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The transmission of monetary policy in CEECs: what is the role of the banks' market power and efficiency?

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Abstract:
We analyze the influence of the banks' market power and efficiency in the transmission of monetary policy in the Central and Eastern European Countries. While the role of other factors, such as liquidity and capitalization levels and the size of bank, has already been studied, the impact of the market power and efficiency levels has not, to our knowledge, been the subject of any study. In this paper, we try to shed light on the subject. We measure market power by using the Lerner Index. Efficiency scores are determined by the parameter frontier approach. Our results confirm the conclusions of previous studies: higher levels of liquidity and capitalization and higher amount of bank's assets reduce the repercussion of the monetary policy on the bank's lending behavior. Concerning the banks' market power and efficiency, we show that the more efficient the bank is and the higher market power it has, the less monetary policy impacts its lending activity.

Keywords: monetary policy, banking, market power, efficiency, Central and Eastern European Countries

JEL classification: D40, E52, G21.

1. Introduction

The impact of monetary policy on interest rates is closely related to the credit market in general and to the credit channel in particular. The latter relies, firstly, on the imperfect substitutability between credits and other forms of investment for banks, and secondly, on the imperfect substitutability between bank credits and other forms of external financing for firms. As capital markets are not very developed in the Central and Eastern European Countries (CEECs), this channel should be there particularly important.

Many studies show that the main banking factors of the monetary policy transmission by the credit channel in the CEECs are: the size of the bank, its capitalization and liquidity levels and whether the bank is domestic or foreign (see, for example, Wróbel and Pawlowska, 2002; Juks, 2004; Pruteanu, 2004; Schmitz, 2004; Havrylchyk and Jurzyk, 2005; Chmielewski, 2005; Matousek and Sarantis, 2006). But any of them studies has not, to our knowledge, studied the impact of the bank's market power and efficiency levels.. The objective of this study is therefore to show how these variables influence the bank's lending behavior to changes in the central bank's rates.

This aspect is extremely important because the intensity of market power modifies the bank's behavior, particularly in the presence of deposit insurance. When competing on the deposit market, banks become identical for depositors. They therefore conduct a more aggressive strategy in order to attract more depositors and win market shares (Matutes and Vives, 1996 and 2000). This implies that a high level of competition should make them more sensitive to central bank's rate changing.

The bank's market power also modifies its behavior on the credit market. Indeed, the bank cannot know the real profitability of borrowers' projects. As a result, it must make an additional effort to reveal it. Cordella and Levy Yeyati (2002) analyze the impact of bank competition on the banks' risk-taking behavior, taking into account the moral hazard both on the deposit and on the credit markets. They find that the degree of effort made by the bank to analyze and monitor projects decreases with the amplification of the competition. And yet, this decrease is less important if the insurance premium is risk-based. It is therefore clear that the bank's market power and efficiency cannot be ignored in a study of the transmission of monetary policy.

In order to better treat this subject, we are firstly going to review the existing literature on the role of the banking sector on the transmission of monetary policy via the credit

channel. Then, we describe the econometric methodology used in the description of the credit channel. We also present the methodologies applied for estimating the banks' market power and efficiency levels. Lastly, we present our results and draw a conclusion.

2. Related Literature

We can distinguish two steps in the transmission of the monetary policy on the real sectors of the economy via the credit channel. Firstly, the imperfect substitution between bank assets leads to a contraction (an expansion) of the credit supply if the monetary policy becomes restrictive (expansionist). When lacking liquidity, banks will prefer to reduce their credit supply instead of selling bonds, in order to preserve the threshold of their liquidity level. Alternatively, they may also issue bonds or collect deposits instead of rationing credits. However, their capacity to borrow on the financial market may be reduced because of existing imperfections as asymmetry of information. Within developing banking system, as that of the CEECs' one, and during the financial meltdown, as that of 2008, there is not a strong confidence among banks namely regarding the banks with low level of capital. On the other hand, the monetary policy affects the real sector of the economy, when certain companies do not have the possibility of substituting other forms of external financing with bank credit, which is the case of the CEECs. The rationing of credits thus reduces the amount of companies' investments.

The first step characterizes banks' behavior. Research has been conducted both in developing and in transition countries. Some of the studies have used aggregate series, to estimate the two steps using impulse response functions obtained from VAR models. Wróbel (2001) shows that in Poland, a monetary shock implies, over the short-term period, a rationing of credits, and that the amount of credits also decreases over the long-term period. However, it may return to its initial level (Creel and Levasseur, 2005). For the Czech Republic and Hungary, Creel and Levasseur (2005) find that, over the short-term period, a monetary shock implies an increase rather than a decrease in the amount of credits. The established effects on production and inflation are divergent.

The individual data of banks make it possible to obtain more precise results concerning their behavior following the changing in central bank's interest rates. Kashyap and Stein's (1997) study was ground-breaking. By categorizing American banks according to their asset level, these authors find that due to limited access to the financial market, small banks

decrease their amount of credits after a monetary shock. However, they do not decrease their amount of bonds. The authors explain that small banks give more credits to small firms whose credit demand is procyclical. Kashyap and Stein (2000) estimate the impact of monetary policy on banks' behavior via the credit channel by taking the liquidity level into account. They conclude that the least liquid banks are the most responsive to monetary shock. As the liquidity of the credit institutions generally depends on their size, the authors confirm the previous result. Basing on the Kashyap and Stein's model, Ehrmann *et al.* (2001) determine the factors that influence the monetary policy transmission via the credit channel in the countries of the euro zone and they show that the liquidity level plays an extremely important role.

Kashyap and Stein's model was also applied to the CEECs, the various bank characteristics being used separately. The results clearly show that the banks respond to a monetary shock according to their size, their capitalization and liquidity levels and the structure of their capital (private or public, domestic or foreign). But the responses prove to be different. For Estonia, Juks (2004) finds that the lending activity is highly affected for banks with a low liquidity level. Size and the capitalization level are of no importance in the transmission of the monetary policy. Matousek and Sarantis (2006) come to the same conclusion when aggregating data for the three Baltic countries. However, banks respond differently according to their size, as the largest banks are capable to resist on the variation of the central bank's interest rates.

For the Czech Republic, Hungary, Poland, Slovakia and Slovenia, Schmitz (2004) underlines not only the same effects relating to banks' size and their liquidity level, but also the fact that foreign banks are more sensitive to the transmission of the monetary policy than domestic institutions. These reactions are also different depending on the country (Matousek and Sarantis, 2006). For Poland, Havrylchyk and Jurzyk (2005) show that banks with a good liquidity level can isolate the credit supply from the effects of the monetary policy. However, concerning the size level the results are not conclusive. Estimated coefficients indicate that small banks are in a better position to protect themselves against the monetary shocks. Likewise, bank capitalization has no impact on the lending behavior. These conclusions contradict those of Wróbel and Pawlowska (2002), who find that largest banks and the most capitalized banks respond to a least extent, whereas the most liquid banks are most sensitive to the variation of the interest rates of the monetary instruments. Havrylchyk and Jurzyk

(2005) consider this result to be counter-intuitive, like a consequence of the over-liquidity of the Polish banking market. The most robust variable in the regressions performed by Chmielewski (2005) and by Matousek and Sarantis (2006) is the capitalization level. Matousek and Sarantis (2006) find this result for the Baltic countries, Hungary, Slovakia, Slovenia and the Czech Republic. Even if foreign banks have higher capitalization levels, they are, in general, more responsive to monetary policy. These authors also show that foreign currency loans, especially those intended for households, are very low sensitive to the actions of monetary authorities.

For the Czech Republic, the results vary according to the period taken into account. Between 1994 and 2003, Matousek and Sarinis (2006) establish that the banks' size and their capitalization and liquidity levels are important in characterizing their lending behavior. Pruteanu (2004) concludes that the most capitalized and the most liquid banks were less responsive to monetary policy between 1996 and 1998 and were no more between 1999 and 2001. The importance of size is confirmed for foreign banks, for which the impact is different between the two sub-periods. From 1996 to 1998, large foreign banks were especially affected by the actions of monetary authorities. From 1999 to 2001, small foreign banks were strongly impacted by monetary policy. The liquidity level is important for foreign banks in the first sub-period, and is substantial for the entire banking system in the second sub-period.

To summarize, the traditional factors likely to influence the transmission of monetary policy on the credit supply are the size of the bank and its capitalization and liquidity levels.

3. Methodology

In order to determine the credit channel in the transmission of monetary policy in the CEECs and to bringing to light the factors that influence it, the regressions will be performed with individual series of banks in the framework of a panel data model with ten countries: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and the Czech Republic. The equation that we are going to regress takes the following form:

$$\begin{aligned}\ln(CR_{ijt}) = {} & c + \eta_i + \mu_t + \alpha_1 CBIR_{jt} + \alpha_2 \ln(CAP_{ijt}) + \alpha_3 \ln(LIQ_{ijt}) + \\ & + \alpha_4 \ln(TA_{ijt}) + \alpha_5 MP_{ijt} + \alpha_6 EF_{ijt} + \alpha_7 GDPR_{jt} + \alpha_8 CBIR_{jt} \times \ln(CAP_{ijt}) + \\ & + \alpha_9 CBIR_{jt} \times \ln(LIQ_{ijt}) + \alpha_{10} CBIR_{jt} \times \ln(TA_{ijt}) + \\ & + \alpha_{11} CBIR_{jt} \times MP_{ijt} + \alpha_{12} CBIR_{jt} \times EF_{ijt} + \varepsilon_{ijt},\end{aligned} \tag{1}$$

where *i* represents the index of the bank *i* and *j* that of the country *j*. *CR* expresses the amount of credits and *CBIR* the average central bank's interest rate of all monetary instruments[1]. The value of α_1 will describe the degree to which monetary policy is transmitted through the credit channel. The expected sign of this coefficient is obviously negative, because the decrease in interest rate should lead to an increase in the amount of credits, and *vice versa*.

The factors that determine the transmission of monetary policy revealed by studies in the CEECs are the bank's capitalization, *CAP*, its liquidity level, *LIQ*, and its size, *TA*, expressed by the total assets. Like the amount of credits, all these factors are considered in absolute terms. More capital should enable the bank to increase its credit portfolio, which implies a positive sign for α_2. But if the bank is forced by the prudential regulations to increase its capital level because of high credit risk, it will ration its credit supply and, in this case, α_2 should be negative. All depends on the source of capital increase. If it is an external source, α_2 is positive. If the source is internal, the coefficient is negative. In the CEECs, this last case is the most probable, because banks have been limited by the prudential regulations. The same is true for the liquidity level. This indicator is composed of the amount of cash available to the bank, the amounts deposited in other banks and at the central bank, and of the government securities. The increase in the liquidity level is made to the detriment of credit, which implies a negative sign for α_3. At the same time, the larger the bank is, the greater its credit granting activity is. As a result, α_4 should be positive.

MP represents the bank's market power. It enables the bank to spend more for the monitoring and analysis of projects, which can lead to greater credit granting activity. α_5 is therefore expected to be positive.

We also study the role of the bank efficiency in the transmission of monetary policy. We then explain how, using the stochastic frontier approach, the efficiency level (*EF*) is determined. It is entirely plausible that the most efficient banks intensify their lending activity. The sign of the α_6 coefficient is expected to be positive.

In order to control of demand factors, we take real *GDP* growth into account. We expect α_7 to be positive, because demand should pull supply in the same direction, and

[1] For the European Central Bank's monetary instruments, the average interest rate includes deposit and credit facility rates, and refinancing operation rates. The same method is used to determine the average rate of the monetary instruments of Central Banks in the CEECs, adding, depending on the case, the reference rate and the rates of the REPO operations, in addition to the rates of deposits collected from banks.

therefore toward the financing of the economy. What's more, the *GDPR* series allow taking into consideration the heterogeneity among countries.

The way and the intensity in which the bank passes the variation of the central bank's interest rates on its lending activity depends on all these characteristics marked by *X*. Knowing that $\partial \ln(Cr)/\partial CBIR < 0$, $\partial^2 \ln(Cr)/\partial X \partial CBIR > 0$ means that the bank that has more *X*s (ln(*CAP*), ln(*LIQ*), ln(*TA*), *MP* and *EF*) is less sensitive to variations of the central bank's rates, and conversely. The characteristics of banks in the transmission of monetary policy are taken into account through crossed terms. If the conclusions of previous studies on the CEECs are confirmed, the most capitalized, the most liquid and the largest banks should be less sensitive to the central bank's monetary policy and the coefficients α_8, α_9 and α_{10} should be positive.

In comparison to other studies, we analyze the effect of the bank's market power and efficiency. Their role is deduced from the coefficients of crossed terms *CBIR*×*MP* and *CBIR*×*EF*. In our opinion, the banks that have market power should be able to and should have more interest to follow their own strategy and thus be less sensitive to central bank's monetary policy. As a result, it is entirely possible that α_{11} to be positive. A same opinion could be assigned to the role of the efficiency level, which implies a positive α_{12}.

4. Market Power

Numerous studies associate the level of competition with the market's concentration level, expressed by the Herfindahl-Hirschman ratio or by the market share of the 5 largest banks. Calculated as the sum of market share squares, the first index represents a more comprehensive and precise measure of market concentration. However, the relationship between the latter and the competition is established only in a particular analysis framework, that of a structure-conduct-performance. According to this theoretical approach, a more concentrated market implies a lower level of competition, because banks are supposed to have more market power. And yet, according to the contestable market theory (Baumol, 1982), there could be both a concentrated and competitive market if there are no entry or exit costs. This fact explains, for example, why higher concentration does not imply lesser competition among banks in Latin America (Levy Yeyati and Micco, 2007). Cetorelli (1999) shows that the negative relationship between concentration and competition is only verified in a Cournot

competition framework. However, in a framework characterized by reactions and production responses, the relationship is less obvious between the concentration level and the market power. For this reason, we use an econometric approach to determining the level of competition among banks.

Two different methodologies are generally implemented to determine the level of competition: the Panzar and Rosse revenue test (1987) and the Bresnahan (1982, 1989) and Lau (1982) mark-up test. The first is a non-structural index and the second is based on a structural approach. The structural approach is used here because it directly takes the competitive banking environment into account. The Lerner index is then the most appropriate as it stems from the Monti-Klein imperfect competition model. Moreover, in comparison to Panzar and Rosse's *H* index and Bresnahan and Lau's λ parameter, the Lerner index is only recently applied to banking industry, for instance by Angelini and Cetorelli (2003), Fernández de Guevara *et al.* (2007), Solís and Maudos (2008) and Carbó *et al.* (2009).

Let be a market with *N* banks where $r_L(L)$ represents inverse demand for bank loans, with $L = \sum_{i=1}^{N} L_i$, and $r_D(D)$ represents inverse demand for bank deposits, with $D = \sum_{i=1}^{N} D_i$. Under budget constraint, the function of the profit of bank *i* is

$$\pi_i = \left(r_L\left(L\right) - r\right)L_i + \left(r - r_D\left(D\right)\right)D_i - C\left(L_i, D_i\right). \tag{2}$$

We introduce the Cournot-Nash equilibrium condition to the following condition for maximizing profit:

$$\frac{\partial \pi_i}{\partial L_i} = 0 \text{ and } \frac{\partial \pi_i}{\partial D_i} = 0. \tag{3}$$

The Lerner indices for credits and deposits are:

$$L_L = \frac{r_L^* - r - \frac{\partial C}{\partial L}}{r_L^*} = \frac{1}{Ne_L} \text{ and } L_D = \frac{r - r_D^* - \frac{\partial C}{\partial D}}{r_D^*} = \frac{1}{Ne_D}. \tag{4}$$

As in the studies by Fernández de Guevara *et al.* (2007), and Carbó *et al.* (2009), we use only one indicator for bank activity. We will consider total assets (*TA*) as a banking product. Here we make the assumption that in CEECs, the flow of banks' products and services is proportional to their assets. We can thus calculate the average price *p* as the ratio between total revenue (*R*) and total assets (*TA*). The Lerner index is determined as follows:

$$L_{it} = \frac{p_{it} - cm_{it}}{p_{it}}, \tag{5}$$

with $p_{it}=R_{it}/TA_{it}$.

For the cost function, we take the translog function:

$$\begin{aligned} \ln C_{it} = c_i + \mu_t + \sum_{j=1}^{3} \theta_j \ln w_{j,it} + \theta_4 \ln TA_{it} + \frac{1}{2} \sum_{k=1}^{3} \sum_{l=1}^{3} \varphi_{kl} \ln w_{k,it} \ln w_{l,it} + \\ + \frac{1}{2} \rho_1 (\ln TA_{it})^2 + \sum_{k=1}^{3} \tau_k \ln w_{k,it} \ln TA_{it} + u_{it} + \varepsilon_{it}, \end{aligned} \tag{6}$$

In order to regress this function, we impose the symmetry and homogeneity conditions for the price coefficients of this cost function. Finally, the marginal cost of bank *i* at the moment *t* is determined as

$$cm_{it} = \frac{\partial C_{it}}{\partial TA_{it}} = \left[\theta_4 + \rho_1 \ln TA_{it} + \sum_{k=1}^{3} \tau_k \ln w_{k,it} \right] \frac{C_{it}}{TA_{it}}. \tag{7}$$

In the cost function, the error term has been divided into two parts: ε_{it} which follows a normal law $N(0, \sigma_\varepsilon^2)$ and u_i which takes only non-negative values according to a normal law truncated below zero, $N(\mu, \sigma_u^2)$, μ>0. This second part is used in the calculation of the efficiency level, because it refers to the gap between the cost of the bank and its optimal value.

5. Efficiency Level

We apply the parametric approach to determine the efficiency scores. Conceptually, it is not different from the non-parametric method. The optimal cost frontier must be estimated and the distance of the bank's cost from this frontier characterizes the cost inefficiency of the bank. What separates the two approaches is the way in which the frontier is established. The non-parametric approach uses linear programming method, the parametric approach uses econometric regression. In the latter case, the deviation of the bank's cost from its optimal level (from the frontier) is included in the error term. This makes the results less sensitive to the exactitude of the cost function.

Thus, cost inefficiency measures the gap between the bank's cost and the minimum cost necessary to produce the same quantity of goods and under the same conditions. Here u_c

expresses the inefficiency factor that may increase the cost above the minimum cost. u_c incorporates allocation inefficiency and technical inefficiency. The first characterizes the impossibility to respond optimally to the modification of the price structure *w*, and the second expresses the exaggerated use of production factors for the same quantity of goods *y*. The cost efficiency of bank *i*, EC_i, is the necessary cost to offer the vector of goods *y* if it had applied a better practice for the same exogenous variables (*w*,*y*), divided by the current cost of bank *i*. This ratio is adjusted by the error term:

$$EC_{it} = \frac{\hat{C}_{\min}}{\hat{C}_{it}} = \frac{\exp\left[\hat{f}\left(w_{it}, y_{it}\right)\right] \times \exp\left[\ln \hat{u}_{c,\min}\right]}{\exp\left[\hat{f}\left(w_{it}, y_{it}\right)\right] \times \exp\left[\ln \hat{u}_{c,it}\right]} = \frac{\hat{u}_{c,\min}}{\hat{u}_{c,it}}, \tag{8}$$

where $\hat{u}_{c,\min}$ is the minimum value of $\hat{u}_{c,it}$ among all the banks. *f* represents the translog function.

According to equation (8), efficiency takes values between 0 and 1. The values close to 1 characterize the most efficient banks, and those close to 0 the less efficient ones. This index is artificially forced to vary between 0 and 1. To alleviate this inconvenient, we follow the suggestion of Solís and Maudos (2008) and apply a logistical transformation of cost efficiency levels: $EC_{it} = \exp(EF_{it}) / (1 + \exp(EF_{it}))$. The efficiency level that we will take into account is therefore:

$$EF_{it} = \ln\left(\frac{EC_{it}}{1 - EC_{it}}\right). \tag{9}$$

6. Results

The estimations concern the 1999-2006 period which is after the major banking reforms in the region. With the exception of Bulgaria, whose banking data are all available from 1999 on the website of the National Bank of Bulgaria, the balance sheet and income reports of banks of the other countries have been extracted, annually, from the database BankScope Fitch IBCA. For certain banks, time series have been completed with data taken from their published balance sheets and income statements. The data concerning real GDP growth are extracted from the IMF's database and those concerning the rates of monetary instruments are taken from the central banks' websites. Because of the limited number of banks, Estonia and Lithuania are studied together.

6.1 Market Power and Efficiency Levels

The market power is measured by the Lerner index. It is obtained by regressing the equation (6) and by estimating the expressions (7) and (5). Theoretically, this index should take non-negative values, zero indicating perfectly competitive behavior. Negative values obtained may be explained as a consequence of extremely strong competition, which forces the bank to offer a price lower than its marginal cost. In values weighted by the amount of total assets, this is the case of Slovakia before 2002 and of Poland after 2003 (see Table 1).

In the latter country, the level of competition increased sharply between 1999 and 2006: the Lerner index thus decreased by more than 1 point. Slovenian banks also lost market power but to a lesser extent, with the Lerner index dropping by 0.05 points. In the other countries, we observe an increase in the banks' market power. It is relatively less pronounced in Estonia and Lithuania (+0.09 points on average). For Hungarian, Slovakian and Czech banks, the increase is of 0.2 points on average.

The case of Bulgaria is unique. Banks recorded fluctuations in their market power that do not allow concluding on the evolution of their competition level. We can however mention that competition among Bulgarian banks dropped between 1999 and 2003 and has increased slightly since 2004.

The efficiency level is determined by the regression of the equation (6) and by applying the equation (8) (see Table 1). Taking into account the fact that the cost frontier has a country specific character, the efficiency score is determined individually for each country. As a result, it is impossible to compare efficiency levels among countries and they must be analyzed only over time. The high values for Bulgarian and Czech banks do not mean that these banks are more efficient than the others. These banking industries simply have a cost frontier from which the banks' cost deviates slightly. According to these results, with the exception of Polish banks (0.1 point drop), the banks increased their efficiency level (maximum in Latvia (0.2 points) and in Slovakia (0.3 points)).

Table 1. Market Power (*L*) and Efficiency Levels (*EC*).

	1999		2000		2001		2002		2003		2004		2005		2006	
	L	***EC***	***L***	***EC***	***L***	***EC***	***L***	***EC***	***L***	***EC***	***L***	***EC***	***L***	***EC***	***L***	***EC***
BG	0.281	0.894	0.325	0.908	0.258	0.913	0.264	0.918	0.274	0.923	0.308	0.927	0.299	0.935	0.267	0.947
HU	0.043	0.714	0.116	0.734	0.072	0.753	0.042	0.768	0.200	0.784	0.245	0.798	0.245	0.814	0.250	0.828
ES+LT	0.241	0.799	0.232	0.820	0.200	0.842	0.239	0.865	0.288	0.888	0.327	0.912	0.329	0.936	0.336	0.961
LV	0.177	0.583	0.211	0.612	0.263	0.638	0.294	0.665	0.322	0.692	0.353	0.717	0.372	0.740	0.347	0.762
PL	0.251	0.942	0.351	0.922	0.372	0.919	0.087	0.896	-0.017	0.875	-0.238	0.846	-0.650	0.808	-0.786	0.811
RO	0.085	0.704	0.043	0.721	0.207	0.755	0.158	0.774	0.174	0.792	0.224	0.808	0.233	0.824	0.198	0.835
SK	-0.348	0.505	-0.068	0.551	-0.099	0.595	-0.028	0.638	0.088	0.678	0.056	0.717	0.092	0.751	0.096	0.814
SL	0.192	0.803	0.208	0.813	0.152	0.821	0.173	0.829	0.172	0.837	0.200	0.846	0.162	0.854	0.147	0.863
CZ	0.119	0.891	0.097	0.908	0.120	0.924	0.203	0.939	0.248	0.950	0.278	0.960	0.332	0.968	0.328	0.974

Note: The Lerner index (*L*) and the cost efficiency (*EC*) are weighted by the total assets.

Table 2. Correlation between Market Power and Efficiency Level.

BG	HU	ES+LT	LV	PL	RO	SK	SL	CZ
0.176*	0.174*	0.235*	0.183**	0.295*	0.320*	0.406*	0.285*	0.366*
(<0.001)	(<0.001)	(0.010)	(0.017)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)

Note: between parentheses are *p*-values of the correlation coefficients. *, **, *** mean that the coefficients are significant at 1%, 5% and 10% levels, respectively.

6.2 Transmission of Monetary Policy

For countries that have a currency board in relation to the euro (Bulgaria, Estonia and Lithuania), we use the rates of the European Central Bank's monetary instruments: *CBIR* represents the average of these rates[2]. In order to determine the factors of the monetary policy transmission via the credit channel in CEECs, we use a panel model.

Panel regressions may incorporate fixed or random effects, depending if individual effects are or are not correlated with regressors. The Hausman test rejects the hypothesis of the non-correlation of individual effects with regressors for all models (see Table 3). We therefore apply a model with fixed effects, also adding temporal effects.

The coefficients of the regression of equation (1) show the expected signs and are statistically significant. Without taking the role of the banks' specific factors into account (size, capital, liquidity levels, market power and efficiency levels), we observe that monetary policy affects the lending behavior of the banks, which do not hesitate to increase the amount of credits with the diminution of the central bank's interest rates. The coefficients of the *CBIR* are economically and statistically significant, except in models 1, 6 and 7 where they lose their statistical significance.

As for bank characteristics, we observe that they have the same impact as that described by the results of other studies on the CEECs' banking sectors. The banks increase their levels of capital and liquidity to the detriment of the lending activity. The logarithmic form of equation (1) makes it possible to analyze the coefficients of variables ln(*CAP*), ln(*LIQ*) and ln(*TA*) as elasticities. The 1% capital increase leads, on average, to a 0.1% decrease in the amount of credits offered to firms. The relationship with the liquidity level is even more elastic, because it is, on average, at -0.25%. The last characteristic is that banks that have 1% more assets offer 1.28% more credits.

[2] Deposit and credit facility rates, refinancing operation rates, reference rates, REPO operation rates and rates on deposits collected from banks.

Table 3. Determinants of the monetary policy transmission

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C	-1.335*	-1.711*	-1.389*	-1.517*	-1.314*	-1.325*	-1.442*	-1.628*
CBIR	-0.153	-0.194***	-1.365*	-0.919*	-1.974*	-0.152	-0.141	-0.578*
ln(*CAP*)	-0.089**	-0.094**	-0.143*	-0.100**	-0.106*	-0.089*	-0.089**	-0.100**
ln(*LIQ*)	-0.262*	-0.264*	-0.263*	-0.279*	-0.262*	-0.262*	-0.265*	-0.259*
ln(*TA*)	1.310*	1.343*	1.319*	1.326*	1.281*	1.309*	1.333*	1.337*
L	0.198*					0.183		
EF		0.134*	0.126*	0.129*	0.120*			0.091**
GDPR	2.315**	2.052*	2.228*	2.221*	2.298*	2.316*	2.108*	2.239*
CBIR×ln(*CAP*)			0.376*					
CBIR×ln(*LIQ*)				0.186*				
CBIR×ln(*TA*)					0.372*			
CBIR×L						**0.139**	**0.640****	
CBIR×EF								**0.395****
Hausman	40.16*	41.58*	44.83*	42.94*	45.61*	42.69*	36.06*	44.10*
R^2-adj.	0.54	0.54	0.54	0.54	0.55	0.54	0.54	0.54
Nr. of obs.	1630	1621	1621	1621	1621	1630	1630	1621

Note: *, **, *** mean that the coefficients are significant at 1%, 5% and 10% levels, respectively.

The results of the regressions confirm that, in CEECs, capital and liquidity levels are increased to the detriment of credit. The first characteristic may be analyzed as a consequence of the prudential regulation. Moreover, we find that the banks that have greater market power offer more credit. Stronger market power makes it possible to make more efforts to analyze and monitor projects, which could explain this result. Likewise, banks that are more efficient are more active in their lending activity, the coefficient of *EF* being economically and statistically significant.

Market power and efficiency levels cannot be studied simultaneously, because there is a correlation between these two indicators:

- either banks with higher market power are also more efficient because they have the financial possibility of analyzing and monitoring the firms' projects, which implies a positive relationship,
- or these banks take advantage of the lack of competition by making useless expenses (Berger and Hannan's (1998) "*quiet life*" hypothesis) and respectively by reducing their efficiency cost, which implies a negative relationship.

The correlation coefficients between these two variables clearly show that the two series are correlated. What's more, the relationship is positive between market power and efficiency levels for all countries studied here (see Table 2).

Concerning the role of capitalization and liquidity levels, and the size of the bank, in the transmission of monetary policy, we find the equivalent results as that of other studies. The coefficients of crossed terms $CBIR \times \ln(CAP)$, $CBIR \times \ln(LIQ)$ and $CBIR \times \ln(TA)$ are all positive and statistically significant. In CEECs, the best capitalized, most liquid and largest banks are also the least sensitive to the central bank's interest rate variation. They pursue their lending strategy diminishing the impact of the monetary policy on their lending behavior.

The analyzed results corroborate the conclusions of previous studies on CEECs' banking industry. But the main objective of our study is to determine the impact of banks' market power and efficiency level on the transmission of monetary policy. The hypotheses that we laid out have been verified: the coefficients of crossed terms $CBIR \times L$ and $CBIR \times EF$ are positive and statistically significant (models 7 and 8). For the Lerner index, the problem of colinearity implies that the coefficients are not statistically significant when free and crossed terms appear simultaneously in the equation (model 6). They become significant for

separate regressions (models 1 and 7). We can therefore conclude that market power and efficiency in cost management offer to banks the possibility of pursuing their lending strategy by curbing the effect of variations in the central bank's interest rates.

7. Conclusion

Studies on the transmission of monetary policy, including in CEECs, account only for the role of banks' balance sheet characteristics (capital and liquidity levels, size). The objective of our study was to contribute to previous works by analyzing the impact of banks' market power and efficiency on the transmission of monetary policy through the credit channel. The significance is noteworthy because, in addition to the negative effect of strong competition on the quality of the credit portfolio, the problem of bank competition could also be posed in the transmission of monetary policy.

To answer these questions, bank market power and efficiency indicators were determined. Except in Poland and Slovenia, banks' market power increased between 1999 and 2006. Polish banks are also an exception from an efficiency viewpoint because all other banks saw this indicator improve during the period.

Our results validate the hypothesis according to which banks in CEECs with strong market power and better efficiency in cost management can reduce the impact of the monetary policy on their lending activity. The other results corroborate the conclusions of existing studies: high capital and liquidity levels and big amount of assets diminish the effect of the central bank's interest rate variations on the lending activity.

References

Angelini P., Cetorelli N., 2003. *The effects of regulatory reform on competition in the banking industry*. Journal of Money, Credit and Banking 35, 663-684.

Baumol W.J., 1982. *Contestable markets: an uprising in the theory of industry structure*. American Economic Review 72, 1-15.

Berger A.N., Hannan T.N., 1998. *The efficiency cost of market power in the banking industry: A test of the "quiet life" and related hypotheses*. Review of Economics and Statistics 80(3), 454-465.

Bresnahan T., 1982. *The oligopoly solution concept is identified*, Economics Letters 10, 87-92.

Bresnahan T., 1989. *Empirical studies of industries of market power*, in Schmalensee R., Willig R. (Eds.), *Handbook of industrial organization*, New-York: North-Holland, vol. II, Chapitre 17, 1011-1057.

Carbó S., Humphrey D., Muados J., Molyneux Ph., 2009. *Cross-country comparisons of competition and pricing power in European banking*. Journal of International Money and Finance 28, 115-134.

Cetorelli N., 1999. *Competitive analysis in banking: Appraisal of the methodologies*. Federal Reserve Bank of Chicago, Economic Perspectives, 1 er Trimestre, 23(1).

Chmielewski T., 2005. *Bank Risks, Risk Preferences and Lending*. Banque Nationale de Pologne, mimeo.

Cordella T., Levy Yeyati E., 2002. *Financial opening, deposit insurance, and risk in a model of banking competition*. European Economic Review 46, 471-485.

Creel J., Levasseur S., 2005. *Monetary Policy Transmission in the CEECs: How Important are the Diffrences with the Euro Area*. OFCE Document de travail n°2.

Ehrmann M, Gambacorta L., Pagés J.M., Sevestre P., Worms A., 2001. *Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area*. ECB, Working paper 105.

Fernández de Guevara J., Maudos J., Pérez F., 2007. *Integration and competition in the European financial markets*. Journal of International Money and Finance 26, 26-45.

Havrylchyk O., Jurzyk E., 2005. *Does the Bank Lending Channel Work in a Transition Economy? A Case of Poland*. European University Viadrina, mimeo.

Juks R., 2004. *The Importance of the Bank Lending Channel in Estonia: Evidence from Microeconomic Data*. Bank of Estonia, Working paper 6.

Kashyap A.K., Stein J.C., 1997. *What Do a Million Banks Have to Say About the*

Transmission of Monetary Policy? NBER, Working paper 6056.

Kashyap A.K., Stein J.C., 2000. *What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?*. The American Economic Review 90(3), 407-428.

Lau L., 1982. *On identifying the degree of competitiveness from industry price and output data*. Economics Letters 10, 93-99.

Levy Yeyati E., Micco A., 2007. *Concentration and foreign penetration in Latin American banking sectors: Impact on competition and risk*. Journal of Banking and Finance 31, 1633-1647.

Matousek R., Sarantis S., 2006. *The Bank Lending Channel and Monetary Transmission in Central and Eastern Europe*. 61st International Atlantic Economic Conference Berlin, 15-19 May.

Matutes C., Vives X., 1996. *Competition for Deposits, Fragility, and Insurance.* Journal of Financial Intermediation 5, 184-216.

Matutes C., Vives X., 2000. *Imperfect competition, risk taking, and regulation in banking.* European Economic Review 44, 1-34.

Panzar J., Rosse J., 1987. *Testing for "monopoly" equilibrium*. Journal of Industrial Economics 35, 443-456.

Pruteanu A., 2004. *The Role of Banks in the Czech Monetary Policy Transmission Mechanism*. Czech National Bank, Working paper 3.

Schmitz B., 2004. *What Role Do Banks Play in Monetary Policy Transmission in EU Accession Countries?* Magyar Nemzeti Bank.

Solís L., Maudos J., 2008. *The social costs of bank market power: Evidence from Mexico*. Journal of Comparative Economics 36, 467-488.

Wróbel E., 2001. *The Monetary Transmission Mechanism and the, Structural Modelling of Inflation at the National Bank of Poland*. BIS, Working paper 8, 232-242.

Wróbel E., Pawlowska M., 2002. *Monetary Transmission in Poland: Some Evidence on Interest Rate and Credit Channels*. National Bank of Poland, Working paper 24.