Monetary Policy Transmission in Transition Economies: The Bank Lending Channel*

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Abstract

In this paper we analyze the bank lending channel in ten Central and Eastern European countries. 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 ajustement of loan quantities along certain bank characteristics. The existence of bank lending channel can explain these asymmetries. Based on our results, we can not, however, conclude for the existence of a bank lending channel in all the analyzed countries.

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1 Introduction

Understanding monetary policy is crucial. It allows answering to several policy questions: What is the appropriate monetary policy in different business cycle episodes? What should be the appropriate rule for monetary policy?

Various observers warn that the enlargement of the euro area may hamper the policies of the European Central Bank. According to Guiso et all. (1999) there are three conditions that must be met for a common monetary policy to succeed without causing frictions among the members of the monetary union. The first condition is that members must agree on the ultimate goals of the common monetary policy; this issue has been settled by the Maastricht Treaty, leading to the adoption of price stability as the primary objective for the ECB. The second condition: a common monetary policy would be easier to implement if the business cycles of the member states are aligned and if inflation rates are similar; if some countries do not have synchronized business cycles or inflation rates, it is difficult to settle the appropriate monetary policy stance. Despite all this, the reality shows that countries in the euro area have different inflation rates and output gaps. The third condition: monetary policy transmission mechanism should operate in a similar fashion across the member countries of the monetary union; differences in the transmission mechanism could make the appropriate size and timing of monetary policy decisions difficult to asses.

Many authors argue that monetary policy transmission differs substantially across countries in the EMU and that this may be related to differences in financial structure. Cecchetti (1999) shows that monetary transmission mechanisms vary across eleven EU countries which are different concerning the size, the concentration and the health of the banking system. The future enlargement of the monetary union will increase the heterogeneity of financial structures in the euro area, so that the ECB's decisions in terms of monetary policy are likely to have a different impact across the countries in the currency union.

The theory of the bank lending channel suggests that the state of financial sector may have a strong influence on the monetary policy transmission. The implications for the euro zone are that a common monetary shock in the euro zone may induce asymmetric reactions in countries with different conditions on the financial market.

We consider important the analysis of differences in the monetary transmission in CEECs both in the context of the forthcoming full euro-area participation of countries that have entered the EU in May 2004 (e.g. Slovenia - member of the euro

area starting 2007), and in that of the existing gap in financial sector' development relative to the euro area. Over the last decade, the banking sectors of CEECs have undergone massive transformation processes, marked by numerous bank failures and the accumulation of huge amounts of non-performing loans (in the early phase of economic transition). We have assisted, in the same time, at the privatization of a large number of public banks, contributing at the increasing efficiency of the banking sectors.

On 1 May 2004 ten new member states have joined the European Union: eight Central and Eastern European Countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia), together with Cyprus and Malta. Bulgaria and Romania have become members of the EU 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 old members. The single currency project is a part of these regulations. The new EU members countries are expected to adopt the euro at some future date and some of them have already indicated that they want to join the euro area as quickly as possible. While Slovenia has joined the euro area the 1st of January 2007, most of the new member states still fight to be in conformity with the admission conditions concerning inflation, budget deficit, exchange rate stabilization and legal compatibility. They have consequently postponed their entry in the euro area; Slovak Republic preserve its deadline - 2009; the demand of Lithuania has been rejected, its inflation rate being too worrying; Estonia and Latvia have postponed their plan of adopting the euro for the same reasons; Baltic countries have admitted the reduced probability of adopting the single currency before 2010. The remaining countries do not intend to adopt the euro before 2010-2012.

In the present paper we analyze the bank lending channel in the case of ten transition countries from Central and Eastern Europe. By using disaggregated data on banks balance sheets, we provide a test of the lending view of monetary policy transmission. Whereas most previous research refers to only a limited number of accession countries, we study ten transition countries[1]. Following an approach similar to that suggested by Kashyap and Stein (1995), we argue that if the lending view is correct, the loan portfolios of large and small banks respond differentially to a contraction in the monetary policy. We find little evidence concerning the existence of a bank lending channel in these economies.

The remainder of the paper is organized as follows. In the next section we present the monetary framework of transition economies. Next, we present a brief

[1]Bulgaria, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

overview of the debate on the lending view, both generally and in the context of transition economies; we will use this in order to motivate our focus on the behavior of different types of banks. The following section describes the econometric model and the data used in the empirical work, and the one after presents our empirical results. The final section concludes.

2 Monetary conditions in transition economies

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

We start by presenting the banking system of 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 in their mandates to control inflation and in maintaining the international value of their currency. At the same time, commercial banking sector remains relatively fragile, with reduced loans made in the past (see Table (1)) and questioning lending policies.

Table 1: Domestic credit (% GDP).

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Bulgaria	15,30	17,83	20,22	23,68	29,67	35,94	43,62
Czech Republic	54,61	49,40	45,69	42,25	48,59	45,24	43,69
Estonia	32,46	35,35	38,80	44,13	51,87	60,70	67,95
Hungary	53,18	54,57	49,98	53,76	57,99	58,98	62,88
Latvia	17,80	23,28	28,48	35,70	44,98	54,05	72,83
Lithuania	16,25	15,18	15,60	17,84	23,24	29,72	42,24
Poland	34,72	32,67	34,91	34,54	35,80	33,17	32,64
Romania	17,83	13,99	12,99	13,87	15,85	16,91	21,15
Slovak Republic	58,15	56,41	59,71	51,00	44,07	43,07	48,53
Slovenia	40,31	44,22	47,12	45,29	49,31	55,03	64,82
CEECs average	34,06	34,29	35,35	36,21	40,14	43,28	50,04
8-CEECs average*	38,43	38,88	40,04	40,56	44,48	47,49	54,45
Euro-area average	132,62	134,45	136,08	132,98	137,03	139,83	**148,22**

Source: IMF.
* excluding Romania and Bulgaria.

These problems are most visible in Romania and Poland[2]. When comparing the average of the domestic credit in % of GDP for CEECs with the euro area average,

[2]In 2005, domestic credit represents only 21,15% of GDP in Romania and 32,64% of GDP in Poland, while the CEECs average is of 50,04%.

the last one is three times larger. The weakness of the commercial bank sector and its reduced contribution in financing the investment activity of the corporate sector limits the policies that the central banks may follow and may distort the transmission of monetary policy impulses to the economy.

The fragility of the commercial bank sector is deepened by the underdevelopment of the other components of the capital market. Even though each of these countries has a stock exchange, the markets for shares are thin and stock markets perform poorly. Insurance companies and mortgage lending are underdeveloped. The relative underdevelopment of the capital markets in these countries is evident when comparing their market capitalization of listed companies (in % of GDP) with the euro-area average (see Table (2)).

Table 2: Market capitalization of listed companies (% GDP).

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Bulgaria	5,45	4,89	3,71	4,71	8,80	11,53	19,08
Czech Republic	19,97	19,75	15,33	21,55	19,50	28,66	31,34
Estonia	32,15	33,73	24,81	34,50	41,24	55,21	26,67
Hungary	33,93	25,55	19,81	19,98	20,12	28,51	29,84
Latvia	5,41	7,19	8,38	7,67	10,19	12,06	16,02
Lithuania	10,50	13,85	9,88	10,35	18,93	28,78	32,10
Poland	17,61	18,25	13,67	14,52	17,16	28,17	31,38
Romania	2,45	2,88	5,28	9,95	9,38	15,61	20,88
Slovak Republic	5,20	6,02	7,46	7,86	8,51	10,73	9,46
Slovenia	10,16	13,21	14,36	20,66	25,42	29,78	23,21
CEECs average	14,28	14,53	12,27	15,17	16,93	24,90	24
8-CEECs average*	16,87	17,20	14,21	17,14	18,88	27,74	25
Euro-area average	84,61	88,48	69,50	51,83	59,53	71,62	**65,83**

Source: WDI(World Bank).
* excluding Romania and Bulgaria.

Although the ten transition economies differ in the starting conditions and in the details of the policies adopted, there are important similarities in their approach to stabilization and disinflation. They all begin the process of transition with distorted domestic prices, unrealistic exchange rates and open or repressed inflation. The initial objectives of macroeconomic policies were to control the inflation that will follow from the freeing of domestic prices. Nominal exchange rate were set at rates well below purchasing power parity, in order to make stabilization 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 the transition, the collapse of CMEA trade has determine a decline in production in all these countries. The fiscal policy suffered a serious burden, as tax revenues declined and the need for social safety for the increased

number of unemployed increased. Investment in plant and equipment decreased as excess capacity emerged in many industries, and this has 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 of the newly created commercial banks.

Over time, output recovered and inflation declined; but the decline of inflation didn't bring it at levels close to that of Western European economies (see Table (3)).

Table 3: Inflation rate (% change, annual averages).

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Bulgaria	2,57	10,32	7,36	5,81	2,16	6,35	5,04
Czech Republic	2,10	3,93	4,71	1,78	0,11	2,83	1,85
Estonia	3,30	4,03	5,74	3,57	1,34	3,05	4,09
Hungary	10	9,79	9,22	5,27	4,64	6,78	3,55
Latvia	2,36	2,65	2,49	1,94	2,92	6,19	6,76
Lithuania	0,75	1,01	1,30	0,30	-1,18	1,20	2,66
Poland	7,28	10,06	5,49	1,90	0,79	3,58	2,11
Romania	45,80	45,66	34,46	22,54	15,27	11,88	8,99
Slovak Republic	10,57	12,03	7,33	3,23	8,55	7,55	2,71
Slovenia	6,15	8,88	8,42	7,47	5,58	3,59	2,48
CEECs average	9,08	10,84	8,65	5,39	4,02	5,29	4,02
8-CEECs average*	5,31	6,55	5,58	3,19	2,84	4,34	3,27
Euro-area average	1,12	2,33	2,11	2,25	2,07	2,14	**2,19**

Source: IMF.
* excluding Romania and Bulgaria.

When looking at the figures for 1999-2005 period, we distinguish several groups of countries: first, the last EU accession countries: Bulgaria and Romania (with levels in 2005 going from 5,04% in Bulgaria to 8,99% in Romania); second, Estonia, Latvia and Hungary (with high levels of inflation compared to the euro area average); third, Czech Republic and Poland (countries where inflation is below the euro area average) and, finally, the resting group: Lithuania, Slovak Republic and Slovenia (where inflation is superior compared to the euro-area average, but the gap is not very large). As one can see, the moderate levels of inflation in these countries have been reduced to low single-digit levels in order to prepare their entry into the EU. The achieving of such a disinflation is crucial for joining the EU. Still, tight monetary policy will hamper the ability of firms to undertake the investments in new equipment and technology needed in order to become competitive on EU markets.

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.

Once we have presented this framework, we will further analyze the bank lending channel in these countries, wondering if there are any similarities among them in the transmission of the monetary policy. The large majority of studies in this area focus on the analysis of interest and exchange rate channels and little attention is paid to bank lending channel. The main explanation is that financial innovation of the last decades makes doubtful the importance of bank lending channel, as banks play a less important role in credit markets. This affirmation stands true in the context of developed economies, but it does not apply for transition countries, where financial systems are mainly bank-based and borrowers do not have viable alternatives to bank loans as sources of financing. Consequently, the actual study examines the bank lending channel of the monetary policy transmission.

The following section presents a brief overview of the debate on the lending view.

3 Debate on the lending view

In this section we first present an overview of the general debate on the lending view. Then, it follows an overview of the existing studies in the context of transition economies. The aim of the present section is to show what sort of empirical methods have been adopted so far and to put in light our motivation for the approach applied in this paper.

3.1 Definition of the lending view

The hypothesis of "bank lending channel" postulates the existence of a channel of monetary policy transmission through bank credit. This channel is independent of the traditional "money channel", which considers 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 a monetary policy tightening can affect not only the demand for loans (through the interest rate channel), but also the supply of loans, which in turn, further influences the monetary policy on investment and consumption. In other words, monetary policy affects not only borrowers, but also the banks. The theoretical underlying mechanism is the following: a monetary policy tightening shrinks banks' reserves and, this way, banks'

deposits. Deposits are an important source of financing the lending. The theory stipulates that, in the aftermath of a monetary policy tightening, the responses of banks might not be the same in term of lending.

Two hypothesis are crucial for the theory of bank lending channel:

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

These two 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 banks' credit supply when there is a tightening of monetary policy (`first stage`). When facing a decrease in liquidity, banks decrease their supply of credit instead of selling bonds that they posses in their portfolios. Alternatively, rather than decreasing credit, banks could issue bonds or collect deposits from households or from 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 financial markets.

Once credit supply has decreased, because of the imperfect substitutability between bank credit and other forms of external funding on firm's balance sheet, the investment spending falls down (`second stage`).

Several empirical approaches have been used to investigate the functioning of the bank lending channel. Earlier papers tried to analyze the bank lending channel based on aggregate data, while recently the identification relies on asymmetries in the loan supplies of individual banks. Our analysis belongs to the last category, that of studies based on bank-level data. We will further present some illustrative studies both in the general context and in the case of transition economies.

3.2 Tests using aggregate data

Bernanke and Blinder (1992) analyze the response of aggregate bank balance sheet variables to changes in the stance of monetary policy (proxied by changes in the Fed funds rate); they find that a monetary tightening is followed by a drop in

bank deposits. Bank holdings of securities also fall. Bank loans respond with a lag, but they also present a decline. The measures of aggregate output respond to monetary impulses with a similar lag, declining contemporaneously with bank loans.

A fluctuation in the growth rate of loans might be equally caused by the demand for, or supply of, loans, so that there is an identification problem which occurs.

Kashyap, Stein and Wilcox (1993) bring new evidence for a clear econometric identification of the lending channel of monetary-policy transmission, by using the relative fluctuations in bank loans and in commercial papers - an important substitute for bank finance. They find that a tighter monetary policy determines a sharp rise in the issuance of commercial papers, while the bank loans fall. Thus, a contractionary policy reduces loan supply.

The results of the study of Kashyap, Stein and Wilcox (1993) are not accepted as being decisive. Oliner and Rudebusch (1995) show that, in an economy with heterogenous agents, aggregate results must be treated with caution. A natural next step is to use disaggregated data to explore the cross-section implications of the lending view.

3.3 Tests using disaggregated data

According to the lending view, a tight monetary policy should pose more problems for small firms (who rely mainly on banks) than for large firms (who have a greater access to nonbank sources of external finance). Evidence in this sens is provided by some recent studies, as that of Oliner and Rudebusch (1995); they show that, with a tightening of monetary policy, liquidity constraints become more pronounced for small firms.

The question is whether changes in banks' deposit liabilities affect their lending. In order to answer this question, it is necessary to analyze the way in which banking firms respond to changes in the stance of monetary policy.

Kashyap and Stein (1995) develop a disaggregated version of that in Bernanke and Blinder (1992), analyzing the way bank deposits, securities holdings and loans respond to shocks in monetary policy. They focus on cross-sectional differences in these responses across banks of different size. The overall message of their model is that loans and securities portfolios of large and small banks respond differentially to a contraction in monetary policy: the lending volume of small banks declines more rapidly in response to a given contraction in deposits than the lending volume

of large banks; however, the securities holdings of small banks decline more slowly in response to a given contraction in deposits than the securities holdings of large banks.

The model specification of Kashyap and Stein (1995) is further adopted in a large number of recent studies. We mention those of 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 (2003), Adams and Amel (2005) and Gambacorta (2005).

According to Kashyap and Stein (1995) and De Bondt (1998), the disaggregate approach has both a benefit and a cost. The benefit is that it is the most precise way to test for the existence of credit channels. The cost is that these data are not appropriate to evaluate the aggregate importance of credit channels.

3.4 Lending view in transition economies

The study of the monetary transmission mechanism in the transition economies of Central and Eastern Europe is very important. It allows a precise understanding of the way in which a change in the central bank's interest instrument affects inflation, being in the center of interest of inflation targeting[3]. Besides, it is crucial to analyze the differences in the monetary transmission in CEECs, in the context of the forthcoming full euro-area participation of the countries that have entered the EU in May 2004 and, in that of the existing gap in financial sector development relative to the euro area.

Corricelli, Egert and MacDonald (2006) survey recent advances in empirical studies of the monetary transmission mechanism in Central and Eastern Europe, presenting the functioning of the separate channels, the possible interrelations between different channels and their impact on prices and on real economy. They classify the empirical evidence for the CEECs in two categories: evidence from VAR and evidence from bank-level data.

In our analysis we proceed with the same classification of the evidence on the bank lending channel like in Corricelli, Egert and MacDonald (2006), as it follows.

[3]A large number of transition countries use the inflation targeting a monetary policy instrument.

3.4.1 VAR evidence

The VAR modeling methodology is the main tool used in the area of research of the monetary transmission mechanisms. For this category of studies we mention some references in the case of transition economies: Klos and Wrobel (2001), Creel and Levasseur (2005), Darvas (2005), Elbourne and de Haan (2006) and Hericourt (2006).

Klos and Wrobel (2001) use the VAR approach, with a relatively modest set of variables: the consumer price index, credit to non-financial sector and the intervention rate of the National Bank of Poland, as a policy instrument. The credit growth is used as an indicator of domestic demand pressure. The authors show that a shock in short-term interest rates causes real credit to drop in the short run and to stabilize at a lower level afterward.

Creel and Levasseur (2005) update the evidence on the monetary policy transmission mechanisms for three large new EU members: the Czech Republic, Hungary and Poland, using a structural VAR. Incorporating either credit or money as an endogenous variable in the VAR makes insignificant the price' rise. The responses of credit and money to a monetary policy shock in Hungary are counterintuitive, as credit and money increase with a positive innovation in the nominal interest rate. The usually explanation is that of a permanent excess in the liquidity of the banking sector.

Darvas (2005) study the transmission of monetary policy in three new member states of the EU: Poland, Czech Republic and Hungary with structural time-varying coefficient VARs and makes a comparison with the transmission of the monetary policy in the euro area. Among the three countries studied, monetary policy is more powerful in Poland and comparable in strength with that in the euro area, but it is less powerful in Hungary; the strength of monetary policy in Czech Republic lies in between. The author explains these differences by the credibility of the monetary policy and the openness.

Elbourne and de Haan (2006) examine the relationship between monetary policy transmission and the financial structure in ten accession countries, using the SVAR methodology. The authors find substantial differences in monetary transmission among the ten countries regarding both inflation and output. Based on the lending view, the indicators of financial structure are grouped in three categories: indicators of size, of banking system' health and of alternative sources of external finance' importance. Rank correlation coefficients are computed for the estimated impact of monetary policy decisions on each financial structure indicator. Elbourne and de Haan (2006) do not find convincing evidence that financial

sector indicators are associated with monetary policy shocks in the ten acceding countries.

By using different VAR estimations for each of the eight CEECs recently integrated to EU, Hericourt (2006) show the existence of similarities with the euro area and an ongoing homogenization process, concluding on the relevance of a close integration of these countries into the euro area. His estimations include money and domestic credit aggregates, on the one hand, and industrial production and rebuilt series of GDP, on the other hand.

3.4.2 Bank-level data evidence

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. The references cited in this case are: Juks (2004), Pruteanu (2004) and Horvath, Kreko and Naszodi (2006).

Juks (2004) analyzes the significance of the bank-lending channel in Estonia. The results of the study are the following: first, the well-capitalized banks seem to experience a smaller outflow of deposits after a monetary contraction; second, the liquidity position of banks seems to be an important determinant of loans supply - more liquid banks are able to maintain their loan portfolios, while less liquid banks must reduce their loan supply, after a monetary policy contraction.

Pruteanu (2004) examines the overall effect of monetary policy changes on the growth rate of loans and the characteristics of the supply of loans for the Czech commercial banks. For the period 1996-1998, cross-sectional differences in the lending reactions to monetary policy shocks are due to the degree of capitalization and liquidity. For the subsequent period 1999-2001, the distributive effects of monetary policy are due to bank size and a bank's proportion of classified loans.

Horvath, Kreko and Naszodi (2006) consider the foreign ownership besides the usual bank specific variables (size, liquidity and capitalization) in a study on Hungary. They find empirical evidence that demand for loans can be considered reasonably homogenous across banks with respect to the share of foreign ownership and the size of banks.

As mentioned, our present study is a bank-level analysis realized on commercial banks from ten CEECs. In the following section we describe the model applied, as well as the data used.

4 Model and data

4.1 Econometric model

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

$$\Delta \ln y_{it} = \sum_{j=1}^{l} \alpha_j \Delta \ln y_{i(t-j)} + \sum_{j=0}^{l} \beta_j \Delta MP_{t-j} + \gamma z_{i(t-1)} + \sum_{j=0}^{l} \delta_j \left[\Delta MP_{t-j} z_{i(t-1)}\right] + \\ + \sum_{j=0}^{l} \varphi_j \pi_{t-j} + \sum_{j=0}^{l} \eta_j \Delta \ln x_{t-j} + \mu_i + \varepsilon_{it} \tag{1}$$

whit: $i = 1, ..., N$ and $t = 1, ..., T$, 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, capitalization 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 the capture of cyclical movements and serves to isolate the monetary policy component of interest rate changes.

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, capitalization and liquidity.

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

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

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

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 capitalization is given by the ratio of equity, E_{it}, to total assets[4]. These characteristics are normalized with respect to their average 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 (1), the average 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 monetary policy on loans.

'Size' is a variable that captures possible bank-specific asymmetries as deviations from their cross-sectional means. This removes a general trend characterizing the financial sector.

For 'liquidity' and 'capitalization' we remove the overall average (across banks and over time) from each observation. Actually, the definition of a large bank may differ with changing market conditions, as banks which are considered to be small on a market with deeper financial sector, might be regarded as medium or large in a smaller market. Contrary to size, liquidity and capitalization 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 capitalization 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 monetary policy changes on the growth of bank lending, and the coefficients in front of interaction terms (δ_j); the latter serves to asses 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 capitalized / less liquid banks react more strongly

[4]Capitalization 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.

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.

4.2 Data

We use the BankScope data set for banks' balance sheet[5] and the International Financial Statistics (IMF) data for real GDP, inflation and interest rate. The sample covers the period 1999-2005 and contains annual data. The analysis does not go before 1999 because of data unavailability on banks' balance sheets.

Our analysis covers the commercial banks from ten CEECs: Bulgaria, with 26 banks; Czech Republic,with 26 banks; Estonia, with 7 banks; Hungary, with 30 banks; Latvia, with 26 commercial banks; Lithuania, with 10 banks; Poland, with 53 banks; Romania, with 28 banks; Slovak Republic, with 17 banks; and Slovenia, with 19 banks. An analysis performed separately for each country does not lead to robust results.

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. Consequently, we choose the banking reform criteria, as we believe pertinent the analysis of banks on the same pace of the reform. For this, we take the EBRD banking reform index (see Appendix 2, Banking Reform in CEECs) and we compute a simple mean of this indicator for the period 1989 - 2005; by using this span of time we take into account both the initial conditions and the entire evolution of the banking reform. This way, we form three main groups of countries: the first one, of the least advanced, is made up of Bulgaria, Lithuania and Romania (economies where the average index of banking reform is situated between 2,24 and 2,55); the second group, the intermediary one, is made of Latvia, Poland, Slovenia and Slovakia (which have an average banking reform index situated between 2,74 and 2,93) and the third group, the advanced one, is made of Czech Rep., Estonia and Hungary (with an average index of the banking reform between 3 and 3,22).

In the following section we present the estimation method and the results obtained.

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

5 Estimation method and results

5.1 Estimation method

The reduced span of time constricts us to estimate the equation (1) for the current period without using lags. This way, the estimated equation is:

$$\Delta \ln y_{it} = \alpha_1 \Delta \ln y_{i(t-1)} + \beta_1 \Delta MP_t + \gamma z_{it} + \delta_1 \left[\Delta MP_t * z_{it}\right] + \varphi_1 \pi_t + \eta_1 \Delta \ln x_t + \mu_i + \varepsilon_{it} \tag{2}$$

We will first estimate a "benchmark model", which does not include the bank characteristic (z) and the interaction between 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 clients loans responds to monetary policy shocks and macroeconomic conditions. The full model, given by the equation (2) will be referred to as the "extended model".

Our sample follows commercial banks over 7 years (1999-2005). The estimation of both "benchmark" and "extended" models is realized separately, for each group of banks; this will help us to observe the existing differences, inside each group, in the banks' behavior, in the aftermath of a monetary policy tightening.

Both the "benchmark model" and the "extended" one are estimated by the Generalized Method of Moments 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 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 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 a 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 summarize the results of estimating 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 realized separately, for each group of banks. The reported figures represent the long-run elasticities of the models[6]. 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 present study, in the GMM estimations, instruments are the second and further lags of the dependent variable and of 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 asses the role of banks in monetary transmission, we will first estimate equation (2) including, within each group, observations on banks in all countries, without discriminating for national parameters.

A. Benchmark model

Table 4: "Benchmark model" (equation (2)) (long term coefficients).

Dependent variable:	**Growth rate of total loans to clients**		
Specifications :	(**1st group**)	(**2nd group**)	(**3rd group**)
Monetary Policy	-0.035***	-0.012*	0.006
	(0.008)	(0.007)	(0.046)
GDP growth	4.90***	2.15***	3.32***
	(0.685)	(0.558)	(1.38)
Inflation	-0.399***	-0.054	-0.368
	(0.110)	(0.088)	(0.243)
p-value Hansen	0.361	0.052	0.056
p-value AR1/AR2	0.903/0.163	0.598/0.192	0.123/0.383
No. obs./ No. banks	245/59	365/95	223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

The estimation of the "benchmark model" reveals differences between the results for the three groups of banks.

[6]The 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 $\sum \beta_j/(1-\sum \alpha_j)$.

Concerning the effects of monetary policy on the growth rate of total loans to clients, the changes in the policy-induced interest rate have a negative and significant impact in the first and the second group of banks, but the impact is non-significant for the third group. Thus, the theory of the bank lending channel is confirmed only for the first two groups: loans fall after a monetary policy tightening. For the impact of the macroeconomic conditions, the influence of GDP growth is positive and significant for all the groups. Inflation impacts negatively only in the case of banks from the 1st group.

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 (2) - 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 (2). We realize this for the whole banking sector of the three group of banks (see tables (5), (6) and (7)).

Size as bank characteristic

Table 5: "Extended model" (equation (2)) (long term coefficients) (a).

Dependent variable:	**Growth rate of total loans to clients**		
Specifications :	(**1st group**)	(**2nd group**)	(**3rd group**)
Control variable :	**Size (S)**		
Monetary Policy	-0.039***	-0.011	-0.010
	(0.007)	(0.010)	(0.026)
S	-0.785***	-0.102	-0.559*
	(0.232)	(0.243)	(0.308)
Monetary policy*S	0.005	0.006	-0.007
	(0.005)	(0.010)	(0.017)
GDP growth	4.78***	2.33***	4.52***
	(0.599)	(0.496)	(0.849)
Inflation	-0.354***	-0.065	-0.533***
	(0.086)	(0.101)	(0.153)
p-value Hansen	0.316	0.059	0.330
p-value AR1/AR2	0.087/0.657	0.352/0.623	0.034/0.253
No. obs./ No. banks	245/59	365/95	223/52

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 for the 1st and the 3rd group of banks. The interaction term between the monetary policy and the bank size presents a non-significant coefficient for all the groups, meaning that size, as a bank characteristic, does not influence the growth rate of total loans to clients in the aftermath of a monetary policy shock for none of these banks.

Liquidity as bank characteristic

Table 6: "Extended model" (equation (2)) (long term coefficients) (b).

Dependent variable:	**Growth rate of total loans to clients**		
Specifications :	(**1st group**)	(**2nd group**)	(**3rd group**)
Control variable:	**Liquidity (L)**		
Monetary Policy	-0.034***	-0.012	-0.016
	(0.008)	(0.009)	(0.017)
L	0.065*	-0.002	0.042**
	(0.037)	(0.018)	(0.018)
Monetary policy*L	-0.0007	-0.0001	-0.002
	(0.0008)	(0.0006)	(0.001)
GDP growth	4.56***	2.27***	3.55***
	(0.471)	(0.422)	(0.851)
Inflation	-0.323***	-0.075	-0.310*
	(0.079)	(0.067)	(0.159)
p-value Hansen	0.129	0.143	0.323
p-value AR1/AR2	0.975/0.129	0.362/0.453	0.027/0.353
No. obs./ No. banks	245/59	365/95	223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

The estimations show an overall positive and significant linear effect of liquidity on the growth rate of total loans to clients for the 1st and the 3rd group of banks. As regards the distributive effects of monetary policy, the overall analysis reveals a non-significant coefficient for all the groups of banks. This means that liquidity does not influence the growth rate of total loans in the aftermath of a monetary policy change.

Capitalization as bank characteristic

Table 7: "Extended model" (equation (2)) (long term coefficients) (c).

Dependent variable:	**Growth rate of total loans to clients**		
Specifications :	(**1st group**)	(**2nd group**)	(**3rd group**)
Control variable:	**Capitalization (C)**		
Monetary Policy	-0.052***	-0.014	-0.009
	(0.008)	(0.011)	(0.013)
C	0.064*	0.105	-0.034
	(0.037)	(0.083)	(0.026)
Monetary policy*C	-0.003***	-0.0009	0.001
	(0.001)	(0.001)	(0.001)
GDP growth	4.54***	2.52***	4.15***
	(0.949)	(0.484)	(0.629)
Inflation	-0.334**	-0.067	-0.463***
	(0.139)	(0.078)	(0.104)
p-value Hansen	0.184	0.217	0.368
p-value AR1/AR2	0.017/0.828	0.346/0.665	0.043/0.867
No. obs./ No. banks	245/59	365/95	223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

Capitalization presents an overall positive and significant linear effect for the 1st group and a non-significant linear effect on the growth rate of total loans to

clients for the 2nd and the 3rd group. The overall analysis reveals a negative and significant coefficient for the interaction term between capitalization and the monetary policy for the least advanced banks (1st group), meaning that the more capitalized banks from this group are more affected by the monetary policy conditions. For the other two groups, the coefficient is non-significant; thus, for these banks, capitalization does not influence the growth rate of total loans to clients in the aftermath of a monetary policy change.

As a conclusion, the analysis at the aggregate level for each group of banks does not show significant results in terms of bank characteristics. The explanation could come from the existing heterogeneity among banks, inside each group. As a result, it would be more appropriate to examine the impact of bank characteristics on the growth rate of loans to total clients by the mean of an analysis on single countries in a pooled regression for each group.

5.2.2 Evidence on single countries in a pooled regression for each group

In the section above, we have treated all banks in the same way, by restricting all coefficients to be the same across groups. In order to put in light the cross-country differences among each group, we extend our model. The parameters of interest, i.e. those on monetary policy indicator and the interaction between the banks characteristics and the monetary policy indicator are allowed to vary across countries, through the introduction of country specific dummies. Consequently, the estimated model is the following:

$$\Delta \ln y_{it} = \alpha_1 \Delta \ln y_{i(t-1)} + \beta_1 \Delta MP_t * dcountry + \gamma z_{it} + \delta_1 \left[\Delta MP_t * dcountry * z_{it}\right] + \\ + \varphi_1 \pi_t + \eta_1 \Delta \ln x_t + \mu_i + \varepsilon_{it} \tag{3}$$

We proceed as before, by estimating the "benchmark model" and "extended model" respectively, for total loans to clients.

A. Benchmark model

The estimation of the "benchmark model" reveals differences between the results for three groups of banks, both in terms of magnitude and significance (see Table (8)).

Concerning the effects of monetary policy on the growth rate of total loans to clients, the changes in the policy-induced interest rate have a negative and significant impact in Bulgaria (1st group) and Poland (2nd group). This confirms the

theory of the bank lending channel: loans fall after a monetary policy tightening. For the rest of the countries the impact is not significant. These results represent the average impact of monetary policy across all banks, where the banks are considered as having the same weight and not a ponder given by their market share or characteristics. Consequently, these estimates can not be used to quantify the effect of a certain change in monetary policy.

As regards the difference in the impact of the macroeconomic conditions, the influence of GDP growth is positive and significant for the 1st and the 2nd group, while it is non-significant in the 3rd group. Inflation, which is meant to account for demand factors, impacts negatively only in the case of banks from the 1st group.

Table 8: "Benchmark model" (equation (3)) (long term coefficients).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Monetary Policy					
Bulgaria	-0.086***	Latvia	-0.012	Czech R.	-0.066
	(0.019)		(0.013)		(0.053)
Lithuania	-0.031	Poland	-0.020*	Estonia	-0.107
	(0.021)		(0.011)		(0.096)
Romania	-0.006	Slovakia	-0.018	Hungary	0.098
	(0.014)		(0.012)		(0.136)
		Slovenia	0.009		
			(0.009)		
GDP growth	4.39***		2.19***		1.29
	(0.921)		(0.541)		(2.55)
Inflation	-0.31**		-0.067		0.034
	(0.138)		(0.085)		(0.09)
p-value Hansen	0.274		0.072		0.188
p-value AR1/AR2	0.674/0.181		0.545/0.188		0.107/0.296
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

B. Extended Model

The features of the supply of loans are revealed by the estimation of the "extended model" (equation (3)). 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 (3) - 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 (3). We realize this for the whole banking sector of the three group of banks (see tables (9), (10) and (11)).

Size as bank characteristic

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 1st group of banks. The distributive effect of the monetary policy changes due to bank size is shown by the interaction term between the monetary policy and the bank size. Its coefficient is non-significant for all the groups of banks, meaning that size, as a bank characteristic, does not influence the growth rate of total loans to clients in the aftermath of a monetary policy shock for neither of these banks.

Table 9: "Extended model" (equation (3)) (long term coefficients) (a).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variable :	**Size (S)**				
Monetary Policy					
Bulgaria	-0.086***	Latvia	-0.001	Czech R.	-0.089**
	(0.015)		(0.007)		(0.043)
Lithuania	-0.055**	Poland	-0.023	Estonia	-0.055**
	(0.025)		(0.015)		(0.024)
Romania	-0.013	Slovakia	-0.013	Hungary	0.035
	(0.010)		(0.015)		(0.024)
		Slovenia	0.006		
			(0.010)		
S	-0.844***		-0.29		-0.357
	(0.212)		(0.235)		(0.278)
Monetary policy*S					
Bulgaria	-0.005	Latvia	0.016	Czech R.	0.030
	(0.015)		(0.026)		(0.027)
Lithuania	0.013	Poland	0.006	Estonia	-0.012
	(0.011)		(0.009)		(0.015)
Romania	0.005	Slovakia	-0.015	Hungary	-0.015
	(0.006)		(0.014)		(0.014)
		Slovenia	0.0009		
			(0.007)		
GDP growth	4.56***		2.37***		2.87***
	(0.656)		(0.374)		(0.768)
Inflation	-0.315***		-0.062		-0.206
	(0.098)		(0.072)		(0.144)
p-value Hansen	0.709		0.455		0.962
p-value AR1/AR2	0.129/0.281		0.331/0.499		0.027/0.186
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

Liquidity as bank characteristic

The estimations show evidence of an overall positive and significant linear effect of liquidity on the growth rate of total loans to clients for the 3rd group of banks. As regards the distributive effects of monetary policy, the overall analysis reveals a non-significant coefficient for the 1st group of banks. This means that liquidity does not influence the growth rate of total loans in the aftermath of a monetary policy change, in the case of banks which are not very advanced in their reform.

In the case of the 2nd group, the estimation results show a negative and significant coefficient of the interaction term in Latvia - meaning that the more liquid banks in Latvia, are more affected by the monetary policy conditions; this is contrary to the theory of the bank lending channel. Meanwhile, the coefficient of the interaction term is positive and significant for Poland, confirming the theory: less liquid banks are strongly affected by the monetary policy conditions. And, in the case of the 3rd group, we found a positive and significant coefficient for Estonian banks, as a reconfirmation of the enounced theory.

Table 10: "Extended model" (equation (3)) (long term coefficients) (b).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variable:	**Liquidity (L)**				
Monetary Policy					
Bulgaria	-0.076***	Latvia	-0.024	Czech R.	-0.051**
	(0.024)		(0.022)		(0.020)
Lithuania	-0.033*	Poland	-0.019*	Estonia	-0.063**
	(0.017)		(0.010)		(0.023)
Romania	-0.010	Slovakia	-0.021*	Hungary	0.023
	(0.010)		(0.011)		(0.029)
		Slovenia	0.047		
			(0.030)		
L	0.052		-0.001		0.054***
	(0.042)		(0.014)		(0.017)
Monetary policy*L					
Bulgaria	-0.0009	Latvia	-0.002**	Czech R.	-0.001
	(0.002)		(0.001)		(0.001)
Lithuania	0.002	Poland	0.002**	Estonia	0.002**
	(0.001)		(0.0008)		(0.001)
Romania	0.0002	Slovakia	-0.0004	Hungary	-0.0005
	(0.001)		(0.0009)		(0.001)
		Slovenia	0.004		
			(0.003)		
GDP growth	4.80***		2.25***		1.94*
	(0.715)		(0.458)		(0.995)
Inflation	-0.336**		-0.060		-0.0008
	(0.117)		(0.079)		(0.185)
p-value Hansen	0.676		0.580		0.997
p-value AR1/AR2	0.818/0.156		0.351/0.609		0.022/0.320
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

Capitalization as bank characteristic

Based on our results, capitalization presents an overall non-significant linear effect on the growth rate of total loans to clients in all the groups. For the distributive effects of monetary policy, the overall analysis reveals in the case of the least advanced banks (1st group) a negative and significant coefficient for the interaction term between capitalization and the monetary policy in Romania - meaning that the more capitalized banks from Romania are more affected by the monetary

policy conditions. The same result - a negative and significant coefficient for the interaction term - is obtained within intermediary group of banks from Poland. But the coefficient is positive and significant for Latvian banks, confirming the theory: the less capitalized banks are more affected by the monetary policy conditions. As for the group of advanced banks (3rd group), the coefficient of the interaction term is non-significant, meaning that capitalization, as a bank characteristic, does not influence the growth rate of total loans to clients in the aftermath of a monetary policy change.

Table 11: "Extended model" (equation (3)) (long term coefficients) (c).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variable:	**Capitalization (C)**				
Monetary Policy					
Bulgaria	-0.097***	Latvia	-0.010	Czech R.	-0.051*
	(0.018)		(0.027)		(0.027)
Lithuania	-0.082**	Poland	-0.021**	Estonia	-0.075
	(0.031)		(0.009)		(0.052)
Romania	-0.035**	Slovakia	0.011*	Hungary	0.025*
	(0.015)		(0.025)		(0.015)
		Slovenia	0.018**		
			(0.008)		
C	0.042		-0.036		-0.035
	(0.036)		(0.057)		(0.034)
Monetary policy*C					
Bulgaria	-0.001	Latvia	0.002*	Czech R.	0.002
	(0.001)		(0.001)		(0.004)
Lithuania	-0.003	Poland	-0.007***	Estonia	-0.003
	(0.005)		(0.001)		(0.002)
Romania	-0.007***	Slovakia	0.009	Hungary	-0.0005
	(0.002)		(0.006)		(0.001)
		Slovenia	0.0006		
			(0.002)		
GDP growth	4.21***		2.65***		2.83***
	(0.870)		(0.476)		(0.586)
Inflation	-0.284**		-0.123		-0.212*
	(0.134)		(0.081)		(0.110)
p-value Hansen	0.849		0.645		0.944
p-value AR1/AR2	0.009/0.695		0.315/0.430		0.024/0.565
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

The different bank-characteristics may be correlated with each other. Consequently, in order to disentangle the asymmetric effects with respect to each other, we control for two of such characteristics at the same time. The results of these regressions are presented in Appendix 4, Tables (14), (15) and (16).

- when we include **size** and **liquidity** as interaction terms, estimation results are similar to those obtained for a separate analysis: size presents an overall negative and significant linear effect on the growth rate of loans for the

1st group; the interaction term between size and monetary policy is non-significant for all the banks; liquidity presents an overall positive and significant linear effect on the growth rate of loans for the third group of banks and the interaction term between monetary policy and liquidity shows a negative and significant coefficient in Latvia;

- when we include **size** and **capitalization** as interaction terms, estimation results are the following: size presents an overall negative and significant linear effect on the growth rate of loans for the 1st and the 3rd groups of banks; the interaction term between size and monetary policy is non-significant for banks from the first and the second group, but, within the 3rd group, the coefficient of this interaction term is positive and significant in the case of commercial banks from Czech Republic, confirming the theory: smaller banks are more affected by a monetary policy change; capitalization presents an overall negative and significant linear effect on the growth rate of loans for the second and third group of banks and the interaction term between the monetary policy and capitalization shows a negative and significant coefficient in Romania (1st group) and Poland (2nd group);
- when we include **liquidity** and **capitalization** as interaction terms, estimation results are the following: liquidity presents an overall negative and significant linear effect on the growth rate of loans for the 3rd groups of banks; the interaction term between liquidity and monetary policy is non-significant for the banks from the first and the third group, but, within the 2nd group, the coefficient of this interaction term is negative and significant in Latvia and positive and significant in the case of commercial banks from Poland, confirming the theory of the bank lending channel: less liquid banks are more affected by a monetary policy change; capitalization presents an overall non-significant linear effect on the growth rate of loans for all the groups of banks and the interaction term between monetary policy and capitalization shows a negative and significant coefficient in Romania (1st group) and Poland (2nd group).

What can explain the estimation results that are contrary to the theory of bank lending channel? We are taking here about the negative and significant coefficients obtained for the interaction term between liquidity and the monetary policy indicator (the case of Latvia) and for the interaction term between capitalization and the monetary policy indicator (the case of Romania and Poland).

Higher liquidity and capitalization might be an endogenous response from smaller banks to counterbalance their financing difficulties resulting from higher asymmetric information problem.

The bank characteristics used in this analysis: size, liquidity and capitalization are not independent from each other. The theory of bank lending channel suggests that banks which face asymmetric information problem to a greater extent, for instance smaller banks, have large difficulties accessing cheap funds. As a consequence, these banks are more inclined to hold more liquid assets and to be better capitalized. According to Kashyap and Stein (2000), data of American banks support this hypothesis.

We further analyze the validity of this hypothesis in the case of commercial banks of the three countries where the estimation results are contrary to the theory. In order to do this, we proceed to a classification, for each country, of the commercial banks 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". For banks which have the average size between the third quartile and the 95th percentile we use the term "medium". Once we distinguish these three categories (small, medium and large banks), we determine the average liquidity and the average capitalization for each of them (see Table (12)).

Table 12: Selected indicators of banks by size (average 1999-2005).

Banks		(**Small**)	(**Medium**)	(**Large**)
Country	**Indicator**			
Latvia	Liquid assets/total assets	**14,9**	**13,77**	**11,93**
	Equity/total assets	13,72	12,38	8,48
Poland	Liquid assets/total assets	9,95	12,44	17,22
	Equity/total assets	**15,52**	**14,32**	**11,49**
Romania	Liquid assets/total assets	11,62	10,85	16,41
	Equity/total assets	**20,85**	**18,70**	**18,25**

Source: Author calculation.

As these data show, banking sectors of Latvia, Poland and Romania underpin the hypothesis that smaller banks tend to have higher liquidity and capitalization than larger banks. In Latvia, small commercial banks have an average ratio of liquid assets to total assets of 14,9%, while the large commercial banks have a ratio of liquid assets to total assets of only 11,93%. For the capitalization, in the case of Poland, small commercial banks have a ratio of equity to total assets of 15,52%, which is bigger than that of large commercial banks (of 11,49%). In Romania, we have the similar situation - small commercial bank are better capitalized that the large ones (20,85% compared to 18,25%). All these aspects can explain the opposed sign of our estimated coefficients.

6 Conclusions

In this paper we investigate the working of bank lending channel in the case of ten CEECs, for the period 1999-2005. We classify the commercial banks of these countries in three groups according to banking reform criteria. Afterwards, by using a panel of annual time series for the commercial banks of each of the three groups, we analyze: (1) whether monetary conditions impact on bank lending; (2) whether there are linear relationships between certain bank characteristics (size, liquidity and capitalization) and the growth rate of total loans to clients; and (3) we characterize the effectiveness of the credit channel, whether there are distributional effects due to bank characteristics in the impact of monetary policy on bank lending. The existence of distributional effects of monetary policy is thought to reveal the effectiveness of the bank lending channel.

Our analysis focus on fluctuations in total loans to clients over the period 1999-2005. We find differences between the results characterizing each group of banks.

The results of the estimations show that total loans to clients react to monetary policy impulses with stronger intensity in Bulgaria (1st group) and Poland (2nd group). The coefficient of the monetary policy indicator is, for both countries, 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 significant linear effects of all bank characteristics on the growth rate of loans to clients.

Concerning the distributive effects of monetary policy on the growth rate of loans due to these bank characteristics, the results are the following: size, as a bank characteristic, does not seem to influence the growth rate of total loans in the aftermath of a monetary policy change; when estimating the model with two interaction term (more exactly with size and capitalization), the coefficient of the variable size interacted with the monetary policy is positive and significant in the case of Czech Republic, confirming the theory: smaller banks are more affected by a monetary tightening. For liquidity, the estimation results show a positive and significant coefficient for Poland (2nd group) as less liquid banks are stronger affected by a monetary policy change; but, this coefficient is negative and significant in Latvia. Concerning the capitalization, the estimation results show a positive and significant coefficient in Latvia, which confirms the theory; but the coefficient is negative and significant in Romania (1st group) and Poland (2nd group). The justification of the contrary results comes from the fact that, in these

countries (Latvia, Poland and Romania), small banks tend to have higher liquidity and capitalization than large banks.

According to these findings we cannot assert the existence of the bank lending channel in all the analyzed countries. This may be due to the short period of analysis. We do not expect that bank dependence of borrowers would decline, as the analyzed economies integrate more into and become more similar to the European economy. The continuously diminishing of excess liquidity in the banking systems and the decreasing capitalization due to the increasing efficiency outlines the possibility of strengthening of the bank-lending channel in the future, in CEECs.

We expect that if we further disaggregate the data, this will increase the precision of the estimates. We can use quarterly data to perform the regressions. We plan to attempt this in future work.

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A Appendix

Appendix 1: Variable Definition

Loans: total loans to clients (th. USD); source: BankScope (Bureau Van Dijk).
Monetary Policy Indicator: money market rate (annual data); source: IFS (IMF).
GDP: the growth rate of real GDP (annual data), own calculation; source: IFS (IMF).
Inflation: CPI % changes (annual data); source: IFS (IMF).
Size: the total assets (th. USD); source: BankScope (Bureau Van Dijk).
Liquidity: the ratio of liquid assets to total assets (%), own calculation; source: BankScope (Bureau Van Dijk).
Capitalization: the ratio of equity to total assets (%); source: BankScope (Bureau Van Dijk).

Appendix 2: Banking Reform in CEECs

Table 13: Banking reform and interest rate liberalization evolution- EBRD (2006).

	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
BU	1	1	1	1,67	2	2	2	2	2,67	2,67	2,67	3	3	3,33	3,33	3,67	3,67
CZ	1	1	2	3	3	3	3	3	3	3	3,33	3,33	3,67	3,67	3,67	3,67	4
ES	1	1	1	2	3	3	3	3	3,33	3,33	3,67	3,67	3,67	3,67	3,67	4	4
HU	1	1	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4
LA	1	1	1	2	2	3	3	3	3	2,67	3	3	3,33	3,67	3,67	3,67	3,67
LI	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3,33	3,33	3,67
PO	1	2	2	2	3	3	3	3	3	3,33	3,33	3,33	3,33	3,33	3,33	3,33	3,67
RO	1	1	1	1	1	2	3	3	2,67	2,33	2,67	2,67	2,67	2,67	2,67	3	3
SK	1	1	2	2,67	2,67	2,67	2,67	2,67	2,67	2,67	2,67	3	3,33	3,33	3,33	3,67	3,67
SL	1	1	1	2	3	3	3	3	3	3	3,33	3,33	3,33	3,33	3,33	3,33	3,33

1: little progress beyond establishment of a two-tier system.
2: significant liberalisation of interest rates and credit allocation, limited use of directed credit or interest rate ceilings.
3: substantial progress in establishment of bank solvency and of a framework for prudential supervision and regulation: full interest rate liberalisation with little preferential access to cheap refinancing; significant lending to private enterprises and significant presence of private banks.
4: significant movement of bank laws and regulations towards BIS standards; welle-functioning banking competition and effective prudential supervision; significant term lending to private enterprises; substantial financial deepening.

Appendix 4: "Extended model" with two asymmetric effects

Table 14: "Extended model" (equation (3)) (long term coefficients) (d).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variables :	**Size (S)**	**Liquidity (L)**			
Monetary Policy					
Bulgaria	-0.083***	Latvia	-0.005	Czech R.	-0.067**
	(0.030)		(0.102)		(0.030)
Lithuania	-0.070***	Poland	-0.023	Estonia	-0.117
	(0.023)		(0.015)		(0.211)
Romania	-0.020*	Slovakia	-0.015	Hungary	-0.005
	(0.011)		(0.020)		(0.045)
		Slovenia	0.006		
			(0.022)		
S	-0.646***		-0.206		-0.275
	(0.184)		(0.218)		(0.282)
Monetary policy*S					
Bulgaria	-0.008	Latvia	0.016	Czech R.	0.025
	(0.012)		(0.016)		(0.020)
Lithuania	0.023	Poland	0.003	Estonia	-0.080
	(0.015)		(0.010)		(0.186)
Romania	0.004	Slovakia	-0.008	Hungary	-0.021
	(0.007)		(0.013)		(0.017)
		Slovenia	-0.002		
			(0.005)		
L	0.026		-0.005		0.035*
	(0.026)		(0.014)		(0.020)
Monetary policy*L					
Bulgaria	-0.0006	Latvia	-0.002*	Czech R.	-0.0003
	(0.002)		(0.001)		(0.001)
Lithuania	0.0004	Poland	0.001	Estonia	-0.0002
	(0.0008)		(0.0007)		(0.007)
Romania	0.0006	Slovakia	-0.0003	Hungary	-0.003
	(0.001)		(0.001)		(0.004)
		Slovenia	0.0001		
			(0.003)		
GDP growth	4.39***		2.03***		3.16***
	(0.573)		(0.433)		(1.14)
Inflation	-0.291***		-0.017		-0.201
	(0.081)		(0.080)		(0.200)
p-value Hansen	1		1		1
p-value AR1/AR2	0.049/0.497		0.324/0.372		0.023/0.285
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

Table 15: "Extended model" (equation(3)) (long term coefficients) (e).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variables :	**Size (S)**	**Capitalization (C)**			
Monetary Policy					
Bulgaria	-0.094***	Latvia	0.02	Czech R.	-0.058**
	(0.014)		(0.016)		(0.024)
Lithuania	-0.059	Poland	-0.02*	Estonia	-0.351
	(0.023)		(0.011)		(0.956)
Romania	-0.030**	Slovakia	-0.0008	Hungary	0.025
	(0.013)		(0.024)		(0.016)
		Slovenia	0.004		
			(0.009)		
S	-0.763***		-0.366		-0.490*
	(0.214)		(0.229)		(0.284)
Monetary policy*S					
Bulgaria	-0.013	Latvia	0.030	Czech R.	0.045*
	(0.016)		(0.035)		(0.025)
Lithuania	0.025	Poland	-0.008	Estonia	-0.082
	(0.018)		(0.008)		(0.184)
Romania	-0.008	Slovakia	-0.008	Hungary	-0.016
	(0.008)		(0.013)		(0.013)
		Slovenia	-0.0001		
			(0.007)		
C	-0.018		-0.107*		-0.071*
	(0.038)		(0.056)		(0.036)
Monetary policy*C					
Bulgaria	-0.0013	Latvia	-0.006	Czech R.	0.007
	(0.0012)		(0.005)		(0.005)
Lithuania	0.001	Poland	-0.008***	Estonia	-0.005
	(0.007)		(0.002)		(0.003)
Romania	-0.005**	Slovakia	0.002	Hungary	-0.001
	(0.002)		(0.003)		(0.002)
		Slovenia	-0.001		
			(0.001)		
GDP growth	4.10***		2.19***		3.10***
	(0.757)		(0.479)		(0.695)
Inflation	-0.264**		-0.042		-0.253**
	(0.111)		(0.094)		(0.102)
p-value Hansen	1		1		1
p-value AR1/AR2	0.016/0.512		0.326/0.529		0.016/0.481
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.

Table 16: "Extended model" (equation (3)) (long term coefficients) (f).

Dependent variable:	**Growth rate of total loans to clients**				
Specifications :	(**1st group**)		(**2nd group**)		(**3rd group**)
Control variables :	**Liquidity (L)**	**Capitalization (C)**			
Monetary Policy					
Bulgaria	-0.094***	Latvia	-0.019	Czech R.	-0.025
	(0.024)		(0.024)		(0.021)
Lithuania	-0.027	Poland	-0.018*	Estonia	0.068
	(0.103)		(0.010)		(0.092)
Romania	-0.024	Slovakia	-0.009	Hungary	-0.007
	(0.015)		(0.029)		(0.031)
		Slovenia	0.016		
			(0.023)		
L	0.054		0.003		0.030*
	(0.037)		(0.010)		(0.015)
Monetary policy*L					
Bulgaria	0.0005	Latvia	-0.003**	Czech R.	-0.001
	(0.002)		(0.001)		(0.001)
Lithuania	0.002	Poland	0.001***	Estonia	0.006
	(0.002)		(0.0006)		(0.008)
Romania	0.0009	Slovakia	-0.00004	Hungary	-0.003
	(0.001)		(0.001)		(0.002)
		Slovenia	0.001		
			(0.002)		
C	0.054		-0.073		-0.028
	(0.039)		(0.053)		(0.031)
Monetary policy*L					
Bulgaria	-0.001	Latvia	0.001	Czech R.	0.004
	(0.001)		(0.001)		(0.004)
Lithuania	0.0024	Poland	-0.007***	Estonia	-0.005
	(0.010)		(0.001)		(0.003)
Romania	-0.004**	Slovakia	0.001	Hungary	-0.0008
	(0.001)		(0.006)		(0.001)
		Slovenia	-0.001		
			(0.002)		
GDP growth	4.63***		2.02***		2.74***
	(0.842)		(0.466)		(0.806)
Inflation	-3.08**		-0.065		-0.168
	(0.130)		(0.077)		(0.146)
p-value Hansen	1		1		1
p-value AR1/AR2	0.016/0.430		0.317/0.369		0.023/0.400
No. obs./ No. banks	245/59		365/95		223/52

Note: Standard errors in parentheses. *,**,*** denotes significance at 10%, 5%, 1% level.