 2010-2012.

bank lending channel. The explanation is that the financial innovation of last decades makes doubtful the importance of the bank lending channel; banks play a less important role in the credit markets. This aspect is valid for the developed economies, but it does not apply in the context of the new EU member states; in these countries, financial systems continue to be mainly bank-based and borrowers do not have viable alternatives to bank loans as sources of financing (“Transition countries are over banked, but under serviced”, Hainz, 2004). We consequently analyze the functioning of the bank lending channel as a monetary policy transmission mechanism and we focus on two questions: (1) what is the role of banks (i.e. bank loans) in monetary transmission in the new EU countries, and (2) are there differences in this respect?

These issues have been addressed in several recent studies on the monetary transmission mechanism at the aggregate level (Klos and Wróbel, 2001; Creel and Levasseur, 2005; Darvas, 2005; Elbourne and de Haan, 2006; Héricourt, 2006). This paper makes use of microdata on banks. We hope to get more precise estimates by using the cross-sectional information of these datasets, thus allowing for better inference on differences across countries. To our knowledge, a similar analysis for these countries does not already exist. Read in conjunction with several papers analysing the country-level (Wróbel and Pawlowska, 2002; Juks, 2004; Pruteanu, 2004; Havrylchyk and Jurzyk, 2005; Horváth, Kréko and Naszódi, 2006), this makes for a very complete analysis of the role of banks in monetary policy transmission in the new EU countries.

The central task is to identify the reaction of loans supply to monetary policy actions. And, in particular, we investigate the existence of asymmetries in the behaviour of banks following a restrictive monetary policy. We follow an approach similar to that of Kashyap and Stein (1995), according to which smaller/less capitalised/less liquid banks react strongly to monetary policy changes i.e. the lending of small/less capitalised/less liquid banks is more sensitive to monetary policy. We use disaggregated micro-level bank data on the commercial banks from Central and Eastern Europe, over the period of 1998 to 2006. We first perform an analysis on all the countries, that does not lead to robust results. The period of analysis is short and the commercial banks of the sample might be heterogeneous. We form three groups of countries according to their ratio of loans to deposits. Afterwards, we proceed to an analysis of the banks in each group; this will help us to identify the possible differences in the behaviour of banks inside each group, following a restrictive monetary policy. We equally consider the fact that certain features, which are particular to each country, may have a potential influence on the behaviour of the banks. The results show some evidence concerning the existence of the bank lending channel in countries like Bulgaria, Czech Republic, Poland and Romania, but we can not conclude for its existence in the entire sample of countries.

We make several contributions to the empirical literature. First, we proceed to an analysis that covers ten CEECs, whereas most previous research consists of country-level studies. Second, we control for the cross-country heterogeneities and we obtain results that are consistent with those of previous studies. Size affects the bank lending activity in the aftermath of a monetary policy change in Bulgaria, Czech Republic and Romania, as small banks react more. Liquidity and capitalisation explain in a standard manner (larger and capitalized banks react less) the bank lending behaviour following a monetary policy change in Poland. Our results for Poland, in terms of liquidity, are similar to those of Havrylchyk and Jurzyk (2005). At the same time, we find some counterintuitive results for liquidity in Latvia. We explain them

by the fact that higher liquidity and capitalisation might be an endogenous response from smaller banks to counterbalance their financing difficulties resulting from higher asymmetric information.

The remainder of the paper is organized as follows. Section 2 describes the monetary framework of transition economies. Section 3 presents a short review of the debate on the lending view, both generally and in the context of transition economies. Section 4 introduces the theoretical and econometric model and describes the data we have used. Section 5 presents the estimation methodology and the results of the econometric estimations. Section 6 contains the concluding remarks.

2 Monetary conditions in transition economies

In order to get an overall picture of the bank lending channel in the analysed countries, we present several stylised facts about their financial systems. We intend to show the existing differences in the monetary transmission mechanisms and the gap in the development of their financial sectors, compared to that of the euro area.

The financial sector role under socialism consisted in the fulfillment of the investment plan and financial requirements of the state enterprises and government budget, included in the credit plan. The central credit plan operated like a global directed credit scheme; interest rates were not a factor in the mobilisation and allocation of resources and much less in managing aggregate demand. Money was not a policy instrument, and therefore, most instruments of monetary policy found in market economies were not used (De Melo and Denizer, 1997). However, money and credit were important. The objective of price stability supposed the need to ensure a balance between money supply and output. This implies a split of the system into cash and non-cash sectors. Non-cash transactions between enterprises were accounting entries within the financial system, without any effect on money supply. Cash transactions were undertaken by households who received their wages in cash. A key condition for the equilibrium of the system was the equality between the wage bill and consumption goods, valued at administratively-fixed prices. If wages paid by the authorities exceeded expenditures on goods sold by state-owned enterprises, money was printed to finance the gap, which resulted in inflationary pressures.

The financial assets of households and enterprises were kept separately. Financial assets and liabilities of enterprises were held by commercial and sectoral banks, while household deposits were directed to Savings Bank. Financial institutions that implemented the central bank's credit plan were passive; they had no role in credit allocation. The basic legal, accounting and regulatory systems were not in place. These initial conditions explain the slow improvements in resource allocation from financial intermediation, in transition economies.

Even though the transition economies under analysis are different in starting conditions and details of the adopted policies, there are important similarities in their approach to stabilisation and disinflation. They all begin the transition process with distorted domestic prices, unrealistic exchange rates and open or repressed inflation. The initial objectives of the macroeconomic policies were to control inflation, a result of the freeing of their domestic prices. The nominal exchange rates were set at rates well below purchasing power parity, in order to make stabilisation credible; to facilitate reorientation of trade to the West; and to

support a liberal trade regime. Policymakers expected that domestic inflation would cause real exchange rate appreciation and lead to a more realistic exchange rate, as these countries came closer to joining the EU.

At the outset of transition, the collapse of Council for Mutual Economic Assistance (CMEA) trade determined a decline in production in all these countries. Fiscal policy suffered a serious burden, as tax revenues declined and the need for social safety due to the increased number of unemployed increased. Investment in plant and equipment decreased as excess capacity emerged in many industries, and this complicated the monetary policy. Many firms failed to respond to the new environment by reducing or altering their output; they accumulated large stocks of inventories and related debts that threatened their liquidity and that of their suppliers and newly created commercial banks.

Based on the speed of their policy response to the break from socialist central planning, transition countries can be classified in two groups: the “fast response” group that consists of most CEE countries (except Romania) and the Baltics; and the “slower response” group, formed by Romania and the non-Baltic FSU countries (De Melo and Denizer, 1997).

Countries from the first group developed a monetary policy framework relatively quickly as part of their strategy to transform their economy. Monetary or exchange rate targets were put in place within the first two years of transition, with the declared objective of price stability. Money and credit targets were designed, along with the imposition of hard budget constraints and enterprise reforms. Even though the objectives of this group were similar, the design of monetary policies differed (as indicated by the choice of a nominal anchor). Czech Republic, Poland and Estonia adopted stabilisation programs backed by IMF stand-by arrangements, based on fixed exchange rate regimes after large devaluations. Other CEE countries chose money as the main nominal anchor for their stabilisation programs; the maintenance of the fixed exchange rate would have been hard without rapid economic liberalisation and fiscal adjustment. The three Baltic countries moved to a monetary policy framework within the context of a fixed exchange rate regime. Estonia adopted a currency board-type arrangement. Latvia initially adopted a money-based stabilisation strategy and pegged its currency to the SDR from early 1994. In 1994, Lithuania adopted a currency board arrangement, pegging its exchange rate to the dollar.

The slow response of the 2nd group of countries was the consequence of institutional arrangements following the break-up of the FSU. Traditional monetary policy objectives were adopted only in 1993 and 1994. Many of these countries were slow reformers, attempting to maintain employment and production arrangements with directed credits to unreformed industrial and agricultural enterprises. The introduction of a new currency to aid in stabilisation would have required a hard budget constraint on enterprises. The overall strategy of transition determined the evolution of their monetary policy.

What about their monetary policy framework today? The large majority of the considered economies adopted the monetary policy framework known as *inflation targeting* (Czech Republic, Hungary since 2001, Poland since 1999, Romania since 2005, Slovakia since 2005)².

²Such a monetary policy framework has the advantage that its transparency can provide a boost to the credibility of macro policy. Moreover, it targets an important convergence criterion, whose value needs to be close to EU levels for a country to qualify for EMU membership (Masson, 1999).

Central banks of Bulgaria, Estonia, Latvia, Lithuania and Slovenia have not formally adopted the framework of inflation targeting but have been clearly influenced by this approach; in these countries, the primary objective announced by the central banks consists of price stability.

How did the banking sector development evolve in transition economies? They all made progresses, creating a banking system that corresponds to the need of a developed market economy; central banks have considerable independence from government influence to control inflation and maintain the international value of their currency. At the same time, the commercial banking sector remains relatively fragile, with reduced loans made in the past and questionable lending policies. When comparing the average of domestic credit to the private sector (in % of GDP) for CEECs with the euro area average, the last one is two times larger in 2006 (see Table (1)).

The weakness of the commercial banking sector and its reduced contribution in financing the investment activity of the corporate sector limit the policies that central banks may follow and may distort the transmission of monetary policy impulses to the economy.

The fragility of the commercial banking sector is deepened by the underdevelopment of other components of the capital market. Even though each of these countries has a stock exchange, share markets are thin and stock markets perform poorly. Insurance companies and mortgage lending are underdeveloped. The relative underdevelopment of their capital markets is obvious when comparing the market capitalisation of listed companies (in % of GDP) with the euro-area average.

What about inflation? Over time, output recovered and inflation declined; however, the decline of inflation did not bring it to levels close to that of Western European economies (see Table (1)). The moderate levels of inflation in these countries have been reduced to low single-digit levels in order to prepare their entry in the EU; the achievement of such a disinflation is crucial for joining the EMU. Still, tight monetary policy will hamper the ability of firms to undertake the investments in new equipment and technology, which is necessary in order to compete within the EU markets.

Table 1: Financial development and inflation figures, in 2006.

	Domestic credit to private sector (% GDP)	Market capitalisation of listed companies (% GDP)	Inflation rate (% change)
Bulgaria	47.37	32.79	6.48
Czech Republic	41.23	34.27	1.73
Estonia	78.39	36.33	5.13
Hungary	55.32	37.14	6.5
Latvia	77.88	13.44	6.79
Lithuania	46.38	34.20	4.43
Poland	37.31	44.00	1.40
Romania	26.34	26.96	4.91
Slovak Republic	39.17	10.12	4.16
Slovenia	68.78	40.69	2.76
CEECs average	51.82	31	4.42
8-CEECs average*	55.56	31.28	4.11
Euro-area average	117	65.83	2.2

Source: International Financial Statistics (IMF) and WDI (World Bank).

* excluding Romania and Bulgaria.

Whether these countries can continue with the process of disinflation and achieve the West European rates of CPI growth during the next years depends on several factors, such as: the international climate; the appropriate fiscal policy that should support the monetary policy ; and, the question of the effectiveness of the new approach of monetary policy based on inflation targeting.

We will further continue with the analysis of the bank lending channel in these new EU countries, wondering if there are any similarities among them in the transmission of the monetary policy.

3 Debate on the lending view

3.1 Definition of the lending view

The hypothesis of ‘bank lending channel’ postulates the existence of a channel of monetary policy transmission through the bank credit. This channel is independent of the traditional ‘money channel’, which takes into consideration the effects of changes in the real interest rate on economic activity.

The bank lending channel theory ascribes a special role to banks in the monetary transmission mechanisms. It stipulates that the tightening of the monetary policy can affect not only the demand for loans (through the interest rate channel), but also the supply of loans, which in turn, further influences investment and consumption. In other words, monetary policy affects not only borrowers, but also banks. The theoretical underlying mechanism is as follows: the contraction of the monetary policy shrinks the banks’ reserves and, furthermore, the banks’ deposits. Deposits are an important source of financing the lending; the theory stipulates that, in the aftermath of a tightening of the monetary policy, the responses of banks might not be the same in terms of lending.

Two hypotheses are crucial for the bank lending channel theory:

- The imperfect substitutability between credits and other assets in banks’ balance sheet; and
- The imperfect substitutability between bank credits and other forms of financing on firms’ balance sheet.

These forms of imperfect substitutability cause monetary policy to impact on economic activity on two stages.

First, the imperfect substitutability in bank assets determines a contraction in the banks’ credit supply when there is a tightening of the monetary policy (**first stage**). When facing a decrease in liquidity, banks decrease their supply of credit instead of selling bonds that they possess in their portfolios. Alternatively, rather than decreasing credit, banks could issue bonds or collect deposits from households or the corporate sector. Financial market imperfections, such as adverse selection and moral hazard (imperfect substitutability between credits and bonds on the asset side and between bonds and deposits on the liability side), limit the ability of some banks to borrow from the financial markets.

Once credit supply has decreased (due to the imperfect substitutability between bank credit and other forms of external funding on the firm's balance sheets), the investment spending decreases, as well as the economic activity (**second stage**).

Several empirical approaches have been used to investigate the existence and the functioning of the bank lending channel. Earlier papers tried to analyse the bank lending channel based on aggregate data (Bernanke and Blinder, 1992; Kashyap, Stein and Wilcox, 1993; Oliner and Rudebusch, 1995). However, more recently the identification relies on asymmetries in the loan supplies of individual banks (Kashyap and Stein, 1995; De Bondt, 1998; Cecchetti, 1999; Kashyap and Stein, 2000; Kishan and Opiela, 2000; Ehrmann, Gambacorta, Martinez-Pagés, Sevestre and Worms, 2001; Altunbas, Fazylov and Molyneux, 2002; Driscoll, 2004; Adams and Amel, 2005; Gambacorta, 2005). Our analysis belongs to the latter category. We will further present some illustrative studies in the case of transition economies.

3.2 Lending view in transition economies

The nature of monetary transmission mechanisms in market economy is difficult to ascertain. It is even more difficult to identify these mechanisms in transition economies (Wróbel and Pawłowska, 2002; Golinelli and Rovelli, 2005). During the planned-economy era and the early-transition period, a market type economy monetary transmission mechanism did not exist in the formerly centrally planned, now transition, economies because of the underdevelopment of financial institutions and markets. Nor could such a mechanism be measured, since the data generation and collection process did not exist. By the middle of the 1990s, institutions and financial markets developed sufficiently for policy-makers to begin employing traditional monetary transmission mechanisms, monetary policy tools, resulting in consistent and purposeful monetary policy. Data availability still limits policy analysts' ability to carry out quantitative analyses (Gavin and Kemme, 2004).

The empirical evidence for CEECs is classified into two categories: evidence from Vector Auto-Regression (VAR)-based studies and evidence from micro bank-level data (Corricelli, Égert and MacDonald, 2006; Égert and MacDonald, 2006). In our analysis we proceed with the same classification, highlighting the second category.

3.2.1 Aggregate evidence, VAR-based studies

The VAR approach is the main tool used in the area of research on monetary transmission mechanisms. By using a VAR, it is possible to determine a monetary policy shock and then to examine the response of endogenous variables to a monetary impulse. Analysis of the monetary policy shocks' impact (or unexpected changes) provides useful information on the transmission mechanism. However, a necessary condition for a VAR model to produce consistent monetary shocks is that the monetary policy regime does not change within the period under consideration; this condition is difficult to fulfil by the economies in transition. This makes VAR analyses difficult and leads to the need of shortening the sample, skipping the period up to the end of 1994 in order to ensure a reasonable mix of sample homogeneity and length.

The aggregate evidence on bank lending channel is weak (Klos and Wróbel, 2001; Creel and Levasseur, 2005; Darvas, 2005; Elbourne and de Haan, 2006; Héricourt, 2006). According to De Bondt (1998), one of the most precise ways to test for credit channels is by using disaggregated data; we will further present a brief review of the bank-level data studies.

3.2.2 Bank-level Data Evidence

Empirical analyses with disaggregated data on banking firms are scarce. The literature on micro data-based evidence applies the generally used approach of Kashyap and Stein (1995, 2000), which relies on discovering asymmetric movements of loans quantities, with respect to certain bank characteristics.

An analysis of the bank lending channel for Poland was realized for 48 commercial banks, from 1995 to 2002. The main findings are that the long-run effect of an increase in the interest rate on bank lending is smaller for a bigger bank. In terms of liquidity the results are counterintuitive, as the long-run coefficient is significant but negative; one explanation is the persistent surplus of liquidity in the banking sector. For capitalisation, the long-run effect of an increase in the interest rate on bank lending is the smaller, the more capitalized bank is. Credit channel appears to operate mainly through small, poorly capitalized banks (Wróbel and Pawlowska, 2002).

The bank-lending channel is analysed for Estonia, using quarterly data from 1996 to 2004. The empirical analysis provides evidence in favour of the bank-lending channel. First, well-capitalized banks seem to experience a smaller outflow of deposits after a monetary contraction. As a consequence, a monetary policy shock that leads to a drain of deposits from the banking sector has the highest effect on deposits of less capitalized and more risky banks. Second, the liquidity position of banks seems to be an important determinant of loan supply, suggesting that more liquid banks are able to maintain their loan portfolios; yet, less liquid banks must reduce their loan supply after monetary policy contraction (Juks, 2004).

In Czech Republic, the overall effect of the monetary policy changes on the growth rate of loans and the characteristics of the supply of loans are analysed using quarterly data, from 1996 to 2001. Changes in monetary policy alter the growth rate of loans with stronger magnitude in the period of 1999-2001 than in the period of 1996-1998. For the period of 1996-1998, the cross-sectional differences in the lending reactions to monetary policy shocks are due to the degree of capitalisation and liquidity. For the subsequent period of 1999 to 2001, the distributive effects of the monetary policy are due to the size of the bank as well as the bank's proportion of classified loans (Pruteanu, 2004).

A second analysis on the existence of the bank lending channel in Poland covers the period of 1997-2002 and concerns 67 banks (commercial banks and a few biggest cooperative banks). When the usual specific characteristics (size, liquidity and capitalisation) are considered, there is no evidence on bank lending channel of the monetary policy transmission. The inclusion of a variable which accounts for the ownership structure changes the results. In the latter case, small, less liquid banks expand their loan portfolios faster, while capitalisation becomes less important (as foreign banks are much better capitalized) (Havrylchyk and Jurzyk, 2005).

The existence of the bank lending channel is examined for Hungary using quarterly data, from 1995 to 2004. Besides the usual bank specific variables (size, liquidity and capitalisation), it equally considers the foreign ownership. The novelty of this study is that it tests whether demand of loans can be considered homogenous across banks with respect to some bank-characteristics; the empirical evidence show that demand of loans can be considered reasonably homogenous across banks with respect to the share of foreign ownership and the size of banks. The main findings in terms of bank lending channel are that an increase in the policy rate induces a larger increase in the average cost of funding for smaller, less capitalized banks and for banks with a higher domestic share (Horváth, Krekó and Naszódi, 2006).

As already mentioned, this work consists of a micro bank-level data analysis. Our contribution to this category of studies consists in analysing the commercial banks from ten CEECs, by controlling for cross-country heterogeneities. Most previous research consists of country-level studies; to our knowledge no other similar analysis for these countries exists. In the following section we describe the model applied, as well as data used.

4 Model and data

4.1 Theoretical Model

Our analysis of the bank lending is based on a simple version of Bernanke and Blinder (1988) model. As in Ehrmann et al. (2001), the model of the deposit market is restricted to a relationship of equilibrium; deposits (D) are assumed to equal money (M) and both depend on the policy interest rate i , as follows:

$$M = D = -\gamma i + \epsilon \quad (1)$$

The demand for loans (L_k^d) faced by a bank k is assumed to depend on real GDP (x), the price level (π) and the interest rate on loans (i_l):

$$L_k^d = \phi_1 x + \phi_2 \pi - \phi_3 i_l \quad (2)$$

The supply of loans of a bank (L_k^s) depends on the available amount of money (or deposits) (D_k), the interest rate on loans (i_l) and the monetary policy rate (i) directly. The direct effect of the monetary policy rate arises in the presence of opportunity costs for the bank, when banks use the interbank market to finance their loans or in the case of mark-up pricing by banks, which pass on increases in deposit rates to lending rates. The supply of loans is thus modelled as:

$$L_k^s = \mu_k D_k + \phi_4 i_l - \phi_5 i \quad (3)$$

We assume that not all banks are equally dependent on deposits. Consequently, we consider the impact of deposit changes to be lower, the higher the bank characteristics (size, liquidity or capitalisation) (z_k):

$$\mu_k = \mu_0 - \mu_1 z_k \quad (4)$$

The clearing of the loan market³, together with equations (1) and (4), leads to the reduced form of the model:

$$L_k = \frac{\phi_1\phi_4x + \phi_2\phi_4\pi - (\phi_5 + \mu_0\gamma)\phi_3i + \mu_1\gamma\phi_3iz_k + \mu_0\phi_3\epsilon - \mu_1\phi_3\epsilon z_k}{\phi_3 + \phi_4} \quad (5)$$

This can be simplified to:

$$L_k = ax + b\pi - c_0i + c_1iz_k + dz_k + const \quad (6)$$

The coefficient $c_1 = \frac{\mu_1\gamma\phi_3}{\phi_3 + \phi_4}$ relates the reaction of bank lending to monetary policy to the bank characteristic. A significant parameter for c_1 implies that monetary policy affects loan supply. This requires, in particular, that the interest elasticity of loan demand (faced by a bank) to be independent of its characteristic z_k , i.e. ϕ_3 is the same across all banks.

This assumption of a homogeneous reaction of loan demand across banks is crucial for the identification of loan supply effects of monetary policy. It excludes cases where, for example, large or small bank customers are more interest rate sensitive. Given that bank loans are the main source of financing for firms in transition economies, and readily available substitutes in times of monetary tightening are very limited even for relatively large firms, we see this theoretical model as a reasonable benchmark for most countries.

For the purpose of the empirical estimations we use the model of Ehrmann et al. (2001) rewritten in first differences.

4.2 Econometric Model

As in the majority of studies using bank-level data, our empirical specification is based on Kashyap and Stein (1995), designed to test whether banks react differently to monetary policy shocks. The model is given by the equation (6) in first differences:

$$\begin{aligned} \Delta \ln y_{it} = & \sum_{j=1}^l \alpha_j \Delta \ln y_{i(t-j)} + \sum_{j=0}^l \beta_j \Delta MP_{t-j} + \gamma z_{i(t-1)} + \sum_{j=0}^l \delta_j [\Delta MP_{t-j} z_{i(t-1)}] + \\ & + \sum_{j=0}^l \varphi_j \pi_{t-j} + \sum_{j=0}^l \eta_j \Delta \ln x_{t-j} + \mu_i + \varepsilon_{it} \end{aligned} \quad (7)$$

with: $i = 1, \dots, N$ and $t = 1, \dots, T$, where N denotes the number of banks and l the number of lags (in our case $l = 1, 2$); y_{it} - total loans of bank i to clients, in year t ; MP_t - monetary policy indicator: the change in money market rate; x_{it} - real GDP; π_{it} - inflation rate; z - bank characteristics: size, capitalisation and liquidity; μ_i - individual bank effects; ε_{it} - error term; $\alpha, \beta, \delta, \gamma, \varphi, \eta$ - parameters to be estimated.

We use the growth rate of GDP and inflation to control for demand shocks. The introduction of these two variables allows us to capture the cyclical movements and serves to isolate the monetary policy component of the interest rate changes.

³We determine the interest rate on loans, i_t , starting from the equation (2) and we replace it in the equation (3).

To test for the existence of distributional effects of monetary policy among banks, we use the following indicators for the bank characteristics (z): bank size, capitalisation and liquidity⁴. These indicators are used by the large majority of studies in this area.

Due to asymmetric information problem, small banks can have more difficulties in raising non-deposit funds to offset monetary policy tightening and keep the supply of loans at a desired level. In other words, after monetary policy tightening, small banks reduce lending more than larger banks (Kashyap and Stein, 1995).

More liquid banks can easier shield their loan portfolio than less liquid banks and offset monetary policy tightening. Specifically, after an increase in the central bank interest rate, they can reduce their portfolio of liquid assets (e.g. bonds) to avoid cutting loans. The rationale for such buffer-stock behaviour of banks is the existence of credit lines, protecting the credit relationship with the client and the lack of a secondary market for the intermediated loans (Bernanke and Blinder, 1992; Kashyap and Stein, 2000).

Poorly capitalized banks have a more limited access to non-deposit financing and therefore reduce lending more than the better capitalized ones (Peek and Rosengren, 1995).

$$Size_{it} = \log A_{it} - \frac{\sum_{i=1}^N \log A_{it}}{N_t}$$

$$Liquidity_{it} = \frac{L_{it}}{A_{it}} - \left(\frac{\sum_{t=1}^T \frac{\sum_{i=1}^N L_{it}/A_{it}}{N_t}}{\sum_{t=1}^T \frac{\sum_{i=1}^N L_{it}/A_{it}}{N_t}} \right) / T$$

$$Capitalisation_{it} = \frac{E_{it}}{A_{it}} - \left(\frac{\sum_{t=1}^T \frac{\sum_{i=1}^N E_{it}/A_{it}}{N_t}}{\sum_{t=1}^T \frac{\sum_{i=1}^N E_{it}/A_{it}}{N_t}} \right) / T$$

‘Size’ is measured by the log of total assets, A_{it} . ‘Liquidity’ is defined as the ratio of liquid assets L_{it} (cash, interbank lending and securities) to total assets, and ‘capitalisation’ is given by the ratio of equity, E_{it} , to total assets⁵. These characteristics are normalized with respect to their mean across all banks in the sample, in order to get indicators that sum to zero over all observations. This means that for the regression model (7), the mean of the interaction terms ($\Delta MP_{t-j} z_{i(t-1)}$) is also zero, and the parameters β_j are directly interpretable as the average effect of the monetary policy on loans.

⁴We have equally consider the ownership of the banks but the results are not significant, so that we will not report them in the paper. BankScope give us the information on the type of ownership only for the present time (2006), so that we can not really analyze its evolution over the period 1998-2006.

⁵Capitalisation is usually defined as the ratio of capital and reserves to total assets. We make use of an alternative measure of capital ratio - *the equity to total assets ratio* - as data on capital and reserves are poorly informed for more than a half of the sample.

The definition of a large bank may differ with changing market conditions, as banks which are considered to be small on a market with a deeper financial sector, might be regarded as medium or large in a smaller market. Consequently, ‘size’ is a variable that captures the possible bank-specific asymmetries as deviations from each period’s mean. This removes the upward trend which can be observed in banks assets.

For ‘liquidity’ and ‘capitalisation’, we remove the overall sample mean (across banks and over time) from each observation. Contrary to size, liquidity and capitalisation are less relative measures. We make use of the variability of these characteristics not only across banks, but also over time. This way, we obtain the interpretability of parameters β_j , but we do not remove the trend from a possibly changing financial market. This approach is used for the two indicators, as we assume that general trends of decreasing liquidity and capitalisation might be relevant from the point of view of the transmission.

The model allows for bank-specific effects (μ_i). The parameters of interest are those in front of the monetary policy indicator (β_j), which capture the direct overall impact of the monetary policy changes on the growth of bank lending, and the coefficients in front of the interaction terms (δ_j); the latter serves to assess whether the considered bank characteristic makes any difference in the way banks react to monetary policy changes. *A positive and significant parameter δ_j is equivalent with the assumption that smaller/less capitalised/less liquid banks react more strongly to monetary policy changes.* The coefficient in front of the bank characteristic (γ) has an illustrative role; it describes whether there is a linear relationship between the growth rate of loans and the bank characteristic.

4.3 Data

We use the BankScope data set for the inflation rate and banks’ balance sheet⁶, the Transition Report (EBRD) data for real GDP and the International Financial Statistics (IFM) for the interest rate. See Table (12) in Appendix for a description of data. The sample covers the period 1998-2006 and contains annual data. The analysis does not go before 1998 because of data unavailability on the banks’ balance sheets.

Our analysis covers commercial banks from ten CEECs: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia. We will first perform an analysis over all the commercial banks from all the countries in the sample.

Second, because of the reduced span of time and the heterogeneity in the commercial banks sample, we have to think to a manner of grouping together these banks in order to obtain robust estimation results. We choose the criteria of loans to deposits ratio, as we consider pertinent the analysis of banks for which the levels of this ratio are close. For this, we take the “Total Loans” and “Total Deposits” positions from the balance sheet of each commercial bank. We calculate the share of total loans in the total of deposits (in %) and we compute its simple mean for each bank over the period 1998-2006; then, we calculate the average loans to deposits ratio for each country. This way, we form three groups of countries:

⁶BankScope is a publicly available database provided by Bureau Van Dijk, that covers balance sheet data on banks in all Eastern European countries, although not the full population in each. It has been used in the majority of the published papers for the euro area that are based on micro data on bank so far.

the first one, with the highest loans to deposits ratio, is made up of Bulgaria, Czech Republic and Estonia (economies where the average loans to deposit ratio is superior to 100.73%); the second group, the intermediary one, is made of Hungary, Poland and Slovenia (with an average loans to deposits ratio situated between 76.34% and 100.73%) and the third group, with the lowest loans to deposits ratio, is made of Latvia, Lithuania, Romania and Slovakia (with an average loans to deposits ratio between 51.68% and 76.34%). See Figure (1) in the Appendix.

5 Estimation method and results

5.1 Estimation method

The reduced span of time constricts us to estimate the equation (7) for the current period without using lags. Hence, the estimated equation is:

$$\Delta \ln y_{it} = \alpha_1 \Delta \ln y_{i(t-1)} + \beta_1 \Delta MP_t + \gamma z_{it} + \delta_1 [\Delta MP_t * z_{it}] + \varphi_1 \pi_t + \eta_1 \Delta \ln x_t + \mu_i + \varepsilon_{it} \quad (8)$$

We will first estimate a ‘benchmark model’, which does not include the bank characteristic (z) and the interaction between the bank characteristic and the monetary policy indicator ($\Delta MP_t z_{it}$). This will give us a preliminary insight into whether the growth rate of client loans responds to monetary policy shocks and to macroeconomic conditions. The full model, given by the equation (8) will be referred to as the ‘extended model’.

Our sample follows commercial banks over 9 years (1998-2006). The estimation of both ‘benchmark’ and ‘extended’ models is realised separately, first for all the banks and then separately for each group of banks; this will help us to observe the existing differences in banks behaviour inside each group, in the aftermath of a monetary policy tightening.

Both the ‘benchmark’ and the ‘extended’ model are estimated by the Generalized Method of Moments (GMM), as designed by Arellano and Bond (1991). The use of this method is due to the inclusion of lagged dependent variable as an explanatory variable; the presence of a lagged dependent variable among the regressors in a specification, which considers the individual effect as well, brings about the correlation between the error term and a right-hand regressor. In such a case, the OLS estimation would be inconsistent and biased. The GMM methodology also accounts for the possible endogeneity of some variables, as is probably the case with bank characteristics. The Arellano and Bond’ methodology first differences the autoregressive model to eliminate the individual effect and ‘optimally exploits’ the moment conditions using the lagged values dated t-2 and earlier of the dependent variable and the lagged values of the predetermined variables as instruments. This ensures efficiency and consistency and provides that the model is not subject to serial correlation in ε_{it} and that the instrument variables are valid (the Sargan and Hansen tests). The Arellano and Bond design both 1-step estimation and a 2-step estimation. The difference between them consists in the specification of an individual specific weighting matrix. The 2-step estimation uses the 1-step’s residuals, so it is more efficient. Therefore, we will further proceed with this estimation in two steps.

5.2 Estimation Results

The tables below summarise the results of the estimation of the ‘benchmark’ and the ‘extended’ models for total loans to clients. We proceed with two estimations - one at the aggregate level and, the other, on single countries in a pooled regression; in the two cases, the estimations are realised separately, first for all the banks together and then for each group of banks. The reported figures represent the long-run elasticities of the models⁷. These have been estimated using the GMM estimator suggested by Arellano and Bond (1991), which ensures efficiency and consistency, provided that the models are not subject to serial correlation of order two and that the instruments are valid (which is tested by the Hansen test). In the GMM estimations, the instruments are the second and further lags of the dependent variable and the bank specific characteristics included in each equation. Inflation, GDP growth rate and the monetary policy indicator are considered as exogenous variables.

5.2.1 Evidence on the Aggregate Level for Each Group of Banks

To assess the role of banks in the monetary policy transmission, we will first estimate the equation (8) including (first globally and then within each group), the observations regarding the banks in all the countries, without discriminating for national parameters.

A. Benchmark model

The estimation results of the ‘benchmark model’ reveal a lack of significance for all the variables included in the model, both when taking all the banks together and when differentiating between the three groups of banks.

Table 2: Long-run coefficients estimated in the ‘benchmark model’ (8).

New EU Member States	Models estimated for the following banks			
	all banks	group1	group2	group3
Monetary policy	0.0004 (0.0004)	0.00002 (0.030)	-0.00006 (0.001)	-0.0002 (0.001)
Real GDP	0.001 (0.004)	-0.262 (0.275)	0.762 (0.924)	0.248 (0.170)
Consumer Price Index	0.136* (0.075)	0.002 (0.007)	0.024 (0.019)	0.001 (0.006)
p-value Hansen	0.203	0.869	0.100	0.103
p-value AR1/AR2	0.124/0.810	0.236/0.620	0.077/0.437	0.151/0.634
No. obs./ No. banks	193/1147	45/267	81/458	67/422

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

Group 1: commercial banks from Bulgaria, Czech Republic and Estonia. Group 2: commercial banks from Hungary, Poland and Slovenia. Group 3: commercial banks from Latvia, Lithuania, Romania and Slovakia.

Concerning the monetary policy effects on the growth rate of total loans to clients, changes in the policy-induced interest rate have a negative but non-significant impact in the 2nd and 3rd group of banks. Thus, the theory of bank lending channel (according to which loans fall after a monetary policy tightening) is not confirmed. With regards to the impact of

⁷The long-term coefficient of a variable is computed as the sum of its coefficients (of its lags and current values, where applicable) divided by one minus the sum of the coefficients of the lags of the dependent variable. For instance, the long-run elasticity of the dependent variable with respect to monetary policy for the average bank is given by $\sum \beta_j / (1 - \sum \alpha_j)$.

macroeconomic conditions, the influence of GDP growth is not significant, while inflation does not present the expected negative impact; we even identify an unexpected positive and significant coefficient for this variable when considering all the banks together.

B. Extended Model

We focus on the significance of the linear relationship between the growth rate of the total loans to clients and the bank characteristics - the coefficient γ in equation (8) - and of the distributive effects of monetary policy on the growth rate of loans due to these bank characteristics - the interaction coefficients δ_1 in equation (8). We realize this for all the commercial banks considered together and, then, separately for the three groups of banks. The main results are summarised in Table (3) for all the banks, and, respectively, in Table (4) for the 1st group, Table (5) for the 2nd group and Table (6) for the 3rd group. All these tables present the same structure. Each column presents the results from one of the specifications - first models with one of the bank characteristics each, then one model with all three characteristics simultaneously and, last a specification where size and liquidity enter, both in single and double interaction⁸. Through double interaction it is possible to test whether the effect of liquidity depends on the size of banks.

1°. Estimations for all the banks

Table 3: Long-run coefficients estimated in the ‘extended model’ (8) - all banks.

Models estimated with the following bank characteristic variables					
New EU Member States	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy	-0.0001 (0.0007)	-0.0003 (0.0006)	-0.00001 (0.0008)	0.00005 (0.0009)	-0.0002 (0.0006)
Real GDP	0.238** (0.103)	0.167* (0.089)	0.259*** (0.097)	0.147 (0.092)	0.136 (0.128)
Consumer Prices Index	0.003 (0.005)	0.002 (0.005)	-0.0008 (0.003)	0.00009 (0.003)	0.003 (0.005)
Char1	-0.016 (0.029)	-0.0009 (0.0010)	-0.0001 (0.002)	-0.068** (0.029)	-0.057* (0.034)
Char1*MP	0.001 (0.001)	-0.00005 (0.00006)	0.0002 (0.0001)	0.002** (0.0009)	0.0006 (0.001)
Char2				-0.002* (0.001)	-0.001 (0.001)
Char2*MP				-0.00005 (0.00008)	-0.00006 (0.00007)
Char3				-0.003 (0.0002)	
Char3*MP				0.0002 (0.0002)	
Char1*Char2*MP					0.00006 (0.00009)
p-val Hansen	0.111	0.398	0.147	0.641	0.650
p-val AR1, AR2	0.028/0.428	0.049/0.742	0.058/0.850	0.030/0.928	0.019/0.538
No of banks, obs.	193/1147	193/1147	192/1128	192/1128	193/1147

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

The estimations reveal a significant linear negative relationship between bank size and the growth rate of total loans to clients in the case of the model with all the three characteristics

⁸The different bank-characteristics may be correlated with each other. A number of authors include simultaneously all bank-specific characteristics in the estimations (Pruteanu, 2004; Havrylychuk and Jurzyk, 2005) or only two at the same time (Horváth, Krekó and Naszódi, 2006).

simultaneously and in that of the model with the characteristics of size and liquidity. This signifies that small banks enjoy higher loan growth rates. The interaction term between monetary policy and bank size presents a non-significant coefficient in the case of models with one of the bank characteristics each. However, this interaction term become significant and positive in the model with three characteristics, confirming the theory: smaller banks reduce their lending more than large banks do, in the aftermath of a monetary policy change. In the same model (with three characteristics) the results show a negative and significant linear effect of liquidity on the growth rate of total loans to clients; this means that low liquid banks enjoy higher loan growth rates. Concerning the interaction term between liquidity and the indicator of monetary policy, the overall analysis reveals an insignificant coefficient for all the groups. With regards to capitalisation, it does not present a significant coefficient; we can conclude that capitalisation does not influence the growth rate of total loans to clients in the aftermath of a monetary policy change.

We will further proceed to estimations separately, for each group of banks.

2°. Estimations for the first group of countries

Table 4: Long-run coefficients estimated in the ‘extended model’ (8) - group 1.

Models estimated with the following bank characteristic variables					
New EU Member States	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy	0.0001 (0.0005)	-0.0004 (0.0006)	-0.0009 (0.0006)	-0.0002 (0.0008)	-0.0002 (0.0009)
Real GDP	-0.378 (0.243)	-0.178 (0.186)	-0.103 (0.214)	-0.332 (0.264)	-0.234 (0.322)
Consumer Prices Index	-0.011 (0.009)	0.0007 (0.008)	-0.003 (0.008)	-0.007 (0.010)	-0.007 (0.010)
Char1	-0.086** (0.033)	0.0004 (0.001)	0.001 (0.001)	-0.143* (0.073)	-0.082 (0.059)
Char1*MP	0.002*** (0.0008)	-0.00005 (0.00005)	-0.0002** (0.00008)	0.002 (0.001)	0.003*** (0.001)
Char2				-0.0008 (0.001)	-
Char2*MP				-0.00005 (0.00004)	-0.00004 (0.00006)
Char3				-0.006* (0.003)	
Char3*MP				-0.0007 (0.0001)	
Char1*Char2*MP					-0.00007 (0.00005)
p-val Hansen	1	1	1	1	1
p-val AR1, AR2	0.137/0.492	0.185/0.430	0.122/0.456	0.058/0.617	0.123/0.584
No of banks, obs.	45/267	45/267	45/267	45/267	45/267

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

When we consider the commercial banks from Bulgaria, Czech Republic and Estonia (the first group), the results are the following:

- size presents a linear negative and significant relationship with the growth rate of loans in the model with size as the only characteristic and in that with three characteristics simultaneously; this confirms that small banks enjoy higher loans growth rates.

- the interaction term between size and the monetary policy indicator presents the expected positive and significant coefficient in the model with size as the only bank characteristic and in that with size and liquidity; this confirms the theory, as smaller banks are strongly affected by a monetary policy change.
- liquidity does not seem to have an impact on the growth rate of loans in the aftermath of a monetary policy change.
- capitalisation presents a negative and significant linear relationship in the model with the three characteristics, meaning that low capitalized banks enjoy higher growth rates of loans. We obtain a negative coefficient for the interaction term between capitalisation and the monetary policy indicator in the model with capitalisation as the only characteristic; this is opposed to the theory, as it means that capitalized banks are strongly affected by a monetary policy change.

3°. Estimations for the second group of countries

Table 5: Long-run coefficients estimated in the ‘extended model’ (8) - group 2.

New EU Member States	Models estimated with the following bank characteristic variables				
	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy	0.0009 (0.002)	0.001 (0.002)	0.001 (0.001)	0.0009 (0.001)	0.001 (0.001)
Real GDP	0.814* (0.476)	0.674 (0.442)	0.564*** (0.191)	0.391*** (0.110)	0.692** (0.318)
Consumer Prices Index	0.009 (0.009)	0.007 (0.009)	0.003 (0.008)	0.003 (0.010)	0.009 (0.008)
Char1	0.109 (0.086)	-0.001 (0.002)	-0.023* (0.013)	0.001 (0.033)	0.109 (0.080)
Char1*MP	-0.0004 (0.002)	0.0001 (0.0001)	0.0005* (0.0002)	0.003** (0.001)	-0.003 (0.005)
Char2				-0.003*** (0.001)	-0.002 (0.001)
Char2*MP				0.0001* (0.00006)	0.0001 (0.0001)
Char3				-0.017** (0.008)	
Char3*MP				0.0004* (0.0002)	
Char1*Char2*MP					-0.0003 (0.0004)
p-val Hansen	0.720	0.711	0.744	1	1
p-val AR1, AR2	0.005/0.422	0.007/0.470	0.001/0.747	0.001/0.731	0.003/0.556
No of banks, obs.	81/458	81/458	81/458	81/458	81/458

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

When we consider the commercial banks from Hungary, Poland and Slovenia (the second group), the results are the following:

- size does not present a linear significant relationship with the growth rate of loans in none of the models.
- the interaction term between size and the monetary policy indicator presents the expected positive and significant coefficient in the model with the three characteristics simultaneously, confirming the theory: smaller banks are reducing more their lending in the aftermath of a monetary policy change.

- liquidity presents a negative and significant linear relationship with the growth rate of loans in the case of the model with the three characteristics simultaneously; according to this result, low liquid banks enjoy higher loan growth rates.
- the interaction term between liquidity and the monetary policy indicator presents the expected positive and significant coefficient, still in the model with the three characteristics simultaneously. Low liquid banks reduce more their lending than liquid banks do.
- capitalisation presents a negative and significant linear relationship in the model with the three characteristics, meaning that low capitalized banks enjoy higher growth rates of loans. Its interaction with the monetary policy indicator presents the expected positive and significant coefficient: low capitalized banks are reducing their lending more than capitalized banks do.

4°. Estimations for the third group of countries

Table 6: Long-run coefficients estimated in the ‘extended model’ (8) - group 3.

New EU Member States	Models estimated with the following bank characteristic variables				
	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy	0.0003 (0.0007)	-0.0001 (0.001)	-0.0004 (0.001)	-0.0002 (0.001)	0.00003 (0.0007)
Real GDP	0.105 (0.143)	0.091 (0.144)	0.227** (0.113)	0.103 (0.129)	0.101 (0.137)
Consumer Prices Index	0.0004 (0.005)	0.002 (0.006)	-0.002 (0.003)	-0.002 (0.003)	0.0006 (0.004)
Char1	-0.061 (0.065)	-0.004*** (0.001)	0.001 (0.003)	-0.072* (0.039)	-0.070 (0.050)
Char1*MP	0.002 (0.001)	-0.0001** (0.00008)	0.00002 (0.0001)	0.0008 (0.001)	0.001 (0.001)
Char2				-0.005*** (0.001)	-0.005*** (0.001)
Char2*MP				-0.00009 (0.00009)	-0.00008 (0.00007)
Char3				-0.0003 (0.003)	
Char3*MP				0.0001 (0.0001)	
Char1*Char2*MP					0.00008 (0.00009)
p-val Hansen	0.973	0.975	0.966	1	1
p-val AR1, AR2	0.099/0.585	0.038/0.820	0.124/0.748	0.081/0.999	0.049/0.736
No of banks, obs.	67/422	67/422	66/403	66/403	67/422

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

When we consider the commercial banks from Latvia, Lithuania, Romania and Slovakia (the third group), the results are the following:

- size presents the expected negative and significant linear relationship with the growth rate of loans in the model with the three characteristics simultaneously.
- the interaction term between size and the monetary policy indicator does not present a significant coefficient in none of the models.

- liquidity presents a negative and significant linear relationship with the growth rate of loans in the case of the model with liquidity as the only characteristic and the last two specifications (the three characteristics together and the one with size and liquidity). The result suggests that low liquid banks from this group enjoy higher loans growth rates.
- the interaction term between liquidity and the monetary policy indicator presents a significant but negative coefficient, still in the model with liquidity as the only characteristic. According to this result, liquid banks reduce more their lending than low liquid banks do.
- capitalisation does not present a significant linear relationship with the growth rate of loans. Its interaction term with the monetary policy indicator is not significant neither.

In conclusion, the analysis at the aggregate level for all the banks shows that size is the only bank characteristic that affect the lending activity of the commercial banks in the ten countries. When we consider separately each group of banks we obtain the following results: for the first group - size affects banks behavior, while capitalisation presents a counterintuitive effect - capitalized banks are stronger affected by a monetary policy change. In the second group, the three bank characteristics have the expected effect on the lending activity of commercial banks: smaller, less liquid and less capitalized banks are reducing more their lending activity in the aftermath of a monetary policy change; this result is obtained in the model with the three characteristics simultaneously. In the third group we obtain a counterintuitive effect for liquidity, while the other bank characteristics do not have significant coefficients.

We wonder if the results obtained above are not influenced by the existing heterogeneity among banks, inside each group. Consequently, it would be more appropriate to examine the impact of bank characteristics on the growth rate of loans to total clients by the means of an analysis on single countries in a pooled regression for each group.

5.2.2 Evidence on Single Countries in a Pooled Regression

In the subsection above, we have treated all banks the same way, by restricting all coefficients to be the same in the global analysis first and, then, inside each group. In order to highlight the cross-country differences among each group, we extend our model. The parameters of interest, i.e. those of the monetary policy indicator and the interaction between banks characteristics and the monetary policy indicator are allowed to vary across countries, through the introduction of country specific dummies. By proceeding this way, we assume that loan demand elasticities with respect to GDP and inflation are homogeneous across banks inside each group. Consequently, the estimated model is the following:

$$\Delta \ln y_{it} = \alpha_1 \Delta \ln y_{i(t-1)} + \beta_1 \Delta MP_t * d_{country} + \gamma z_{it} + \delta_1 [\Delta MP_t * d_{country} * z_{it}] + \varphi_1 \pi_t + \eta_1 \Delta \ln x_t + \mu_i + \varepsilon_{it} \quad (9)$$

We continue to distinguish between the three group of countries, as there are differences between them in terms of demand factors (GDP and inflation). We proceed as before, by estimating the ‘benchmark model’ and ‘extended model’ respectively, for total loans to clients.

A. Benchmark Model

Table 7: Long-run coefficients estimated in the ‘benchmark model’ (8).

New EU Member States	Models estimated for the following banks			
	all banks	group1	group2	group3
Monetary policy				
Bulgaria	-0.0004 (0.0008)	-0.0006 (0.0008)		
Czech Rep.	0.0002 (0.012)	0.001 (0.001)		
Estonia	0.001*** (0.003)	-		
Hungary	-0.0009 (0.0007)		-0.0008 (0.001)	
Latvia	0.0016* (0.0009)			-0.001 (0.001)
Lithuania	0.00007 (0.0008)			0.0002 (0.007)
Poland	0.003** (0.001)		0.006 (0.004)	
Romania	-0.013 (0.001)			-0.002* (0.001)
Slovakia	-0.0002 (0.0009)			0.0002 (0.0008)
Slovenia	0.0005 (0.0009)		0.0008 (0.003)	
Real GDP	0.121* (0.065)	-0.266 (0.258)	0.484 (0.513)	0.304* (0.157)
Consumer Price Index	-0.003 (0.005)	0.002 (0.007)	-0.006 (0.020)	-0.0006 (0.006)
p-value Hansen	0.384	0.878	0.080	0.067
p-value AR1/AR2	0.119/0.748	0.257/0.595	0.055/0.327	0.174/0.770
No. obs./ No. banks	193/1147	45/267	81/458	67/422

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

Group 1: commercial banks from Bulgaria, Czech Republic and Estonia. Group 2: commercial banks from Hungary, Poland and Slovenia. Group 3: commercial banks from Latvia, Lithuania, Romania and Slovakia.

The estimation of the ‘benchmark model’ does not reveal significant differences between the results for three groups of banks, as the coefficients are largely not significant.

Concerning the effects of monetary policy on the growth rate of total loans to clients, changes in the policy-induced interest rate have a negative and significant impact only in Romania (3rd group). This confirms the bank lending channel theory: loans fall after a monetary policy tightening. For the rest of countries the impact is not significant. When we take all the banks together - the first specification - we obtain a positive and significant coefficient in the case of Estonia, Latvia and Poland. These results are counterintuitive, they represent the average impact of the monetary policy across all banks; banks are considered to have the same weight, they do not have a ponder given by their market share or characteristics. Consequently, these estimates cannot be used to quantify the effect of a certain change in the monetary policy.

As regards the difference in macroeconomic conditions' impact, the influence of GDP growth is positive and significant only when considering all the banks together and for the 3rd group, while it is not significant in the first two groups. Inflation, which is meant to account for demand factors, does not present a significant coefficient in none of the models.

B. Extended Model

The features of the supply of loans are revealed by the estimation of the 'extended model' (equation (9)). We focus on the significance of the linear relationship between the growth rate of total loans to clients and the bank characteristics - the coefficient γ in equation (9) - and the distributive effects of monetary policy on the growth rate of loans due to these bank characteristics - the interaction coefficients δ_1 in equation (9). We realize this for the three groups of banks.

1°. Estimations for the first group of countries

Table 8: Long-run coefficients estimated in the 'extended model' (9) - group 1.

New EU Member States	Models estimated with the following bank characteristic variables				
	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy					
Bulgaria	0.0002 (0.0008)	-0.0009 (0.0006)	-0.0006 (0.0008)	-0.002* (0.001)	-0.0007 (0.0008)
Czech Rep.	-0.003 (0.002)	0.0008 (0.001)	-0.001 (0.002)	-0.002 (0.002)	0.0001 (0.001)
Real GDP	-0.231 (0.214)	-0.133 (0.216)	-0.119 (0.210)	-0.311 (0.234)	-0.266 (0.220)
Consumer Prices Index	-0.005 (0.008)	0.003 (0.007)	-0.0008 (0.008)	-0.008 (0.006)	-0.013 (0.009)
Char1	-0.053* (0.029)	-0.0003 (0.001)	0.0007 (0.002)	-0.213* (0.119)	-0.063 (0.050)
Char1*MP					
Bulgaria	0.001 (0.001)	0.00004 (0.00001)	-0.0001 (0.00009)	-0.002 (0.003)	-0.00002 (0.0024)
Czech Rep.	0.006** (0.002)	-0.0001 (0.00009)	-0.0003 (0.0002)	0.008 (0.006)	0.002 (0.002)
Char2				-0.001 (0.001)	-0.001 (0.001)
Char2*MP					
Bulgaria				0.00008* (0.00004)	0.0004 (0.00006)
Czech Rep.				-0.00003 (0.00005)	-0.0001 (0.0001)
Char3				-0.009* (0.005)	
Char3*MP				-	
Bulgaria				-0.0001 (0.0001)	
Czech Rep.				0.0003 (0.0003)	
Char1*Char2*MP					
Bulgaria					-0.00008 (0.00007)
Czech Rep.					0.0001 (0.0002)
p-val Hansen	1	1	1	1	1
p-val AR1, AR2	0.065/0.642	0.199/0.402	0.107/0.491	0.230/0.385	0.222/0.408
No of banks, obs.	45/267	45/267	45/267	45/267	45/267

Note: Standard errors in parentheses. *, **, *** denotes significance at 10%, 5%, 1% level. Observations on the monetary policy indicator were dropped for Estonia, because of the colinearity.

The estimations reveal a significant linear negative relationship between bank size and the growth rate of total loans to clients in the model with size as the only characteristic and when considering the three characteristics simultaneously, as small banks from this group enjoy higher loan growth rates. The distributive effect of monetary policy changes due to bank size is shown by the interaction term between the monetary policy and bank size. Its coefficient presents the expected positive and significant sign only for commercial banks from Czech Republic in the case of the model with size as the only bank characteristic, and, respectively, for commercial banks from Bulgaria in the model with the three characteristics simultaneously. Liquidity presents a negative and significant linear relationship with the growth rate of loans for the banks from this group (see Table (8) above).

2°. Estimations for the second group of countries

The estimations show a positive and significant coefficient for the interaction term between capitalisation and the monetary policy indicator in Poland, as low capitalized banks are reducing more their lending than capitalized banks do. This result is obtained in the model with capitalisation as the only bank characteristic. The same result is obtained in the model with three characteristics simultaneously. Another significant result obtained in the latter model is a positive and significant coefficient for the interaction term between liquidity and the monetary policy indicator, still in the case of Poland: low liquid banks from Poland are strongly affected by a monetary policy change. For the linear relationship between liquidity and the growth rate of loans, the results of the estimations show that low liquid banks from the second group have a higher growth rate of loans (see Table (9) below).

Table 9: Long-run coefficients estimated in the ‘extended model’ (9) - group 2.

Models estimated with the following bank characteristic variables					
New EU Member States	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy					
Hungary	-0.002 (0.002)	-0.002 (0.001)	-0.001 (0.002)	-0.002 (0.003)	-0.002 (0.002)
Poland	0.007 (0.004)	0.005 (0.002)	0.006*** (0.002)	0.004** (0.002)	0.005** (0.002)
Slovenia	-0.003 (0.004)	0.0009 (0.003)	-0.0004 (0.002)	0.001 (0.007)	-0.005 (0.006)
Real GDP	0.725 (0.491)	0.437 (0.276)	0.447** (0.174)	0.255* (0.139)	0.513** (0.203)
Consumer Prices Index	-0.013 (0.013)	-0.006 (0.010)	-0.013 (0.011)	-0.007 (0.010)	0.001 (0.010)
Char1	0.142 (0.127)	-0.001 (0.001)	-0.016 (0.010)	-0.012 (0.077)	0.073 (0.052)
Char1*MP					
Hungary	0.003 (0.003)	-0.00007 (0.0001)	-0.00001 (0.0001)	0.00003 (0.003)	0.004 (0.003)
Poland	-0.004 (0.005)	0.0002 (0.0001)	0.0009*** (0.0001)	0.0011 (0.002)	-0.006 (0.005)
Slovenia	0.009 (0.006)	0.0001 (0.0001)	-0.0001 (0.0004)	0.001 (0.005)	0.013 (0.015)
Char2				-0.004*** (0.001)	-0.003** (0.001)
Char2*MP					
Hungary				-0.00008 (0.00006)	-0.00009 (0.00008)
Poland				0.0001* (0.0001)	0.0001 (0.0001)
Slovenia				-0.00009 (0.0001)	-0.00001 (0.0003)
Char3				-0.011 (0.007)	
Char3*MP					
Hungary				-0.00002 (0.0001)	
Poland				0.0007*** (0.0001)	
Slovenia				0.0001 (0.0007)	
Char1*Char2*MP					
Hungary					0.0002 (0.0001)
Poland					-0.0007 (0.0005)
Slovenia					0.0004 (0.0007)
p-val Hansen	1	1	1	1	1
p-val AR1, AR2	0.002/0.297	0.002/0.283	0.000/0.485	0.001/0.631	0.001/0.553
No of banks, obs.	81/458	81/458	81/458	81/458	81/458

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

3°. Estimations for the third group of countries

Table 10: Long-run coefficients estimated in the ‘extended model’ (9) - group 3.

New EU Member States	Models estimated with the following bank characteristic variables				
	Size	Liquidity	Capitalisation	Size Liquidity Capitalisation	Size Liquidity
Monetary policy					
Latvia	-0.00008 (0.0009)	-0.0003 (0.001)	-0.0004 (0.002)	-0.002 (0.002)	-0.001 (0.003)
Lithuania	0.001 (0.0006)	0.001 (0.005)	0.00005 (0.002)	-0.005 (0.011)	-0.002 (0.002)
Romania	-0.001 (0.001)	-0.001 (0.001)	-0.003** (0.001)	-0.0004 (0.004)	-0.00002 (0.001)
Slovakia	0.0001 (0.001)	0.0005 (0.0012)	0.001 (0.001)	0.002 (0.004)	-0.0002 (0.001)
Real GDP	0.206 (0.137)	0.133 (0.177)	0.329* (0.166)	0.211 (0.217)	0.205 (0.199)
Consumer Prices Index	-0.001 (0.005)	-0.002 (0.006)	0.003 (0.003)	-0.004 (0.010)	0.002 (0.006)
Char1	-0.010 (0.040)	-0.002* (0.001)	0.002 (0.003)	-0.063 (0.125)	-0.016 (0.062)
Char1*MP					
Latvia	0.001 (0.002)	-0.0001* (0.0001)	0.0002 (0.0002)	-0.003 (0.002)	-0.002 (0.002)
Lithuania	0.001 (0.001)	0.00001 (0.00009)	-0.0004 (0.0003)	-0.002 (0.010)	0.0001 (0.004)
Romania	0.006*** (0.002)	0.00008 (0.0001)	0.00005 (0.0001)	0.004 (0.005)	0.006** (0.002)
Slovakia	0.001 (0.001)	-0.00004 (0.00007)	0.0002 (0.0002)	-0.0008 (0.006)	0.001 (0.002)
Char2				-0.004*** (0.001)	-0.003 (0.002)
Char2*MP					
Latvia				-0.0001 (0.0001)	-0.0001 (0.0001)
Lithuania				-0.0001 (0.0004)	0.00005 (0.00008)
Romania				0.0002 (0.0002)	0.00003 (0.0001)
Slovakia				0.00003 (0.0001)	0.00004 (0.0001)
Char3				-0.002 (0.005)	
Char3*MP					
Latvia				-0.0004 (0.0002)	
Lithuania				-0.0001 (0.0008)	
Romania				-0.00001 (0.0001)	
Slovakia				0.0003 (0.0008)	
Char1*Char2*MP					
Latvia					0.0007 (0.0001)
Lithuania					0.0007 (0.0007)
Romania					-0.0002 (0.0003)
Slovakia					-0.00008 (0.0001)
p-val Hansen	1	1	1	1	1
p-val AR1, AR2	0.092/0.675	0.044/0.897	0.108/0.855	0.166/0.747	0.105/0.591
No of banks, obs.	67/422	67/422	66/403	66/403	67/422

Note: Standard errors in parentheses.

*, **, *** denotes significance at 10%, 5%, 1% level.

Size has the expected positive and significant coefficient for its interaction term in the case of Romania, confirming the theory: smaller banks reduce more their lending than larger banks do. For liquidity, its linear effect is negative and significant and its interaction term with the monetary policy indicator presents a counterintuitive coefficient in the case of Latvia. This means that liquid banks from Latvia are strongly affected by a monetary policy change. Capitalisation does not present a significant influence on the growth rate of loans (see Table (10) above).

What can be the explanations for the counterintuitive results relating to the bank lending channel theory? We are talking here about the negative and significant coefficients obtained for the interaction term between ‘liquidity’ and the monetary policy indicator in the case of Latvia.

According to Kashyap and Stein (2000), higher liquidity and capitalisation might be an endogenous response of smaller banks in order to counterbalance their financing difficulties resulting from higher asymmetric information problems.

Bank characteristics used in this analysis (size, liquidity and capitalisation) are not independent from each other. The bank lending channel theory suggests that banks facing asymmetric information problems to a greater extent for instance smaller banks, have large difficulties accessing cheap funds. Consequently, these banks are inclined to be better capitalized and hold more liquid assets. Kashyap and Stein (2000) show that data on American banks support this hypothesis.

We further analyse the validity of the enounced hypothesis in the case of commercial banks from Latvia, where results are contrary to the theory. In order to do this, we proceed to a classification of the commercial banks from Latvia in accordance to their size. As in studies like that of Gambacorta (2005), a bank that has the average size below the third quartile is considered “small” and a bank that has the average size above the 95th percentile is considered “big”. Banks with an average size between the third quartile and the 95th percentile are considered “medium”. Once we distinguish these three categories (small, medium and large banks), we determine the average liquidity for each of them (see Table (11)).

Table 11: Selected indicators of banks by size (average 1998-2006).

Banks		(Small)	(Medium)	(Large)
Country	Indicator			
Latvia	Liquid assets/total assets	36.88	33.91	22.44
	Equity/total assets	18.68	16.81	8.73

Source: Author calculation based on BankScope data.

As the data shows, the banking sector of Latvia underpins the hypothesis that smaller banks tend to have higher liquidity and capitalisation than larger banks. In Latvia, the small commercial banks have an average ratio of liquid assets to total assets of 36.88%; whilst the large commercial banks have a ratio of liquid assets to total assets of only 22.44%. This can explain the opposed sign of our estimated coefficient.

6 Conclusions

In this paper we investigate the working of the bank lending channel in the case of the new EU member states, from 1998 to 2006. We classify the commercial banks of these countries in three groups according to the loans to deposits ratio criteria. Afterwards, by using a panel of annual time series for commercial banks of each group, we analyse: (i) whether monetary conditions impact on bank lending; (ii) whether there are linear relationships between some particular bank characteristics (size, liquidity and capitalisation) and the growth rate of total loans to clients; and (iii) we characterise the effectiveness of the credit channel, by looking whether there are distributional effects due to the bank's characteristics in the impact of monetary policy on bank lending.

Our analysis focuses on the fluctuations in total loans to clients over the period of 1998 to 2006. We find differences between the results in each group of banks.

The results of the estimations show that total loans to clients react to monetary policy impulses with stronger intensity in Romania (3rd group). The coefficient of the monetary policy indicator is, in this country, negative and significant. The development of the banking sector and the recovery of the demand after the 1998 crisis could explain the stronger impact of the monetary policy on the growth rate of total loans to clients.

We find some significant linear effects of all bank characteristics on the growth rate of loans to clients. Small, liquid, capitalized banks enjoy higher loan growth rates.

Concerning the distributive effects of monetary policy on the growth rate of loans due to such bank characteristics, the results are as follows:

- 'size', as a bank characteristic, influences the growth rate of total loans in the aftermath of a monetary policy change in Bulgaria and Czech Republic (1st group) and Romania (3rd group). The coefficient of the variable 'size' interacted with the monetary policy indicator is positive and significant in the case of these countries, confirming the theory: smaller banks are more affected by a monetary policy tightening. The result obtained for the commercial banks from Czech Republic is in line with the findings of Pruteanu (2004).
- for 'liquidity', the estimation shows a positive and significant coefficient for Poland (2nd group), as low liquid banks are stronger affected by a monetary policy tightening. This result is in line with the findings of Havrylchyk and Jurzyk (2005), but is contrary to those of Wróbel and Pawlowska (2002). We equally find a negative and significant coefficient for commercial banks from Latvia. We may suppose that this counterintuitive result can be explained by the over-liquidity of the Latvian banking sector.
- concerning the 'capitalisation', the estimation results show a positive and significant coefficient in Poland, which confirms the theory. The result obtained for Poland can be compared to those of previous studies; Wróbel and Pawlowska (2002) show that a better capitalisation position enables banks to insulate loans from monetary policy actions; whilst Havrylchyk and Jurzyk (2005) show that bank capitalisation does not play any role in the lending behaviour of banks.

We explain the counterintuitive findings by showing that in Latvia the smaller banks

tend to have higher liquidity and capitalisation ratios than large banks; and this, in order to counterbalance their difficulties in financing, which result from higher asymmetric information problems.

According to these findings, we cannot assert the existence of the bank lending channel in the entire sample of countries but only for several countries: Bulgaria, Czech Republic, Poland and Romania. This may be due to the short period of analysis. We do not expect the bank dependency of borrowers to decline, as the analysed economies integrate more and become similar to the European economy. The continuously diminishment of excess liquidity in the banking systems and the decreasing capitalisation, due to the increasing efficiency, outlines the possibility of strengthening of the bank-lending channel in the future, in CEECs.

We attempt to realize the same analysis for the commercial banks in the euro-area. This will give us an insight on the existing differences/similarities in the functioning of the bank lending channel between the “old” and the “new” members of the European Union.

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A Appendix

Appendix 1

Table 12: Variables definition.

Variable	Definition and Source
Loans	total loans to clients (th. EUR), BankScope
Monetary Policy Indicator	money market rate (annual data), IFS
GDP	the growth rate of real GDP (annual data), Transition Report, EBRD
Inflation	CPI % changes (annual data), BankScope
Size	the total assets (th. EUR), BankScope
Liquidity	the ratio of liquid assets to total assets (%), own calculation, BankScope
Capitalisation	the ratio of equity to total assets (%), BankScope

Appendix 2

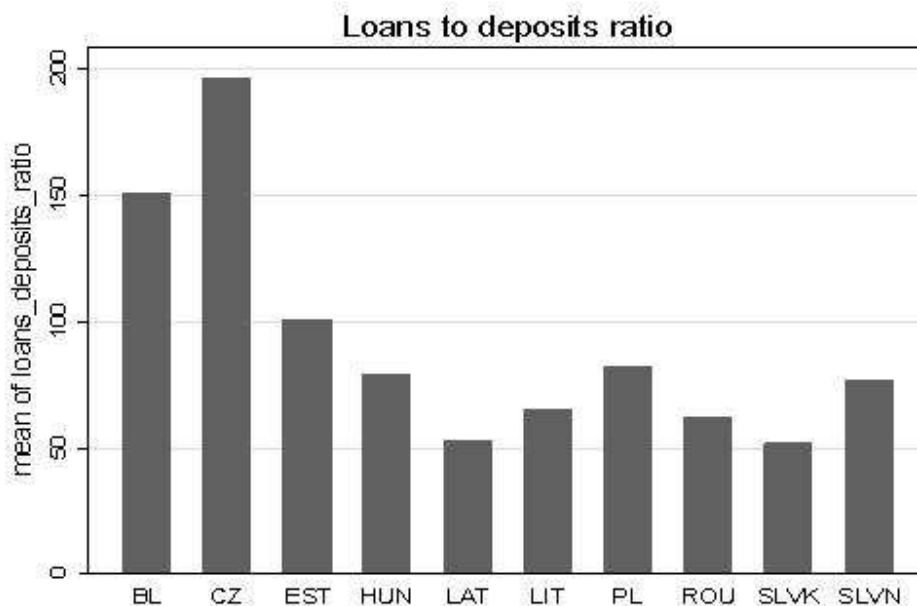


Figure 1: The ratio of loans to deposits.

Source: Authors' calculation based on BankScope data. Average ratio over the period 1998-2006.