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**Research Report**

## Market power in CEE banking sectors and the impact of the global financial crisis

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# CASE Network Studies & Analyses

## Market Power in CEE Banking Sectors and the Impact of the Global Financial Crisis

Georgios Efthymoulou  
Canan Yildirim

No. 452/2013

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## **Abstract**

The aim of this study is to undertake an up-to-date assessment of market power in Central and Eastern European banking markets and explore how the global financial crisis has affected market power and what has been the impact of foreign ownership. Three main results emerge. First, while there is some convergence in country-level market power during the pre-crisis period, the onset of the global crisis has put an end to this process. Second, bank-level market power appears to vary significantly with respect to ownership characteristics. Third, asset quality and capitalization affect differently the margins in the pre-crisis and crisis periods. While in the pre-crisis period the impacts are similar for all banks regardless of ownership status, in the crisis period non-performing loans have a negative effect and capitalization a positive effect only for domestically-owned banks.

## 1. Introduction<sup>1</sup>

The current global financial crisis has revealed the complexity of the interactions between regulations, competition and stability in the financial services industry and led to a crucial debate over how to improve the financial regulatory and supervisory framework. In particular, bailing out financial institutions during the crisis, together with the proposed regulatory changes, raised concerns over the resulting market structure and the implications for competition in the finance sector (Beck *et al.*, 2010; Vives, 2011). The deepening crisis in the advanced European countries and continuing banking fragilities requiring state support arrangements necessitate a re-assessment of the resulting market competition in the financial services industry. Business models have been changing in response to the new market and regulatory conditions, and thus, understanding the determinants of market power is fundamental for developing policies aimed at promoting stable and efficient financial systems.

This study seeks to undertake an up-to-date assessment of market power in Central and Eastern European (CEE) banking markets and identify the factors that explain its level and variation over time. In particular, this study aims to analyze how the global crisis has affected market power and what has been the impact of foreign ownership. We focus on CEE countries for three main reasons. First, the banking sectors in these countries have undergone a major restructuring process as the transition from centralized systems to market economies progressed. The variability in reform experiences - in terms of initial conditions, the choice and sequencing of policies and outcomes - makes the case of CEE countries an ideal forum for exploring the relationships between market competition and financial regulatory frameworks. Second, despite different reform experiences, CEE banking systems share one common trait: high levels of foreign bank penetration due to high economic and financial integration with the advanced European countries. While integration with Western Europe has been instrumental in the pre-crisis economic growth of these countries, during the crisis their banking systems became highly susceptible to deepening European debt and the banking crisis. Hence, our results contribute to a better understanding of how the market power of banks with different

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ownership classes evolved over time and whether the impact of ownership on market power has changed in response to the crisis. Third, there is little research about the evolution of market competition in CEE banking sectors, especially in more recent years. Existing studies on this topic either focus on the early transition period (see, for instance, Mamatzakis *et al.*, 2005; Yildirim & Philippatos, 2007), or concentrate their analysis on the interactions between regulations and performance (Brissimis *et al.*, 2008; Agoraki *et al.*, 2011; Fang *et al.*, 2011). None of these studies, however, investigate the dynamics of market power per se or try to explain the factors that influence these dynamics.

Our empirical analysis is undertaken for 17 CEE banking sectors over the period 2002 to 2010 and involves two stages. In the first stage, we develop non-structural bank-level Lerner indices and examine the evolution of market power during the sampled period, whereas in the second stage, we use a dynamic econometric framework to identify its determinants. Has competition deteriorated because of the financial crisis and the measures taken to remove the fragilities in the banking systems? Has the market power of banks across different ownership categories evolved differently in the process? In tackling these questions, we employ GMM estimation techniques in a set of multivariate models that capture bank level, macroeconomic, and institutional characteristics, and split the sample in different time periods.

By way of preview, the main findings can be listed as follows. First, while there is some convergence in country-level market power during the pre-crisis period, the onset of the global crisis has put an end to this process. Second, bank-level market power appears to vary significantly with respect to ownership characteristics. Third, asset quality and capitalization affect differently the margins in the pre-crisis and crisis periods. While in the pre-crisis period the impacts are similar for all banks regardless of ownership status, in the crisis period non-performing loans have a negative effect and capitalization a positive effect only for domestically-owned banks.

This paper builds on the earlier empirical work on the assessment of competitive conduct in banking and the factors affecting market power. Concerning the former, a number of recent studies analyzing the evolution of competition in European markets in response to the deregulation process have not yet provided conclusive answers. For instance, Fernández de Guevara *et al.* (2005), using data from five European Union (EU) countries over the years 1992-1999, show that while there are substantial cross-country differences in market power, there is no increase in the degree of competition over time. On the other hand, Carbó *et al.* (2009), who undertake a cross-country comparison of various measures of competition in 14 European banking markets over the period 1995-2001, reach conflicting results regarding its variability within and across countries and over time. Bolt & Humphrey (2010) demonstrate that there can be different levels of market power in different market segments in European banking

markets. Specifically, they find greater levels of competition in the activities that generate spread income and lower level of competition in non-interest income generating activities. Concerning the latter, only a handful of studies consider the factors affecting bank competition and almost all of them focus on developed European markets: Angelini & Cetorelli (2003) on the Italian banking industry; Fernández de Guevara *et al.* (2005) on EU banking sectors; and, Fernández de Guevara & Maudos (2007) on the Spanish banking sector. The only exception is the study by Fungáčová *et al.* (2010) which employs data from Russian banks and illustrates that market concentration and asset quality significantly affect market power.

Our paper also draws on various studies analyzing the performance of foreign-owned banks and the impact of foreign bank penetration on the stability and performance of the host-country banking systems. It is generally argued that the increased presence of foreign banks is associated with better performance in the domestic banking systems of both developed and developing countries, and that foreign banks can achieve better performance than domestic banks (Berger *et al.*, 2000; Claessens *et al.*, 2001). However, the existing empirical evidence remains somewhat inconclusive mainly due to the heterogeneity among foreign banks with respect to the home countries from which they originate and the (target) countries in which they enter (Claessens & van Horen, 2012). Furthermore, the implications for the resilience of local banking markets of the differing business models and strategies employed by the foreign banks across different regions have become more explicit during the crisis ( Canales-Kriljenko *et al.*, 2010). As opposed to previous evidence that foreign banks contribute to credit market stabilization in their host markets (see Haselmann, 2006; de Haas & van Lelyveld, 2006, 2010), there is empirical evidence emerging from the current crisis suggesting that the presence of multinational banks increases the risk of instability from abroad (de Haas & van Lelyveld, 2011).

Our paper is the first one that focuses on the evolution of market power during the crisis. By covering the pre-crisis and the crisis periods and a geographical market which is increasingly exposed to the deepening European debt crisis, it provides a systematic analysis of the impacts of foreign ownership and different home and host country macroeconomic factors on market power.

The remainder of the paper is organized as follows: Section 2 outlines the empirical strategy and describes the data used; Section 3 presents the empirical results; and, Section 4 offers a discussion of the study's conclusions.

## 2. Empirical Methodology

### 2.1. Estimation of the Lerner Index

We derive the Lerner index of market power following the non-structural approach to the assessment of bank competition. In this approach, competitive conduct is assessed explicitly rather than inferred through the analysis of the market structure, as in the case of the alternative structural approach (Heffernan, 1996).<sup>2</sup> The Lerner index ( $L$ ) represents the markup of price over marginal cost for each bank  $i$  in country  $n$  at year  $t$ , and is calculated as follows:

$$L_{int} = \frac{(P_{int} - MC_{int})}{P_{int}} \quad (1)$$

where  $P$  is the price of bank output, proxied by the ratio of total revenue (interest and non interest income) to total assets and  $MC$  is the marginal cost.  $MC$  is derived from a translog cost function which incorporates technical change in a non-neutral form, as follows:

$$\begin{aligned} \left( \ln \frac{TC_{int}}{W_{3,int}} \right) &= \alpha_0 + \sum_{j=1}^2 \alpha_j \left( \ln \frac{W_{j,int}}{W_{3,int}} \right) + \frac{1}{2} \sum_{j=1}^2 \sum_{k=1}^2 \alpha_{jk} \left( \ln \frac{W_{j,int}}{W_{3,int}} \right) \left( \ln \frac{W_{k,int}}{W_{3,int}} \right) \\ &+ \alpha_q \left( \ln \overline{Q_{int}} \right) + \frac{1}{2} \alpha_{qq} \left( \ln \overline{Q_{int}} \right)^2 + \sum_{j=1}^2 \alpha_{jq} \left( \ln \frac{W_{j,int}}{W_{3,int}} \right) \left( \ln \overline{Q_{int}} \right) \\ &+ \alpha_z Z + \frac{1}{2} \alpha_{zz} Z^2 + \sum_{j=1}^2 \alpha_{jz} \left( \ln \frac{W_{j,int}}{W_{3,int}} \right) Z + \alpha_{qz} \left( \ln \overline{Q_{int}} \right) Z + \mu_n + \varepsilon_{int} \end{aligned} \quad (2)$$

where  $TC$  is the total cost;  $Q$  is a proxy for bank output (measured by total assets);  $W_1$ ,  $W_2$ , and  $W_3$  are the input prices of funds, capital, and labor, respectively, calculated as the ratios of interest expenses to total deposits and short-term funding, total depreciation and other capital expenses to total fixed assets, and personnel expenses to total assets, respectively;  $Z$  is an annual index of time representing the level of technology; and,  $\varepsilon$  is an *i.i.d.* error term. Country fixed effects ( $\mu_n$ ) are also introduced to capture unobserved cross-country heterogeneity.

Variables with bars represent deviations from their medians, specified in this way to reduce multi-collinearity, which is a well-known problem of the translog functional form (see Uchida &

<sup>2</sup> Recent applications of the Lerner index include, among others, Fernández de Guevara *et al.* (2005), Carbó *et al.* (2009), Weill (2011) and Lozano-Vivas & Weill (2012) for European markets, Berger *et al.* (2009) for developed banking markets, Angelini & Cetorelli (2003) for the Italian banking sector, Fernández de Guevara & Maudos (2007) for the Spanish banking sector, Fungáčová *et al.* (2010) for the Russian banking sector, Agoraki *et al.* (2011) for the Central and Eastern European banking sectors, Fang *et al.* (2011) for the banking sectors of South-Eastern Europe, Maudos & Solis (2011) for the Mexican banking sector, and Liu & Wilson (2012) for the Japanese banking industry.

Tsutsui, 2005; Brissimis *et al.*, 2008). Total cost and all the terms involving the input prices  $W_1$  and  $W_2$  are divided by  $W_3$ , such that the restriction of linear homogeneity for input prices is automatically satisfied.

We estimate Eq. (2) by maximum likelihood techniques for the whole panel of banks in the 17 CEE countries of our sample. Robust standard errors clustered by bank are used to calculate the corresponding test statistics. Within this framework, the marginal cost is computed as:

$$MC_{int} = \frac{TC_{int}}{Q_{int}} \left[ \alpha_q + \alpha_{qq} (\ln \overline{Q_{int}}) + \sum_{j=1}^2 \alpha_{jq} \left( \ln \frac{\overline{W_{j,int}}}{\overline{W_{3,int}}} \right) + \alpha_{qz} Z \right] \quad (3)$$

Alternatively, Eq. (2) can be estimated separately for each country  $n \in \{1, 2, \dots, 17\}$  to reflect potentially different technologies. Most of our sampled countries, however, have a relatively small number of banks, and thus, country-by-country regressions may produce biased estimates and lead to misleading inferences. Despite this problem, we also carry out the analysis at the country level and test the robustness of our results using the corresponding Lerner indices. The main difference of this approach is that the parameters in the marginal cost equation are allowed to vary across countries, as follows:

$$MC_{int} = \frac{TC_{int}}{Q_{int}} \left[ \alpha_{qn} + \alpha_{qqn} (\ln \overline{Q_{int}}) + \sum_{j=1}^2 \alpha_{jqn} \left( \ln \frac{\overline{W_{j,int}}}{\overline{W_{3,int}}} \right) + \alpha_{qzn} Z \right] \quad n = 1, \dots, 17 \quad (4)$$

The Lerner index is expected to range from a high of one to a low of zero, with higher numbers implying greater market power. Specifically, for a purely monopolistic bank in year  $t$ ,  $L$  will be equal to one, whereas for a perfectly competitive bank in year  $t$ ,  $L$  will be equal to zero. Theoretically it is also possible to observe values for the Lerner index below zero, which would indicate that the bank is making losses in year  $t$  as marginal cost is higher than price.

## 2.2. Market Power Model Specification

In order to evaluate the determinants of market power, we employ an empirical specification that builds on the work of Angelini & Cetorelli (2003), Fernández de Guevara *et al.* (2005) and Fungáčová *et al.* (2010) and takes the following form:

$$L_{int} = \beta L_{int-1} + \gamma \mathbf{X}_{int} + \delta \mathbf{Y}_{nt} + \mathcal{M}_{nt} + \mu_n + u_{int} \quad (M.1)$$

where  $\mathbf{X}$  is a vector of bank-level control variables;  $\mathbf{Y}$  is a vector of macroeconomic control variables;  $\mathbf{M}$  is a vector of market structure and institutional variables;  $u$  is an *i.i.d* error term; and,  $i$ ,  $n$ ,  $t$  index bank, country, and time, respectively. The previous period's Lerner index

is included among the explanatory variables since persistence over time is an important determinant of bank profitability and risk (Goddard *et al.*, 2004; Liu & Wilson, 2012). Specifically, vector  $\mathbf{X}$  includes:

- Operational inefficiency ('Inefficiency') proxied by non-interest expenses to total revenues following the common practice in the literature (see Fernández de Guevara *et al.*, 2005; Liu & Wilson, 2012).
- Share of non-interest sources of income in total revenue ('Diversification') capturing the impact of diversification on margins (Stiroh & Rumble, 2006; Lepetit *et al.*, 2008).
- Total customer deposits to total assets ('Customer Deposits') capturing the funding preferences, the importance of which has become more apparent in recent years, in particular with the onset of the global crisis (Demirgüç-Kunt & Huizinga, 2010).
- Non-performing loans to total loans ('NPL') as a proxy for asset risk or quality (Berger *et al.*, 2009).
- Total equity to total assets ('Capitalization') accounting for the interactions between capitalization levels and bank performance. In well-capitalized banks, the tendency to assume excessive risks would potentially be less profound, and this, in turn, could result in lower cost of funds and better performance. Moreover, banks that are not capital constrained can take advantage of highly profitable investment opportunities more easily.
- Bank size measured by four binary dummy variables that group banks into total asset quartiles (calculated separately for each country), and market share ('Market Share') proxied by the share of bank  $i$  in the country  $n$ 's banking sector total assets. As suggested by Cole & Gunther (1995), larger banks may diversify credit risk better due to higher flexibility in financial markets and enjoy other cost advantages associated with size.

On the other hand, vector  $\mathbf{Y}$  includes exogenous determinants of market power common to all banks in the same country, namely, the GDP growth rate ('Growth') and the inflation rate ('Inflation') as proxies of macroeconomic fluctuations and business cycle effects. High levels of GDP growth might entail plentiful business opportunities for banks, yet the direction of the relationship between bank margins and GDP growth can be positive or negative ( Angelini & Cetorelli, 2003). Similarly, the impact of inflation on margins is not clear-cut. In an inflationary environment, banks may demand higher risk premiums (Angelini & Cetorelli, 2003), but, at the same time, bank costs may also rise since higher inflation can result in a larger number of

transactions and an expansion in bank branches relative to the population (Demirgüç-Kunt & Huizinga, 1999). Finally, vector  $\mathbf{M}$  includes:

1. The normalized Herfindahl index ('HHI') as an indicator of the degree of concentration, which is expected to affect the competitive conduct of banks. According to the structure-conduct-performance paradigm, as concentration in a market increases, firms with greater monopoly power charge higher prices, and hence, have higher profitability levels.<sup>3</sup>
2. The EBRD index of banking sector reform ('Banking Reforms') as a proxy for the financial sector development, which has been found to be correlated with bank profitability and risk (see Demirgüç-Kunt & Huizinga, 1999).

To take into account the global financial market conditions which have deteriorated dramatically since the onset of the crisis and the banks' likely responses to these changing conditions, we estimate model (M.1) in three alternative time periods: full sample period (2002-2010), pre-crisis period (2002-2006) and crisis period (2007-2010). Furthermore, in order to study the impact of institutional and ownership factors on market power, we implement a number of additional tests based on the following extension of the baseline model:

$$\begin{aligned}
 L_{int} = & \beta L_{int-1} + \gamma \mathbf{X}_{int} + \delta \mathbf{Y}_{int} + \mathcal{M}_{int} + \xi \text{Foreign}'_{int} + \rho \text{State}'_{int} \\
 & + \lambda_1 \text{GrowthGap}'_{int} + \lambda_2 \text{InflationGap}'_{int} + \psi \mathbf{X}_{int}^s * \text{Foreign}'_{int} \\
 & + \mu_n + u_{int}
 \end{aligned}
 \tag{M.2}$$

where 'Foreign' is an indicator coding foreign-owned banks (those with foreign ownership exceeding 50% in year  $t$ ); 'State' is an indicator coding state-owned banks (those with state ownership exceeding 50% in year  $t$ ); and,  $\mathbf{X}^s$  is a sub-vector of  $\mathbf{X}$ . Apart from the ownership status, the origin (home country) of the parent bank may also affect the profitability and efficiency of a foreign bank, as suggested by Sturm & Williams (2008), Havrylchuk & Jurzyk (2011) and Claessens & van Horen (2012).<sup>4</sup> Following this literature, we partition the sample of foreign-owned banks into sub-samples of banks originating from EU countries, the US and all remaining countries, and re-estimate model (M.2) with 'Foreign' replaced by the interaction terms 'Foreign \* EU', 'Foreign \* US' and 'Foreign \* Others'. In addition, we include two variables capturing the differences between the macroeconomic conditions of the home countries and those of the countries in which the foreign banks operate (the host markets),

<sup>3</sup> Fernández de Guevara *et al.* (2005), Casu & Girardone (2006) and Fernández de Guevara & Maudos (2007), among others, show that the degree of concentration is not significantly related to the degree of competition. However, for consistency with previous empirical applications, we do include the Herfindahl index in our model.

<sup>4</sup> Claessens & van Horen (2012) find that foreign banks have higher profitability in developing countries when they originate from a high-income country. In addition, Havrylchuk & Jurzyk (2011) show that the profitability of foreign banks operating in Central and Eastern Europe is affected both less and differently by domestic economic conditions (compared to that of domestic banks), but does respond to the financial health of the parent banks and the economic conditions in their home countries.

namely, 'Growth Gap' and 'Inflation Gap'. The focus of the last set of our tests is on whether the interaction between the bank's financial condition and ownership status has any effect on market power, and if so, whether this effect has changed during the crisis period. This is done by interacting the variables 'NPL' and 'Capitalization' (included in  $\mathbf{X}^s$ ) with the foreign-ownership dummy, and calculating the conditional effects. In this way, it is possible to estimate the impact of each factor on market power conditional on the ownership status (foreign versus domestic) and analyze its variability in different time periods.

Equations (M.1) and (M.2) are standard dynamic panel data specifications. The presence of country specific effects and the lagged dependent variable among the regressors means that ordinary least squares and fixed effects (FE) estimations are severely biased and inconsistent unless the time dimension  $T$  is large (see Nickell, 1981; Kiviet, 1995). The time dimension in our data set is relatively small (at most 9 years) and, hence, the bias that results from using a FE estimator is non-negligible. To address this problem we adopt the system GMM estimator proposed by Blundell & Bond (1998). This estimator is designed for short, wide panels, and to fit linear models with one dynamic dependent variable, additional controls and fixed effects, and hence, it is appropriate for our data and model. Given our choice of system GMM as an estimation technique, we need to resolve two key issues. First, the asymptotic standard errors of the two-step GMM estimator have been shown to have a severe downward bias in small samples. To evaluate the precision of the two-step estimators for hypothesis testing, we apply the "Windmeijer finite-sample correction" (Windmeijer, 2005) to these standard errors. Second, it has often been pointed out that using too many instruments can make some asymptotic results about the GMM estimators and related specification tests misleading (see Roodman, 2009). To reduce this risk and make sure that the number of instruments does not exceed the number of groups, we only use a subset of the available instrument matrix.<sup>5</sup> The consistency of the GMM estimator is dependent upon the condition of no second-order serial correlation and the validity of instruments. We thus perform two tests: the Arellano-Bond test for second-order serial correlation of the differenced residuals, and the Hansen test for over-identifying restrictions.

### **2.3. Data**

Financial data (unconsolidated) were obtained from BankScope for 425 banks from 17 CEE countries, covering the period 2002- to 2010. The countries considered are: Albania, Bosnia and Herzegovina, Bulgaria, Belarus, Czech Republic, Croatia, Hungary, Latvia, Moldova,

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<sup>5</sup> The instruments used are lagged levels (two periods) of the dependent variable and the endogenous covariates (bank-level variables) for the first differencing equation, and lagged difference (one period) of these variables for the level equation. The exogenous covariates (country-level variables) are instrumented by themselves in the level equation and by first-differences in the first differencing equation.

Montenegro, FYR of Macedonia, Poland, Romania, Serbia, Slovenia, Slovakia, and Ukraine.<sup>6</sup>To be included in the final sample, banks had to be classified as commercial banks and have all model variables available in a given year. All extracted (nominal) variables were adjusted for inflation, and winsorized at the 1st and 99th percentiles. Moreover, to mitigate the impact of extreme observations on regression coefficients, values for the model variables that lie more than nine standard deviations from the sample mean were deleted. The final sample for the first stage analysis (estimation of the Lerner index) is an unbalanced panel with 1671 bank-year observations (306 banks). As ownership data in BankScope reflects the current status, time-series information on the ownership classification of banks was extracted from older issues of this database. Data on macroeconomic and institutional variables were collected from the EBRD's Transition Reports and the World Bank's World Development Indicators (WDI). More details of variable definitions and data sources can be found in Table A.1. Descriptive statistics of model variables are given in Table A.2. The cross correlation matrix for all model variables is displayed in Table A.3.

### 3. Empirical Results

#### 3.1. Evolution of the Lerner Indices

We start by considering the evolution of competitive conditions in the CEE banking systems over the period 2002 to 2010. Table 1 shows the average estimated Lerner indices for each country and year, as well as the resulting grand averages for all countries and all years. Three findings stand out. First, the average Lerner indices for all 17 countries range from 16.69 % to 22.22% over the period. These figures are comparable to the recent estimates by Weill (2011) who reports average Lerner indices for the 12 new EU member states (8 out of which are included in our sample) ranging from 14.30% to 21.33% over the period 2002 to 2008. Second, the overall picture emerging from the country averages and the changing trends over time is rather mixed, with some countries reflecting more competitive behavior than others, and/or exhibiting relatively more competitive practices in certain years.<sup>7</sup> Third, while for the majority

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<sup>6</sup> Two CEE countries with less than 30 bank-year observations in BankScope during the sampled period (namely, Estonia and Lithuania) were excluded from our analysis. Russia is also not considered here for two reasons: first, the Russian banking system differs significantly from that of the other CEE countries; and second, 71% of banks operating in CEE countries (available in BankScope) are in Russia, and hence, including those banks in a panel regression will lead to bias selection problems and produce misleading inferences.

<sup>7</sup> The negative values on the Lerner indices in Hungary (banks not behaving as optimizing firms) during the period 2007 to 2010 are associated with problems in the country's banking system which made it very vulnerable to the devaluation experienced, such as foreign currency denomination of mortgage loans as the prevailing practice and too high credits to deposits ratios (Andor, 2009).



of countries (12 countries) the Lerner indices fall in 2008 compared to 2007, when we consider all crisis years (2007-2010) we fail to identify any similar patterns.



Table 1: Evolution of market power in CEE banking sectors

Year(s)	Albania	Bosnia & Herzegovina	Bulgaria	Belarus	Czech Republic	Croatia	Hungary	Latvia	Moldova
2002	13.91		29.06	35.24	11.33	23.40	9.12	22.21	34.80
2003	3.88		24.19	29.85	7.86	25.38	4.49	21.13	38.16
2004	12.30	15.93	28.81	20.60	8.10	21.99	6.55	29.64	30.22
2005	24.58	20.38	19.04	19.77	11.56	20.23	9.69	34.42	22.22
2006	20.16	21.01	27.36	26.86	13.37	13.28	3.40	43.81	28.27
2007	20.11	22.99	31.32	31.13	17.49	16.31	-4.60	30.65	29.42
2008	19.90	14.59	24.71	30.29	22.42	12.86	-15.66	33.54	20.28
2009	16.71	19.50	23.83	27.20	26.97	16.62	-0.85	24.95	12.21
2010	19.96	22.32	25.67	26.99	24.13	15.51	-19.97	21.05	17.68
2002-2010	16.83	19.53	27.11	27.55	15.91	18.40	-0.87	29.04	25.92
Year(s)	Montenegro	FYR of Macedonia	Poland	Romania	Serbia	Slovenia	Slovakia	Ukraine	CEE17
2002	12.42	21.77	10.31	25.48	39.61	36.85	15.58	14.37	22.22
2003	25.06	28.36	-2.62	17.57	47.81	30.61	13.65	18.54	20.87
2004	21.68	28.38	11.35	24.87	30.93	34.37	8.62	20.38	20.87
2005	12.86	33.42	7.14	18.18	30.40	27.01	10.72	19.57	20.66
2006	13.17	33.84	20.89	10.33	15.20	21.86	18.24	18.31	20.55
2007	19.94	33.42	18.65	15.19	20.80	24.49	19.39	16.28	21.35
2008	13.42	27.75	14.63	22.05	10.10	16.18	29.88	21.91	18.76
2009	10.42	22.39	6.57	23.06	13.32	25.88	11.50	3.55	16.69
2010	16.69	19.73	19.49	23.12	5.03	30.58	16.41	6.82	17.13
2002-2010	16.18	27.67	11.82	19.98	23.69	27.54	16.00	15.53	19.90

Columns report the weighted average estimates of the Lerner index (using deposit shares as weights) for 17 CEE countries over the period 2002 to 2010. Higher values indicate increased market power; lower values indicate increased competition.



Figure 1 presents graphically the evolution of (i) prices, (ii) marginal costs, (iii) prices minus marginal costs, and (iv) Lerner indices on the basis of cross-country averages. Both prices and marginal costs display a downward trend up until 2007. The net effect of the reduction of prices and marginal costs, which depends on which one decreases faster, generates a relatively flat cross-country Lerner index over the period 2002 to 2007. Most importantly, there is a clear indication of convergence in both prices and marginal costs between the sampled countries over this period, as evidenced by the declining standard deviations from the cross-country averages. The country Lerner indices also exhibit a similar convergence during the pre-2008 period, albeit with some disturbance in 2006. In the two years that follow (2008 and 2009), we observe sharp rises in both prices and marginal costs prior to some reductions in year 2010. As a result, the cross-country Lerner index falls in 2008 and then stabilizes in 2009 and 2010. In addition, during the crisis period, there are high discrepancies in all series, in contrast to the pre-crisis period. The divergence in country Lerner indices in the last year of our sample is especially noteworthy. While we do not empirically test the level of convergence in competitive conditions across countries, our findings are in agreement with Weill (2011) who reports convergence towards the same level of bank competition in EU banking markets during the period 2002 to 2008. However, our evidence also suggests that the onset of the crisis has put an end to this convergence and prevented further banking integration in the CEE region.

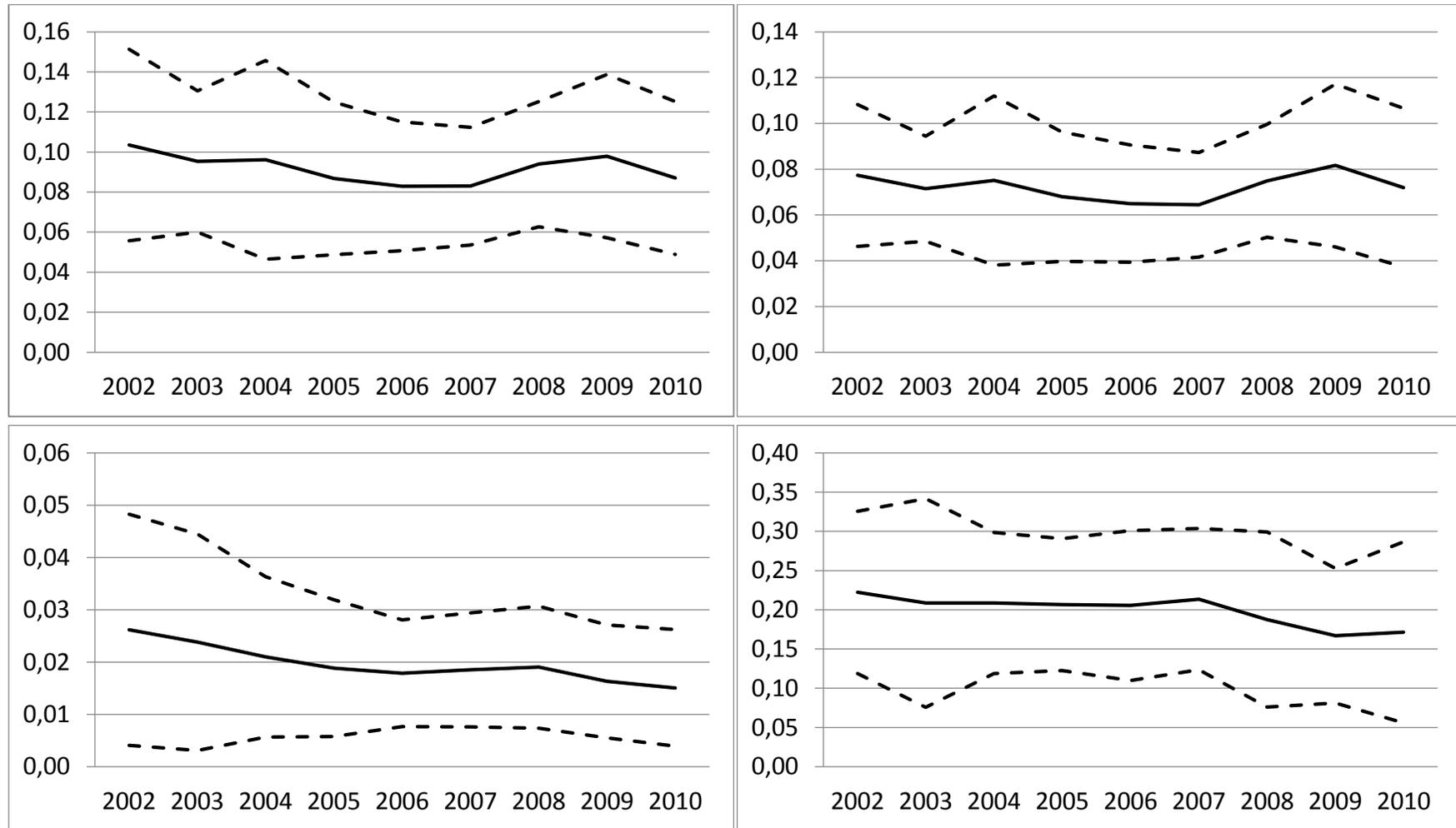


Figure 1: Price (top-left), marginal cost (top-right), price minus marginal cost (bottom-left) and Lerner index (bottom-right): cross-country means and standard deviations over the period 2002 to 2010 (calculated using the corresponding country-level values)

## 3.2. What Determines Market Power?

### 3.2.1. Basic findings

We continue our analysis by estimating model (M.1) for the full sample period 2002 to 2010 (see columns (1) and (2) of Table 2). The coefficient on the lagged Lerner index is positive and statistically significant, indicating the persistence of market power over time and justifying the use of a dynamic model. Turning now to the bank-specific control variables, we can see that operational inefficiency reduces market power by presumably increasing the costs of intermediation: the estimated coefficient on 'Inefficiency' is negative and highly statistically significant. This result meets our expectation and provides support to the relative efficiency paradigm, according to which firms earn superior profits because they are more efficient than other firms. Concerning diversification, we find that banks with a higher share of non-interest income in total revenue tend to have higher margins: the coefficient on 'Diversification' is positive and statistically significant at the 1% confidence level. This finding is in line with Bolt & Humphrey (2010), who demonstrate that bank competition is lower in activities that generate non-interest income than in those that generate spread income. Consistent with earlier empirical studies,<sup>8</sup> we also find that capitalization has a positive and highly statistically significant impact on market power. On the other hand, our proxies for funding preferences and the quality of the asset portfolio appear to exert little or no influence on the dependent variable. Likewise, while there is some indication in column (1) that higher market share is associated with higher levels of market power, the coefficient on 'Market Share' loses its statistical significance when we augment the baseline model with additional controls.

Among the macroeconomic variables, the coefficient on GDP growth has a positive sign and is statistically significant at conventional levels, suggesting that during economic expansions banks tend to have higher margins, as also found by Fernández de Guevara *et al.* (2005) and Fungáčová *et al.* (2010). Inflation, on the other hand, does not appear to be related to margins. In line with previous empirical applications, we find no statistically significant relationship between the level of market concentration ('HHI') and bank-level market power.<sup>9</sup> Furthermore, we fail to find any evidence that the introduction of banking reforms is associated with different

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<sup>8</sup> A positive relationship between bank profitability and capitalization has been shown, for example, in a sample of developing and developed countries (Demirgüç-Kunt & Huizinga, 1999), in China (García-Herrero *et al.*, 2009), in the Middle East and North Africa countries (Naceur & Omran, 2011) and in Mexico (Garza-García, 2012).

<sup>9</sup> Since the impact of market concentration on market power may be different conditional on the bank product type (Fernández de Guevara *et al.*, 2005), we also employ alternative HHI indices based on deposit and loan shares. None of these alternative indicators, however, have a statistically significant effect on market power.



values of the Lerner index: the variable 'Banking Reforms' appears to be statistically insignificant when added to the baseline model (see column (2)). The latter may be driven by the fact that the impact of financial reforms is already captured by the bank-level and macroeconomic variables included in our model.

Table 2: Market power in CEE banking sectors: full sample period (2002-2010)

Dependent variable: Lerner Index (x100). Method: System Generalized Method of Moments						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.17*** (5.03)	0.19*** (4.35)	0.18*** (4.35)	0.18*** (4.32)	0.19*** (4.28)	0.18*** (4.21)
Inefficiency	-0.73*** (11.12)	-0.74*** (10.58)	-0.76*** (11.31)	-0.76*** (11.09)	-0.74*** (11.68)	-0.75*** (11.93)
Diversification	0.56*** (7.09)	0.54*** (7.30)	0.52*** (7.84)	0.53*** (7.82)	0.51*** (7.38)	0.51*** (7.91)
Customer Deposits	0.09 (1.04)	0.10 (1.32)	0.12* (1.68)	0.11 (1.50)	0.09 (1.58)	0.09 (1.42)
NPL	-0.15 (0.40)	-0.16 (0.45)	-0.16 (0.48)	-0.16 (0.48)	-0.27 (0.62)	-0.28 (0.66)
NPL * Foreign					0.25 (0.62)	0.24 (0.62)
Capitalization	0.57*** (3.75)	0.48*** (3.52)	0.53*** (4.53)	0.54*** (4.74)	0.88** (2.19)	0.90** (2.33)
Capitalization * Foreign					-0.56 (1.18)	-0.54 (1.15)
Market Share	0.32** (2.15)	0.22 (1.36)	0.18 (1.27)	0.19 (1.29)	0.08 (0.56)	0.10 (0.70)
Growth	0.17** (2.28)	0.21*** (2.82)	0.21*** (2.80)	0.21*** (2.73)	0.22*** (3.58)	0.29*** (3.71)
Inflation	0.10 (0.90)	0.08 (0.85)	0.07 (0.69)	0.07 (0.65)	0.06 (0.67)	-0.02 (0.16)
HHI	-0.08 (0.51)	-0.04 (0.22)	0.01 (0.01)	-0.01 (0.02)	0.02 (0.12)	0.02 (0.11)
Banking Reforms		-3.21 (1.04)	-3.04 (1.00)	-3.44 (1.13)	-4.91 (1.60)	-4.25 (1.37)
Foreign			3.64*** (2.59)		12.25* (1.71)	11.47 (1.58)
Foreign * EU				3.68** (2.27)		
Foreign * US				10.59*** (3.04)		
Foreign * Others				2.41 (1.15)		
State			1.59 (0.84)	1.37 (0.69)	1.71 (0.74)	1.94 (0.76)
Growth Gap						0.24* (1.65)
Inflation Gap						-0.19 (1.44)
Number of observations	1112	1103	1068	1068	1068	1068
Number of banks	250	250	245	245	245	245
Number of instruments	160	161	163	165	191	193
AR(2) $p$ -value <sup>a</sup>	0.98	0.73	0.67	0.60	0.74	0.63
Hansen $p$ -value <sup>b</sup>	0.22	0.12	0.17	0.14	0.26	0.26

Columns report estimated coefficients ( $|z$ -statistics). \*\*\*, \*\*, \* Statistically significant at the 1%, 5% and 10% confidence level respectively. All specifications include size dummy variables and country dummy variables. Equations estimated using Windmeijer WC-robust standard errors and covariance. <sup>a</sup> Reports the Arellano-Bond test  $p$ -value for serial correlation of order two in the first-differenced residuals, where  $H_0$ : no autocorrelation. <sup>b</sup> Reports the Hansen test  $p$ -value for over-identifying restrictions, where  $H_0$ : over-identifying restrictions are valid.

### 3.2.2. Ownership and home country effects

To examine the role of ownership and home country characteristics on margins, we consider alternative specifications based on the modified model (M.2). In column (3) of Table 2, we add to the equation of column (2) the ownership indicators 'Foreign' and 'State' (coding foreign-owned and state-owned banks respectively). Both variables enter the regression with a positive sign, but only the coefficient on 'Foreign' appears to be statistically significant. Qualitatively, the corresponding estimate suggests that the market power (Lerner) index is 3.64 percentage points higher for foreign-owned banks than for domestically-owned banks. This can be explained by a number of factors. Foreign-owned banks may achieve higher operational efficiency by servicing clients in more than one country, which lowers marginal costs and leads to higher margins (provided that they do not pass the efficiency gains to customers in the form of lower prices for services). Furthermore, they may have more diversified funding bases, including access to liquidity from the parent banks, which may lower their funding costs (Claessens & van Horen, 2012). Finally, they may take advantage of profitable lending opportunities made possible by better access to international financial markets or the existence of internal capital markets through which multinational banks manage the credit growth of their subsidiaries (de Haas & van Lelyveld, 2010).<sup>10</sup> To investigate whether the observed market power differences between foreign- and domestically-owned banks can be attributed to the country of origin of the foreign bank, we replace the variable 'Foreign' with the interaction terms 'Foreign \* EU', 'Foreign \* US' and 'Foreign \* Others'. The results (displayed in column (4)), indicate that the reported effect is primarily driven by foreign banks originating from the US and the EU: only the coefficients on 'Foreign \* EU' and 'Foreign \* US' reach statistical significance. Specifically, the corresponding estimates suggest that the market power index is 10.59 percentage points higher for foreign-owned banks originating from the US and 3.68 percentage points higher for foreign-owned banks originating from the EU than for domestically-owned banks.

What is the underlying source of the observed positive relationship between foreign ownership and market power? To answer this question, we augment the regression model of column (3) with the interaction terms 'NPL \* Foreign' and 'Capitalization \* Foreign'. Foreign ownership itself might signal better asset quality as foreign banks may have better monitoring technologies and easier access to international financial markets than domestically-owned banks. Hence, we might expect a much weaker response of market power to non-performing loans and capitalization in the case of foreign bank subsidiaries. The results (displayed in

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<sup>10</sup> In particular, de Haas & van Lelyveld (2010) find that multinational bank subsidiaries with financially strong parent banks are able to expand their lending faster, and as a result, they do not need to rein in their credit supply during a financial crisis.

column (5)) fail to validate this prediction for the full-sample period: the variables 'NPL' and 'Capitalization' and the corresponding interaction terms with the 'Foreign' indicator enter with the opposite sign, but only the coefficient on 'Capitalization' appears to be statistically significant. This indicates that higher levels of capitalization are associated with higher market power for both foreign-owned and domestically-owned banks when one considers all sample years. As also shown in Table 3, when we evaluate the impact of 'NPL' and 'Capitalization' on margins at the values one and zero of the 'Foreign' variable, the resulting conditional effects are similar for all banks regardless of ownership classification.

In column (6) of Table 2 we test the robustness of our results by controlling for the relative macroeconomic conditions in the source countries of the foreign-owned banks. To do that, we include among the regressors the variables 'Growth Gap' and 'Inflation Gap', capturing the growth and inflation rate differences between the home country of the parent bank and the host country. Overall, the inclusion of these variables has little effect on the key findings reported above. Moreover, the positive and statistically significant coefficient on 'Growth Gap' suggests that subsidiaries of banks originating from relatively higher growth countries tend to produce higher margins.

Table 3: Conditional effects of NPL and Capitalization at one and zero value of the foreign variable

Sample Period	NPL		Capitalization	
	Foreign-owned (Foreign=1)	Domestic-owned (Foreign=0)	Foreign-owned (Foreign=1)	Domestic-owned (Foreign=0)
Full (2002-2010)	-0.05 (0.35)	-0.28 (0.66)	0.36* (1.70)	0.90** (2.33)
Pre-crisis (2002-2006)	-0.08 (0.44)	0.21 (1.24)	0.94*** (4.91)	0.66* (1.85)
Crisis (2007-2010)	-0.25 (1.01)	-2.29 (2.07)	0.12 (0.42)	0.80*** (3.56)

Columns report estimated conditional coefficients (conditional  $|t|$ -statistics). \*\*\*, \*\*, \* Statistically significant at the 1%, 5% and 10% confidence level respectively. The methods of calculating the conditional coefficients and the conditional  $|t|$ -statistics are outlined by Friedrich (1982).

### 3.2.3. The impact of the crisis

In order to explore the impact of the recent financial crisis on the banks' market power determinants, we partition the full sample period into two sub-periods and re-estimate the regression package of Table 2. Table 4 presents the results for the pre-crisis years (2002-

2006), while Table 5 for the crisis years (2007-2010). As a first point, we can notice that the previously observed relationships between market power on one hand and its lagged value, inefficiency and diversification on the other hand remain virtually unchanged in the two sub-samples. However, the coefficient on 'Growth' loses its statistical significance in the shorter periods, possibly due to a lack of time-series variation. Furthermore, when we focus on the crisis years, our proxy for loan portfolio risk ('NPL') has a negative impact on market power, with the coefficient being significant at the 10% confidence level (see columns (2)-(4) of Table 5).

Turning to the ownership indicators, our results for the two time periods support the findings of the previous section; that is, higher degree of market power for foreign-owned banks than for domestically-owned banks, especially when the parent bank is located in the US or the EU countries.<sup>11</sup> In line with the results for the full sample period, we also find that the impact of 'NPL' and 'Capitalization' on market power does not depend on the ownership status in the years preceding the crisis (see column (5)-(6) of Table 4). However, things look completely different in the crisis years. Specifically, our results provide evidence that the negative (positive) relationship between 'NPL' ('Capitalization') and margins, identified in columns (1) through (4) of Table 5, is clearly driven by domestically-owned banks: the interaction terms 'NPL\*Foreign' and 'Capitalization\*Foreign' enter the regressions highly statistically significant and with the opposite sign to the coefficients on the marginal variables 'NPL' and 'Capitalization' (see columns (5)-(6) of Table 5). The findings are also qualitatively important. As shown in Table 3, when we evaluate the impact of 'NPL' and 'Capitalization' on margins at the value zero of the 'Foreign' variable, the percentage point change in the Lerner index is large (-2.29 when 'NPL' increases by 1 percentage point and +0.80 when 'Capitalization' increases by 1 percentage point) and highly statistically significant. On the other hand, when we evaluate the impact of 'NPL' and 'Capitalization' on margins at the value one of the 'Foreign' variable, the percentage point change in the Lerner index is very small (-0.25 when 'NPL' increases by 1 percentage point and +0.12 when 'Capitalization' increases by 1 percentage point) and statistically insignificant. This result can be attributed to the fact that foreign-owned banks may carry significantly less non-performing loans than domestically-owned banks, and thus, they may have a better asset quality and enjoy greater overall stability. Hence, in times of financial turmoil, foreign ownership can eliminate the negative impact of non-performing loans by signaling such lower risk or better quality. Furthermore, the important role of capitalization on margins in the case of domestically-owned banks suggests that higher risk perceptions in financial markets disproportionately affect domestic banks with lower capital

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<sup>11</sup> Even though the coefficient on the interaction term between the foreign and the US variables fails to reach statistical significance in Table 4, its size is remarkably the same as that in Table 5.

levels. Domestically-owned banks may face higher costs of external funding and may be cut off from international financial markets during episodes of financial turmoil. In addition, they be subject to market discipline; that is, depositors may react to the observed weakness by requiring a deposit rate premium as compensation..

The relationship between home country macroeconomic conditions and market power turns out to be also different in the two sub-periods (see column (6) of Table 4 and Table 5). Before the crisis, the coefficient on 'Growth Gap' is negative and statistically significant at the 10% confidence level, possibly due to the impressive economic growth enjoyed by the CEE economies during the years 2002 to 2007. However, this does not hold in the period that follows. Specifically, 'Growth Gap' and 'Inflation Gap' appear to have a significantly positive and negative effect on margins, respectively, suggesting that foreign banks originating from countries with better economic performance during the global crisis (compared to the host countries) have higher levels of market power. This, in turn, implies that while all banks reduced their lending during the crisis, banks originating from countries with relatively better macroeconomic conditions managed to maintain higher margins by taking advantage of good lending and investment opportunities and by monitoring their financial costs. A final result that is worth mentioning is that the coefficient on the 'State' indicator becomes stronger (both economically and statistically) during the crisis years compared to the preceding years, although the corroborating evidence is still statistically weak (the highest  $z$ -statistic, obtained in the equation of column (6), is 1.77). This may suggest that during the crisis years, government-owned banks were considered to be sounder banks in comparison to privately-owned institutions, leading to higher margins for the former.

Table 4: Market power in CEE banking sectors: pre-crisis period (2002-2006)

Dependent variable: Lerner Index (x100). Method: System Generalized Method of Moments.						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.28*** (3.74)	0.29*** (3.66)	0.29*** (3.84)	0.28*** (3.72)	0.23*** (3.53)	0.21*** (3.09)
Inefficiency	-0.70*** (4.78)	-0.71*** (4.45)	-0.67*** (4.57)	-0.68*** (4.64)	-0.71*** (4.98)	-0.72*** (4.74)
Diversification	0.40*** (3.61)	0.42*** (3.83)	0.42*** (4.13)	0.41*** (3.94)	0.48*** (3.90)	0.45*** (3.97)
Customer Deposits	0.20* (1.94)	0.16 (1.42)	0.13 (1.27)	0.15 (1.42)	0.12 (1.08)	0.15 (1.30)
NPL	0.24 (1.21)	0.23 (1.19)	0.26 (1.55)	0.26 (1.58)	0.23 (1.39)	0.21 (1.24)
NPL * Foreign					-0.28 (1.09)	-0.28 (1.11)
Capitilization	0.70*** (3.00)	0.73*** (3.69)	0.73*** (3.76)	0.75*** (3.96)	0.56 (1.61)	0.66* (1.85)
Capitilization * Foreign					0.33 (1.14)	0.28 (0.98)
Market Share	0.09 (0.58)	0.16 (0.84)	0.18 (1.07)	0.19 (1.11)	0.34** (2.13)	0.38** (2.20)
Growth	-0.29 (1.10)	-0.25 (0.82)	-0.21 (0.70)	-0.22 (0.77)	-0.07 (0.22)	-0.35 (1.12)
Inflation	-0.17 (0.91)	-0.16 (0.72)	-0.15 (0.68)	-0.15 (0.72)	-0.07 (0.30)	-0.01 (0.03)
HHI	-0.18 (1.06)	-0.18 (0.95)	-0.20 (1.06)	-0.21 (1.10)	-0.28 (1.27)	-0.27 (1.33)
Banking Reforms		2.99 (0.92)	3.36 (1.04)	2.91 (0.89)	4.07 (1.17)	4.16 (1.26)
Foreign			4.42** (2.34)		0.79 (0.16)	-0.07 (0.01)
Foreign * EU				4.55** (2.27)		
Foreign * US				9.27 (1.36)		
Foreign * Others				3.48 (1.40)		
State			1.14 (0.46)	1.03 (0.42)	0.48 (0.15)	0.64 (0.20)
Growth Gap						-0.71 (2.17)
Inflation Gap						0.07 0.44
Number of observations	461	451	451	451	451	451
Number of banks	179	177	177	177	177	177
Number of instruments	99	100	102	104	118	120
AR(2) $p$ -value <sup>a</sup>	0.14	0.12	0.09	0.08	0.14	0.29
Hansen $p$ -value <sup>b</sup>	0.68	0.41	0.48	0.50	0.37	0.41

See notes for Table 2.

Table 5: Market power in CEE banking sectors: crisis period (2007-2010)

Dependent variable: Lerner Index (x100). Method: System Generalized Method of Moments.						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.14*** (4.53)	0.16*** (4.14)	0.15*** (4.16)	0.15*** (4.34)	0.14*** (3.53)	0.14*** (3.70)
Inefficiency	-0.80*** (15.03)	-0.81*** (15.01)	-0.84*** (16.92)	-0.84*** (16.38)	-0.86*** (18.01)	-0.88*** (19.12)
Diversification	0.59*** (7.86)	0.58*** (7.39)	0.56*** (7.76)	0.56*** (7.43)	0.51*** (10.07)	0.50*** (9.94)
Customer Deposits	0.13 (1.30)	0.10 (1.17)	0.15* (1.88)	0.14* (1.72)	0.09 (1.13)	0.07 (0.87)
NPL	-0.99 (1.34)	-1.18* (1.92)	-1.22* (1.90)	-1.21* (1.75)	-2.37** (2.09)	-2.29** (2.07)
NPL * Foreign					2.09** (1.99)	2.04** (2.01)
Capitilization	0.60*** (3.64)	0.36** (2.02)	0.42** (2.06)	0.39** (1.98)	0.74*** (3.32)	0.80*** (3.56)
Capitilization * Foreign					-0.70* (1.90)	-0.68* (1.75)
Market Share	0.34* (1.86)	0.26 (1.57)	0.19 (1.10)	0.19 (1.20)	0.08 (0.39)	0.05 (0.25)
Growth	0.07 (0.48)	0.04 (0.26)	0.04 (0.28)	0.03 (0.26)	0.09 (0.66)	0.22 (1.62)
Inflation	-0.06 (0.38)	-0.04 (0.23)	-0.05 (0.30)	-0.04 (0.27)	-0.03 (0.17)	-0.18 (0.97)
HHI	-0.20 (0.74)	-0.01 (0.01)	0.04 (0.13)	0.02 (0.07)	0.08 (0.36)	0.03 (0.13)
Banking Reforms		-6.71 (1.24)	-5.55 (1.07)	-5.88 (1.12)	-9.98** (2.19)	-8.38* (1.78)
Foreign			4.44** (2.45)		5.94 (0.81)	4.73 (0.69)
Foreign * EU				4.50** (2.13)		
Foreign * US				9.57** (2.23)		
Foreign * Others				3.14 (1.23)		
State			3.27 (1.46)	3.23 (1.45)	5.79 (1.50)	6.17* (1.77)
Growth Gap						0.42*** (2.93)
Inflation Gap						-0.36** (2.06)
Number of observations	651	617	617	617	617	617
Number of banks	218	205	205	205	205	205
Number of instruments	140	140	142	144	166	168
AR(2) <i>p</i> -value <sup>a</sup>	0.43	0.26	0.26	0.27	0.20	0.23
Hansen <i>p</i> -value <sup>b</sup>	0.40	0.31	0.34	0.32	0.21	0.38

See notes for Table 2.

### **3.2.4. Robustness tests**

To assess the robustness of the above results, we perform a number of tests. Specifically, we augment the baseline model (M.1) with one of the following variables: money and quasi money to GDP ('M2') to control for financial sector developments; the EBRD index of non-banking reforms ('Non-banking Reforms') to control for development levels in the non-banking financial sector; and, foreign-owned banks' market share in banking sector total assets ('Foreign Bank Share') to account for the spillover effects of foreign penetration. However, these additional variables fail to reach statistical significance and the key findings reported above remain essentially intact (see columns (1)-(3) of Table 6). In addition, we experiment by adding in the specification of model (M.2) the difference in M2 between the home and host countries ('M 2 Gap'). Once again, estimates based on this alternative specification are very similar to the estimates reported in the previous tables and do not change the inferences drawn (see column (4) of Table 6). Finally, the reported results are invariant to further tests of robustness, such as using the alternative Lerner index described in Section 2.1 (based on country-by-country regressions) as the dependent variable and employing different instrument structures.



Table 6: Market power in CEE banking sectors: robustness tests

Dependent variable: Lerner Index (x100). Method: System Generalized Method of Moments.												
	Full sample period				Pre-crisis period				Crisis period			
	1	2	3	4	5	6	7	8	9	10	11	12
Lagged Lerner Index	0.17*** (4.76)	0.19*** (4.24)	0.19*** (3.99)	0.18*** (4.25)	0.28*** (3.73)	0.30*** (3.75)	0.29*** (3.40)	0.22*** (3.21)	0.14*** (4.27)	0.16*** (4.12)	0.13*** (6.93)	0.14*** (3.88)
NPL	-0.15 (0.43)	-0.15 (0.45)	0.21 (1.41)	-0.29 (0.65)	0.22 (1.05)	0.23 (1.19)	0.20 (1.08)	0.22 (1.29)	-1.14 (1.45)	-1.18* (1.95)	-0.38 (1.28)	-2.29* (2.02)
NPL * Foreign				0.24 (0.61)				-0.28 (1.09)				2.04* (1.94)
Capitalization	0.56*** (4.32)	0.49*** (3.48)	0.43*** (2.16)	0.92** (2.31)	0.72*** (3.19)	0.74*** (3.60)	0.73*** (3.31)	0.69** (2.00)	0.54*** (3.18)	0.36** (2.10)	0.44*** (2.69)	0.81*** (3.58)
Capitalization * Foreign				-0.51 (1.12)				0.30 (1.07)				-0.69 (1.91)
Growth	0.13* (1.79)	0.19** (2.53)	0.15** (1.99)	0.30*** (3.75)	-0.25 (0.92)	-0.27 (0.88)	-0.27 (0.93)	-0.29 (0.91)	0.03 (0.23)	0.03 (0.19)	-0.09 (0.75)	0.22 (1.57)
Inflation	0.12 (1.13)	0.10 (0.93)	0.11 (1.33)	0.01 (0.08)	-0.15 (0.83)	-0.17 (0.80)	-0.18 (0.86)	0.02 (0.07)	-0.03 (0.19)	-0.04 (0.22)	0.41** (2.52)	-0.18 (0.95)
M2	-0.09 (0.86)				0.02 (0.10)				-0.06 (0.34)			
Banking Reforms		-2.10 (0.73)		-3.92 (1.29)		2.80 (0.86)		4.41 (1.32)		-6.92 (1.51)		-8.23* (1.73)
Non-Banking Reforms		-2.61 (0.98)				1.26 (0.33)				-1.62 (0.47)		
Foreign Bank Share			-0.07 (1.45)				0.05 (0.85)				-0.36** (2.51)	
Foreign				10.50 (1.44)				-0.92 (0.19)				5.08 (0.75)
State				2.05 (0.78)				0.73 (0.22)				6.55* (1.86)
Growth Gap				0.25* (1.73)				-0.61* (1.94)				0.43*** (2.92)
Inflation Gap				-0.14 (1.03)				0.12 (0.74)				-0.35** (2.04)
M2 Gap				0.01 (0.73)				0.02 (0.95)				0.01 (0.18)
Number of observations	1103	1068	891	1068	461	451	451	451	642	617	440	617
Number of banks	250	245	231	245	179	177	177	177	218	205	190	205
Number of instruments	161	162	141	194	100	101	100	121	141	141	110	169
AR(2) <i>p</i> -value	0.68	0.75	0.52	0.61	0.13	0.11	0.10	0.31	0.18	0.25	0.54	0.23
Hansen <i>p</i> -value	0.21	0.10	0.38	0.24	0.63	0.41	0.36	0.42	0.25	0.29	0.17	0.40

See notes for Table 2. For brevity, the estimated coefficients on Inefficiency, Diversification, Customer Deposits, Market Share and HHI are not displayed.

## 4. Conclusions

This paper provides an up-to-date assessment of market power in CEE banking markets and some new insights into the mechanisms that determine its level and variation over time. In particular, it contributes to the relevant literature in two main aspects. First, building upon contributions by Angelini & Cetorelli (2003), Fernández de Guevara *et al.* (2005) and Fungáčová *et al.* (2010), it models market power by including controls for different ownership types and home country conditions. Second, it analyzes the factors affecting market power by distinguishing between pre-crisis and crisis times. Finally, to the best knowledge of the authors, this is the first study to comprehensively examine the recent evolution of market power in the CEE banking markets which have been highly vulnerable to the deepening European debt and banking crisis.

The overall picture that emerges from the evolution of the average Lerner indices suggests that competitive conditions in banking sectors vary significantly across countries and over time, despite some convergence in the pre-crisis period, and have changed with the onset of the financial crisis. Concerning the analysis of the factors that affect market power, two main results emerge. First, market power differs across banks with different ownership characteristics. Specifically, foreign-owned banks originating from the EU and the US have higher margins compared to privately-owned domestic banks. Second, the effects of asset quality and capitalization on margins are different in the pre-crisis and crisis years. While in the pre-crisis period the impacts are similar for all banks regardless of ownership status, during the crisis period foreign ownership is found to eliminate the negative impact of non-performing loans on margins possibly through signaling lower risk level or higher asset quality. Capitalization level, on the other hand, becomes critically important only for domestically-owned banks, suggesting that higher risk perceptions in financial markets disproportionately affect domestic banks with lower capital levels.

Despite the complexity of the relationship between market power and risk-taking in banking, there seems to be a trade-off between the two, and hence, the optimal regulation should take into account the intensity of competition in the banking sector (Vives, 2011). Different sources of competitive power between banks with different ownership and home country characteristics, as well as varying competitive conditions over time (for example, during times of financial turmoil), as documented here, point to the necessity of adjustments in the way regulatory and competition policies should be combined in these countries.

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## Appendix

Table A.1: Description of variables and data sources

Variable	Definition	Source
Total Cost ( $TC$ )	total expenses (at constant 2005 prices)	BankScope
Quantity of Output ( $Q$ )	total assets (at constant 2005 prices)	BankScope
Price of Funds ( $W_1$ )	ratio of interest expenses to total deposits and short-term funding	BankScope
Price of Capital ( $W_2$ )	ratio of total depreciation and other capital expenses to total fixed assets	BankScope
Price of Labor ( $W_3$ )	ratio of personnel expenses to total assets	BankScope
Price of Output ( $P$ )	ratio of total revenue to total assets	BankScope
Lerner Index ( $L$ )	ratio of the difference between price and marginal cost to price ( $\times 100$ ), where the marginal cost is estimated on the basis of a translog cost function	BankScope & OC
Inefficiency	ratio of non-interest expenses to total revenue ( $\times 100$ )	BankScope
Diversification	ratio of non-interest operating income to total revenue ( $\times 100$ )	BankScope
Customer Deposits	ratio of total customer deposits to total assets ( $\times 100$ )	BankScope
NPL	ratio of non-performing loans to total loans ( $\times 100$ )	BankScope
Capitalization	ratio of total equity to total assets ( $\times 100$ )	BankScope
Market Share	market share in banking sector total assets ( $\times 100$ )	BankScope & OC
Growth	annual growth rate of real GDP in the host country ( $\times 100$ )	WDI
Inflation	annual difference of log GDP deflator in the host country ( $\times 100$ )	WDI
HHI	normalised Herfindahl index for host country; calculated as $\frac{(H-1)/N}{1-(1/N)} \times 100$ , where H is the sum of squared shares of total assets and N is the number of banks	BankScope & OC
M2	ratio of money and quasi money to GDP in the host country ( $\times 100$ )	WDI
Banking Reforms	index of banking sector reform; ranges from 1.0 to 4.0+, with a higher number indicating a better score	EBRD
Non-Banking Reforms	index of reform of non-bank financial institutions; ranges from 1.0 to 4.0+, with a higher number indicating a better score	EBRD
Foreign Bank Share	foreign-owned banks' market share in banking sector total assets ( $\times 100$ )	EBRD
Foreign	0-1 dummy variable; takes value 1 if the bank is foreignowned (foreign-owned banks are defined as those with foreign ownership exceeding 50% in year t)	BankScope & OC
State	0-1 dummy variable; takes value 1 if the bank is stateowned (state-owned banks are defined as those with state ownership exceeding 50% in year t)	BankScope & OC
Growth Gap	difference between the growth rate in the home country of the parent bank and the growth rate in the host country	BankScope & WDI
Inflation Gap	difference between the inflation rate in the home country of the parent bank and the inflation rate in the host country	BankScope & WDI
M2 Gap	difference between the M2-to-GDP ratio in the home country of the parent bank and the M2-to-GDP ratio in the host country	BankScope & WDI

**WDI:** World Bank's World Development Indicators; **EBRD:** European Bank for Reconstruction and Development; **OC:** Own Calculations



Table A.2: Descriptive statistics

Variable	Full sample period (2002-2010)					Pre-crisis period (2002-2006)					Crisis period (2007-2010)				
	Obs	Mean	StDv	Min	Max	Obs	Mean	StDv	Min	Max	Obs	Mean	StDv	Min	Max
Total Cost <sup>a</sup>	1671	41.03	54.55	0.71	345.74	836	30.25	38.36	0.77	289.98	835	51.84	65.21	0.71	345.74
Quantity of output <sup>a</sup>	1671	666.81	1000.22	12.86	5093.91	836	497.47	729.03	12.86	5093.91	835	836.35	1188.96	12.86	5093.91
Price of Funds	1671	0.045	0.031	0.001	0.266	836	0.040	0.027	0.002	0.232	835	0.050	0.034	0.001	0.266
Price of Capital	1671	2.73	6.18	0.06	101.47	836	2.54	5.72	0.06	101.47	835	2.93	6.61	0.06	85.47
Price of Labor	1671	0.020	0.015	0.001	0.128	836	0.021	0.015	0.002	0.128	835	0.020	0.015	0.001	0.116
Price of Output	1671	0.102	0.057	0.007	0.725	836	0.103	0.060	0.007	0.725	835	0.100	0.053	0.011	0.625
Lerner Index	1671	12.25	37.21	-560.44	85.84	836	15.29	30.17	-361.39	85.84	835	9.20	42.92	-560.44	73.86
Inefficiency	1668	47.97	29.28	7.99	368.22	835	48.58	27.33	8.98	368.22	833	47.36	31.11	7.99	299.55
Diversification	1669	24.38	16.62	-77.09	88.88	836	27.11	16.79	-48.05	88.88	833	21.63	16.00	-77.09	86.06
Customer Deposits	1646	55.70	23.80	0.04	96.23	827	57.17	23.81	0.07	96.23	819	54.21	23.71	0.04	95.25
NPL	1383	5.93	8.71	0.04	135.76	664	7.10	10.65	0.04	135.76	719	4.85	6.22	0.06	82.53
Capitalization	1671	17.03	12.70	0.33	88.26	836	17.43	13.18	0.33	88.26	835	16.63	12.20	0.35	82.34
Market Share	1671	8.22	10.36	0.10	77.74	836	8.73	10.85	0.16	77.74	835	7.71	9.83	0.10	64.90
Growth	1671	3.69	4.67	-17.95	12.23	836	5.53	2.27	0.85	12.23	835	1.85	5.64	-17.95	10.70
Inflation	1671	7.19	5.96	-2.34	37.08	836	7.23	5.77	-0.29	37.08	835	7.15	6.14	-2.34	25.14
HHI	1671	9.10	5.72	1.91	31.50	836	9.27	5.87	1.91	30.79	835	8.94	5.56	2.30	31.50
M2	1660	46.29	13.75	11.10	79.67	834	41.08	13.02	11.10	69.25	826	51.55	12.40	21.37	79.67
Banking Reforms	1622	3.18	0.55	1.70	4.00	825	3.11	0.62	1.70	4.00	797	3.25	0.47	2.00	4.00
Non-Banking Reforms	1622	2.57	0.67	1.70	4.00	825	2.52	0.66	1.70	4.00	797	2.63	0.67	1.70	4.00
Foreign Bank Share	1406	65.58	26.24	8.10	99.20	825	61.24	27.69	8.10	97.30	581	71.74	22.65	19.70	99.20
Foreign	1671	0.57	0.50	0	1	836	0.60	0.49	0	1	835	0.54	0.50	0	1
State	1671	0.03	0.16	0	1	836	0.03	0.16	0	1	835	0.03	0.17	0	1
Growth Gap	1671	-1.28	2.86	-10.94	16.41	836	-1.65	2.42	-10.94	4.90	835	-0.90	3.19	-10.59	16.41
Inflation Gap	1671	-2.12	4.94	-24.37	28.55	836	-2.18	5.17	-22.68	28.55	835	-2.07	4.69	-24.37	13.11
M2 Gap	1671	41.63	58.19	-30.15	581.37	836	41.38	52.52	-30.15	581.37	835	41.87	63.39	-27.47	580.44

<sup>a</sup> Values are in million US dollars at constant 2005 prices



Table A.3: Cross correlation matrix for independent variables

	Inefficiency	Diversification	Customer Deposits	NPL	Capitalization	Market Share	Growth	Inflation	HHI	Banking Reforms	Foreign	State
Inefficiency	1.00											
Diversification	0.14	1.00										
Customer Deposits	0.02	0.14	1.00									
NPL	0.11	0.27	-0.03	1.00								
Capitalization	0.21	0.19	-0.36	0.32	1.00							
Market Share	-0.20	-0.10	0.07	-0.10	-0.30	1.00						
Growth	0.01	0.13	0.02	-0.01	0.04	0.05	1.00					
Inflation	-0.03	0.07	-0.12	0.05	0.11	-0.09	0.19	1.00				
HHI	0.09	-0.05	0.21	0.04	-0.04	0.22	-0.08	-0.42	1.00			
Banking Reforms	-0.08	-0.36	0.09	-0.20	-0.32	-0.04	0.34	-0.21	-0.40	1.00		
Foreign	0.03	-0.06	-0.15	-0.11	-0.16	0.22	-0.01	0.03	-0.06	0.03	1.00	
State	0.02	0.06	0.03	0.07	0.03	-0.05	-0.04	0.03	0.03	-0.03	-0.17	1.00