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The transmission of monetary policy in central and east European countries: what is the role of the banks' market power and efficiency?[1]

Abstract

In this article, we analyse the influence of the banks' market power and efficiency in the transmission of monetary policy in central and eastern European countries. The role of other factors, such as liquidity and capitalisation levels and the size of the bank concerned, has already been studied, but the impact of market power and efficiency levels has not, to our knowledge, been the subject of any study. In this article, we try to shed light on this subject. We measure market power in terms of the Lerner Index, while efficiency scores are determined by the parameter frontier approach. Our results confirm the conclusions of previous studies: higher levels of liquidity and capitalisation and a higher amount of banking assets reduce the repercussions of monetary policy for banks' lending behaviour. Concerning the market power and efficiency of banks, we show that the more efficient the bank is and the higher market power that it has, the lesser the impact of monetary policy on its lending activity.

Keywords: *monetary policy, banking, market power, efficiency, central and eastern European countries*

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. Capital markets are not very developed in central and east European countries, so this channel should be particularly important there.

Many studies show that the main banking factors of the transmission of monetary policy by credit channel in central and east European countries are: the size of the bank; its capitalisation 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, to our knowledge, none of these studies has studied the impact of banks' market power and efficiency levels. The objective of this study is therefore to show how these variables influence bank lending behaviour in response to changes in central bank rates.

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

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

In order better to treat this subject, we firstly 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 and also present the methodologies applied for estimating banks' market power and efficiency levels. Lastly, we present our results and draw a conclusion.

Related literature

We can distinguish two steps in the transmission of monetary policy on the real sectors of the economy via the credit channel. Firstly, imperfect substitution between bank assets leads to a contraction (an expansion) of the credit supply if monetary policy becomes restrictive (expansionist). When lacking liquidity, banks will prefer to reduce their credit supply instead of selling bonds in order to preserve their threshold 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, such as asymmetry of information. Within a developing banking system, such as that in central and east Europe, and during financial meltdown, such as that of 2008, there is not a strong confidence among banks, namely regarding banks with low levels of capital. On the other hand, monetary policy affects the real sector of the economy, when certain companies do not have the possibility to substitute other forms of external financing with bank credit, which is the case in central and east European countries. The rationing of credit thus reduces the amount of investments by companies.

The first step characterises banks' behaviour. 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, monetary shock implies a rationing of credits in the short-term while, in the long-term, the amount of credits also decreases. However, this may return to its initial level (Creel and Levasseur, 2005). For the Czech Republic and Hungary, Creel and Levasseur (2005) find that, over a short-term period, monetary

shock implies an increase rather than a decrease in the amount of credits. The established effects on production and inflation are divergent.

Individual data from banks make it possible to obtain more precise results concerning their behaviour following a change in central bank interest rates. Kashyap and Stein's (1997) study was ground-breaking. By categorising 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 provide more credits to small firms whose credit demand is pro-cyclical.

Kashyap and Stein (2000) further estimate the impact of monetary policy on banks' behaviour via the credit channel by taking into account the liquidity level. They conclude that the least liquid banks are the most responsive to monetary shock. The liquidity of credit institutions generally depends on their size, allowing the authors to confirm their previous result. Basing their approach on the Kashyap and Stein model, Ehrmann *et al.* (2001) determine the factors that influence monetary policy transmission via the credit channel in the countries of the euro zone. They show that the liquidity level plays an extremely important role.

The Kashyap and Stein model was also applied to central and east European countries, the various bank characteristics being used separately. The results clearly show that banks respond to monetary shock according to their size, their capitalisation and liquidity levels and the structure of their capital (private or public, domestic or foreign). However, the responses prove to be different. For Estonia, Juks (2004) finds that lending activity is highly affected for banks with low liquidity levels. Size and the level of capitalisation are of no importance in the transmission of 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 the variation of central bank interest rates.

For the Czech Republic, Hungary, Poland, Slovakia and Slovenia, Schmitz (2004) underlines not only the same effects relating to bank size and liquidity levels, but also that foreign banks are more sensitive than domestic institutions to the transmission of monetary policy. 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 supply of credit from the effects of monetary policy. However, the results are not conclusive concerning size. The estimated coefficients indicate that small banks are in a better position to protect themselves against monetary shocks and that, likewise, bank capitalisation has no impact on lending behaviour. These conclusions contradict those of Wróbel and Pawlowska (2002), who find that the largest and most capitalised banks respond to the lowest extent, whereas the most liquid banks are the most sensitive to variations in the interest rates of monetary instruments. Havrylchyk and Jurzyk (2005) consider this result to be counter-intuitive, a consequence of over-liquidity in the Polish banking market. The most robust variable in the regressions performed by Chmielewski (2005) and by Matousek and Sarantis (2006) is the level of capitalisation. Matousek and Sarantis (2006) find this result for the Baltic countries, Hungary, Slovakia, Slovenia and the Czech Republic. Even if foreign banks have higher capitalisation levels, they are, in general, more responsive

to monetary policy. These authors also show that foreign currency loans, especially those intended for households, are only lowly sensitive to the actions of the monetary authorities.

For the Czech Republic, the results vary according to the period taken into account. Between 1994 and 2003, Matousek and Sarantis (2006) establish that banks' size and their capitalisation and liquidity levels are important factors in characterising their lending behaviour. Pruteanu (2004) concludes that the most capitalised and most liquid banks were less responsive to monetary policy between 1996 and 1998, and were no more so 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 the monetary authorities. From 1999 to 2001, monetary policy had a strong impact on small foreign banks. The liquidity level was important for foreign banks in the first sub-period and was substantial for the entire banking system in the second.

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

Methodology

In order to determine the role of the credit channel in the transmission of monetary policy in central and east European countries, and to bring to light the factors that influence it, regressions will be performed with an individual series of banks within the framework of a panel data model based on 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:

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

where *i* represents the index of bank *i* and *j* that of country *j*. *CR* expresses the amount of credits and *CBIR* the average central bank interest rate for all monetary instruments.[2] 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 a decrease in interest rates should lead to an increase in the amount of credits, and *vice versa*.

2 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 monetary instruments of central banks in central and east European countries, adding, depending on the case, the reference rate and the rates of REPO operations in addition to the rates of deposits collected from banks.

The factors that determine the transmission of monetary policy revealed by studies in central and east Europe are the bank's capitalisation, *CAP*; its liquidity level, *LIQ*; and its size, *TA*, expressed by 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 prudent regulations to increase its capital level because of a high credit risk, it will ration its credit supply and, in this case, α_2 should be negative. All depends on the source of the capital increase. If it is an external source, α_2 is positive; if the source is internal, the coefficient is negative. In central and east European countries, this latter case is the most probable, because banks have been limited by prudent 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 with the central bank; and of government securities. An 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 is its credit granting activity. The result is that α_4 should be positive.

MP represents the bank's market power. This enables the bank to spend more on 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 efficiency of banks in the transmission of monetary policy. We then explain how, using a 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 thus expected to be positive.

In order to control 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, therefore, toward the financing of the economy. What is more, the *GDPR* series allows us to take heterogeneity among countries into consideration.

The way and the intensity in which the bank deals with the variation in central bank interest rates as regards 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 a bank which has more *X*s (ln(*CAP*), ln(*LIQ*), ln(*TA*), *MP* and *EF*) is less sensitive to variations in the central bank 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 central and east Europe countries are confirmed, the most capitalised, the most liquid and the largest banks should be less sensitive to the central bank's monetary policy and coefficients α_8, α_9 and α_{10} should be positive.

In comparison to other studies, we also analyse the effect of the bank's market power and its level of efficiency, based on a role deduced from the coefficients of the crossed terms *CBIR*×*MP* and *CBIR*×*EF*. In our opinion, banks that have market power should be both more able to follow their own strategy and have more interest in doing so, thus allowing them to be less sensitive to the central bank's monetary policy. The

result is that it is entirely possible that α_{11} is positive. The same opinion could be assigned to the role of the level of efficiency, which implies a positive α_{12}.

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 five largest banks. Calculated as the sum of the squares of market share, the first index represents a more comprehensive and precise measure of market concentration. However, the relationship between the latter and competition is established only within a particular analytical framework based on 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 explains, for example, why higher concentration does not imply lesser competition between 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 characterised by reactions and production responses, the relationship between the level of concentration and market power is less obvious. For this reason, we use an econometric approach to determining the level of competition between 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 has only recently been applied to the banking industry, for instance by Angelini and Cetorelli (2003); Fernández de Guevara *et al.* (2007); Solís and Maudos (2008); and Carbó *et al.* (2009).

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

$$\pi_i = (r_L(L) - r)L_i + (r - r_D(D))D_i - C(L_i, D_i) \quad (2)$$

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

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

(3)

The Lerner indices for credits and deposits are:

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

(4)

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

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

(5)

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

For the cost function, we take the translog function:

$$\ln C_{it} = c_i + \mu_t + \sum_{j=1}^{3} \theta_j \ln w_{j,it} + \theta_4 \ln TA_{it} + \frac{1}{2} \sum_{k=1}^{3} \sum_{l=1}^{3} \varphi_{kl} \ln w_{k,it} \ln w_{l,it} +$$

$$+ \frac{1}{2} \rho_1 (\ln TA_{it})^2 + \sum_{k=1}^{3} \tau_k \ln w_{k,it} \ln TA_{it} + u_{it} + \varepsilon_{it},$$

(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 moment *t* is determined as:

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

(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 $N(\mu, \sigma_u^2)$, $\mu>0$. This second part is used in the calcu-

lation of the efficiency level because it refers to the gap between the cost of the bank and its optimal value.

Efficiency level

We apply a parametric approach to determine the scores for efficiency. Conceptually, it is no different to the non-parametric method. The optimal cost frontier must be estimated and the distance of the bank's cost from this frontier characterises the level of cost inefficiency of the bank. What separates the two approaches is the way in which the frontier is established. The non-parametric approach uses a linear programming method; whereas the parametric approach uses econometric regression. In the latter case, the deviation of the bank's cost from its optimal level (i.e. 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. u_c incorporates allocative inefficiency and technical inefficiency. The first characterises the impossibility of responding optimally to the modification of the price structure, w; while 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 of offering the vector of goods y, if a better practice had been applied, for the same exogenous variables (w,y) divided by the current cost of bank i. This ratio is adjusted by the error term:

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

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

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

(9)

Results

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

Market power and efficiency levels

Market power is measured by the Lerner Index and is obtained by regressing equation (6) and by estimating expressions (7) and (5). Theoretically, this Index should take non-negative values, zero indicating perfectly competitive behaviour. Any negative values obtained may be explained as a consequence of extremely strong levels of competition which force a bank to offer a price lower than its marginal cost. In values weighted by the amount of total assets, this is the case in Slovakia before 2002 and in 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 one 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 banks' market power. This 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. The banks have recorded fluctuations in their market power that do not allow a conclusion on the evolution of their level of competition. 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 equation (6) and by applying equation (8) (see Table 1). Taking into account that the cost frontier has a country-specific character, the efficiency score may be determined individually for each country. The result is that it is impossible to compare efficiency levels among countries; they may be analysed 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 only slightly. According to these results, with the exception of Polish banks (0.1 point drop), banks have increased their efficiency level (most of all in Latvia (0.2 points) and in Slovakia (0.3 points)).

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.[3] In order to determine the factors in monetary policy transmission via the credit channel in central and east European countries, we use a panel model.

Panel regressions may incorporate fixed or random effects, depending on whether individual effects are correlated with the regressors or not. The Hausman test rejects the hypothesis of the non-correlation of individual effects with the 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 into account the role of the banks' specific factors (size, capital, liquidity levels, market power and efficiency levels), we may observe that monetary policy does affect the lending behaviour of the banks in that banks do not hesitate to increase the amount of credits with the diminution of central bank 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.

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

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	-0.02	0.875	-0.24	0.846	-0.65	0.808	-0.79	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	-0.35	0.505	-0.07	0.551	-0.1	0.595	-0.03	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 cost efficiency (EC) are weighted by total assets.

Table 2 – Correlation between market power and efficiency level

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

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

Table 3 – Determinants of 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 the 1 %, 5 % and 10 % levels, respectively.*

As for bank characteristics, we may observe that they have the same impact as that described by the results of other studies on the banking sectors of central and east European countries: banks increase their levels of capital and liquidity to the detriment of lending activity. The logarithmic form of equation (1) makes it possible to analyse the coefficients of variables ln(*CAP*), ln(*LIQ*) and ln(*TA*) as elasticities. A 1 % increase in capital 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, -0.25 %. The last characteristic is that banks that have 1 % more assets offer 1.28 % more credits.

The results of the regressions confirm that, in central and east European countries, capital and liquidity levels are increased to the detriment of credit. The first characteristic may be analysed as a consequence of prudent regulation. Moreover, we find that banks that have greater market power offer more credit. Stronger market power makes it possible to make more efforts to analyse and monitor projects, which could explain this result. Likewise, the 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 the two indicators:

- either banks with higher market power are also more efficient because they have the financial possibility to analyse and monitor firms' projects, which implies a positive relationship, or
- these banks take advantage of the lack of competition by making useless expenditures (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. Furthermore, the relationship between market power and efficiency levels is positive for all the countries under study here (see Table 2).

Concerning the role of capitalisation and liquidity levels and the size of the bank in the transmission of monetary policy, we find equivalent results to those in other studies. The coefficients of the crossed terms $CBIR \times \ln(CAP)$, $CBIR \times \ln(LIQ)$ and $CBIR \times \ln(TA)$ are all positive and statistically significant. In central and east European countries, the best capitalised, most liquid and largest banks are also those which are least sensitive to variations in central bank interest rates; they pursue a lending strategy which diminishes the impact of monetary policy on their lending behaviour.

The analysed results corroborate the conclusions of previous studies on the banking industry in central and eastern Europe. However, the main objective of our study was to determine the impact of banks' market power and efficiency levels on the transmission of monetary policy. The hypotheses that we laid out have been verified: the coefficients of the 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 co-linearity implies that the coefficients are not statistically significant when the free and crossed terms appear simultaneously in the equation (model 6). They do, however, become significant for separate regressions (models 1 and 7). We can therefore conclude that market power and efficiency in cost management offer banks the possibility of pursuing their lending strategies in spite of the effect of variations in central bank interest rates.

Conclusion

Studies on the transmission of monetary policy, including in central and east European countries, account only for the role of bank balance sheet characteristics (capital and liquidity levels, and size). The objective of our study was to add to previous works by analysing 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 effects 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. Other than in Poland and Slovenia, the market power of banks increased between 1999 and 2006. Polish banks are also an exception from the viewpoint of efficiency, since all other banks saw this indicator improve during this period.

Our results validate the hypothesis according to which banks in central and east European countries which have strong market power and better efficiency in cost management can reduce the impact of monetary policy on their lending activity. The other results corroborate the conclusions of the existing studies: high capital and liquidity levels, and a large amount of assets, diminish the impact on lending activity of variations in central bank interest rates.

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