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Market power in CEE banking sectors and the impact of the global financial crisis[*]

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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 the 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.

JEL classification: F23; G01; G21; L10
Keywords: bank market power; CE European countries; global financial crisis; foreign ownership

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1 Introduction

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 the deepening European debt and banking crisis. Hence, our results contribute to a better understanding of how the market power of banks with different 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. The aim of this paper is to fill this gap.

Our empirical analysis is undertaken for 17 CEE banking sectors over the period 2002-2010 and involves two stages. In the first stage, we develop non-structural bank-level Lerner indices and explore the evolution of market power during the sampled period. This also allows us to examine whether competition has deteriorated because of the financial crisis and the measures taken to remove the fragilities in the banking systems. In the second stage, we use a dynamic econometric framework and employ GMM techniques to identify the determinants of market power. In particular, we focus on answering the following two research questions: What have been the sources of market power before and during the recent financial crisis episode? Has the market power of banks with different ownership characteristics evolved differently over time? In tackling these questions, we control for bank level, structural, institutional and macroeconomic characteristics that have been shown to correlate with market power in previous studies; split the sample into pre-crisis and crisis years; and investigate interaction effects between ownership type and other potential sources of market power (such as capitalization and asset quality).

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. Fourth, the market power of foreign banks during the crisis years is highly sensitive to differences in the macroeconomic conditions between the home and the host countries.

The remainder of the paper is organized as follows: Section 2 presents an overview of the related literature and develops the main hypotheses to be tested; Section 3 outlines the empirical strategy and describes the data used; Section 4 reports the empirical results and investigates their robustness; Section 5 offers a discussion of the study's conclusions.

2 Literature Review and Hypotheses Development

2.1 Banking competition and its determinants

Assessment of competitive conditions in the financial sector is of high interest to researchers and policy-makers due to the important linkages between competition, efficiency, access to financial services and stability. Two approaches can be identified in the literature on bank competition: the structural and the non-structural. Under the structural approach, the competitive conduct of banks is inferred through indicators of market structure, such as the number and size distribution of firms in a market. The structural approach embraces the structure-conduct-performance (SCP) paradigm and the efficient-structure (ES) paradigm. According to the SCP paradigm, when concentration in a market increases, firms with greater monopoly power can charge higher prices and thereby achieve higher profits. In addition, market power may result in higher costs (rather than higher profits) due to inefficiencies, as the management is under less pressure to minimize costs - the so-called "quiet life effect" (Hannan, 1991; Berger & Hannan, 1998). According to the ES paradigm, some firms earn superior profits because they are more efficient than other firms, and this, in turn, leads to higher market share and higher concentration (Demsetz, 1973). The non-structural approach, on the other hand, follows the new industrial organization theory which suggests that competitive behavior can exist in concentrated markets if firms are vulnerable to hit-and-run entry; in other words, when markets are contestable (Baumol, 1982). Accordingly, the level of market competition in an industry should be assessed explicitly by taking into account the actual behavior of bank conduct (Bikker & Haaf, 2002; Claessens & Laeven, 2004).

A recently emerged literature focuses on measuring bank competition and exploring its dynamics based on the non-structural approach. Many studies employ the Panzar and Rosse H-statistic[1] to banking sectors in both developed and emerging markets, and typically report that these markets are characterized by monopolistic competition[2]. A particular group of studies in this area examine the evolution of competition in European markets in response to the deregulation process, but have not yet provided conclusive answers. For instance,

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[1]The Panzar and Rosse H-statistic is the sum of input price elasticities derived from a reduced-form revenue function and is used to distinguish oligopolistic, competitive and monopolistically competitive markets (Panzar & Rosse, 1987).

[2]See, for instance, Claessens & Laeven (2004) and Bikker *et al.* (2007) for developed and developing banking markets, Gelos & Roldós (2004) for emerging markets in Latin America and Europe, Mamatzakis *et al.* (2005) for the South Eastern European banking sector, Levy Yeyati & Micco (2007) for Latin American markets and Liu *et al.* (2012) for the South Eastern Asian banking sector.

Angelini & Cetorelli (2003) focus on the Italian banking industry over the period 1984-1997 and provide evidence that the deregulation process significantly contributed to improving bank competition. On the other hand, Fernández de Guevara *et al.* (2005), using data from five European Union (EU) countries over the years 1992-1999, find substantial differences in market power between countries and no increase in the degree of competition over time, despite the liberalization measures implemented in order to create a single banking market. Likewise, Carbó *et al.* (2009), who undertake a cross-country comparison of various structural and non-structural measures of competition in 14 European banking markets over the period 1995-2001, reach mixed results regarding its variability within and across countries and over time. Similar conclusions are drawn by Agoraki *et al.* (2011) who concentrate their analysis on 13 CEE banking sectors over the period 1985-2005. In a different vein, Bolt & Humphrey (2010) employ a competition frontier to assess the degree of banking competition across 11 European countries over the period 1987-2006. Their analysis demonstrates that there are different levels of market power in different market segments in European banking markets. Specifically, the authors find greater levels of competition in the activities that generate spread income and lower level of competition in non-interest income generating activities. Finally, Weill (2013) examines the evolution of bank competition in the EU banking markets over the 2002-2010 period and fails to identify significant changes over time. Nevertheless, the study reports significant convergence in bank competition, supporting the view that bank integration has taken place in the EU during the 2000s.

A handful of studies consider the factors explaining the variability of bank competition across countries[3]. The first comprehensive cross-country analysis of the determinants of competition is conducted by Claessens & Laeven (2004). The authors estimate H-statistics as competitive environment indicators for 50 developing and developed countries' banking systems covering the years 1994-2001 and find the following: first; banking sector concentration is not negatively associated with competition, suggesting that concentration measures should not be used as indicators of market competitiveness; second, the degree of foreign bank ownership is positively related to the level of competition, implying that the nature of ownership matters; third, more contestable systems, as proxied by fewer activity restrictions and less severe fitness tests, are more competitive. Overall, the study concludes that maintaining a contestable system (rather than a system with low level of concentration) is more important for assuring competitiveness. Bikker *et al.* (2007) extend the study by Claessens & Laeven (2004) for 76 countries over the 1995-2004 period and find supportive evidence that market structure indicators do not have any impact on competition, whereas contestability does. More specifically, they find that extensive regulations on investments and start-up of a business and fewer restrictions on foreign investments significantly improve competitiveness in banking.

A limited number of studies investigate the factors explaining the variability of bank competition over time. Angelini & Cetorelli (2003) report that the increasing consolidation in the Italian banking industry, which accompanied the deregulation process, was not detrimental to competition; it was rather the result of strategic responses of banks to increased contestability. Fernández de Guevara *et al.* (2005) and Fernández de Guevara & Maudos (2007) perform detailed analysis of bank-level factors that affect market power in EU banking sectors and the Spanish banking sector, respectively. The former finds that, while market share has no significant influence on the relative margins, size and operational efficiency exert a positive

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[3]A related body of literature examines the role of regulatory and supervisory factors together with market environment, such as increased foreign penetration, on various measures of banking sector development, performance and stability (see, for instance, Claessens *et al.*, 2001; Barth *et al.*, 2004; Beck *et al.*, 2006). These studies can only be considered as providing indirect evidence on the impact of contestability on banking competition, since they do not employ explicit measures, but rather indicators of competition, such as interest margins (Bikker *et al.*, 2007).

- and concentration in the deposit market a negative - impact on market power. The latter finds that the variables with the greatest explanatory power are efficiency and specialization in retail activities, and that the relationship between size and market power is non-linear (small- and large-sized banks have greater market power than medium-sized banks). In addition, it finds that changes in market power cannot be attributed to changes in concentration, measured at regional level. Fungáčová *et al.* (2010) implement a similar analysis for the Russian banking sector and show that market concentration and asset quality have a positive influence on market power. Finally, Anzoategui *et al.* (2012), who also consider data from Russian banks, demonstrate the following: first, very large banks and government-owned banks have relatively higher market power; second, market power is lower in regions where there is lower bank concentration, greater presence of bank branches, and greater financial depth and economic development.

In this context, a particular line of inquiry focuses on the impact of foreign bank penetration on the performance of the host-country banking systems. Our paper intends to contribute to this relatively limited literature. It is generally argued that 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). If foreign-owned banks are more efficient than domestically-owned banks, spillover effects will emerge within the sector (in addition to direct effects associated with ownership), in the form of increased pro-competitive pressure on the incumbents. However, the existing empirical evidence on the impact of foreign entry on banking competitiveness remains inconclusive. Gelos & Roldós (2004) find that consolidation did not result in reduced competition in a sample of emerging markets and argue that this may be due to increased foreign bank participation in these countries. Levy Yeyati & Micco (2007), using data for the eight Latin American countries that experienced an accelerated process of foreign penetration and concentration in the 1990s, find that foreign penetration actually weakened banking competition. In contrast, Poghosyan & Poghosyan (2010) show that foreign bank participation in the CEE countries was beneficial in terms of efficiency and competition. Similarly, in a wider cross-sectional study covering 17 Asian and Latin American countries for the period 1997-2008, Jeon *et al.* (2011) obtain a positive relationship between foreign penetration and banking competition. Jeon *et al.* (2011) also show that: (i) the positive spillover effects from foreign penetration are more pronounced when foreign banks are more efficient and less risky and when the host markets are less concentrated; (ii) the pro-competitive impact is stronger in the case of de novo penetration than penetration through mergers and acquisitions.

Concerning the influence of ownership status on bank-level market power, Fungáčová *et al.* (2010) fail to find significant differences between foreign-owned and domestically-owned Russian banks. On the other hand, Poghosyan & Poghosyan (2010) show that banks acquired by foreigners have less market power compared to domestic and foreign greenfield banks. According to the authors, the lower degree of market power in the case of foreign acquired banks can be attributed to the strategy of expanding activities in the region and the increase of competitive pressure that follows. Similarly, Lozano-Vivas & Weill (2012) test whether cross-border banking activity in the EU is effective in enhancing competition and cost efficiency, as promoted by the policy-makers. Covering 10 "old" EU countries over the period 1994-2005, they find that relative market power (as measured by Lerner indices of cross-border banks) depends on the mode of entry: greenfield banks have lower market power and thereby enhanced competition, whereas mergers and acquisitions are associated with hampered competition and cost efficiency. The authors argue that, while switching costs allow incumbent banks to extract monopoly rents, such extraction is more difficult for new entrants.

2.2 Sources of market power, ownership structure and financial crises

The review carried out in the previous section reveals not only the scarcity of studies that analyze the explanatory factors of market power, especially in the case of transition countries, but also the ambiguous results with respect to the role of foreign ownership and penetration. Clearly, the impact of ownership structure on market power still requires further analysis and empirical evaluation. New research in this direction should also examine if and how the determinants of market power vary across different ownership types, which is one of the novel contributions of this paper.

One can identify a number of channels through which foreign ownership may result in relatively higher margins. First, foreign-owned banks may achieve higher operational efficiency as a result of their superior investment and risk management skills (Berger *et al.*, 2000). This, in turn, can lower their marginal costs and lead to higher margins, provided that they do not pass the efficiency gains to customers in the form of lower prices for services. Second, 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). Third, 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). Fourth, foreign subsidiaries of multinational banks may have higher market power in host markets due to their parents' larger and internationally diversified customer pools, which, as shown by Buch *et al.* (2013), can provide them with advantages in generating private information and lead to higher market power at home. Furthermore, there is evidence in the literature that the origin of the parent bank may also affect the profitability and efficiency of a foreign bank. Sturm & Williams (2008) show that banks from more financially developed nations are able to operate more efficiently in foreign markets, whereas Claessens & van Horen (2012) find that foreign banks have higher profitability in developing countries when they originate from a high-income country. Similarly, Havrylchyk & Jurzyk (2011b) 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. These arguments and findings imply that: (i) foreign banks in general, and banks originating from financially developed markets in particular, may enjoy relatively higher market power in the host country banking markets; (ii) these differences can be explained, to some extent, by different interaction effects with the sources of market power and by heterogeneities among foreign banks with respect to the home countries from which they originate and the countries in which they enter. The present study seeks to explore these issues.

In addition, even though there is an extensive literature on the relationship between banking competition and stability[4], there is yet no study that examines how market power changes in response to financial crises and the changing regulatory environment and business models and strategies associated with these crises. Why do we pose the last question? A strong motivation can be found in a couple of recent studies suggesting that the strategies and performances of banks during financial turmoils - as opposed to normal times - may vary across different ownership types. Fungáčová *et al.* (2013) report that foreign banks in Russia reduced their credit supply more than domestic private banks during the recent financial crisis, whereas state-controlled banks reduced their credit supply less than domestic private banks. Canales-Kriljenko *et al.* (2010) illustrate that foreign banks employed different business mod-

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[4]Both the theoretical literature and the empirical evidence on the relationship between competition and stability fail to reach conclusive results (see, for instance, Keeley, 1990; Allen & Gale, 2004; Boyd & De Nicoló, 2005; Schaeck *et al.*, 2009; Berger *et al.*, 2009; Agoraki *et al.*, 2011).

els and strategies across different countries and regions during the crisis years, which affected the resilience of the local banking markets[5]. Following this line of reasoning, one may expect that the mechanisms through which market power changes in periods of financial distress depend on ownership characteristics, as well as the home and host country conditions[6]. Drawing upon these observations, this paper presents new multi-country evidence on the relationship between bank competition and financial crises by analyzing the (marginal and interactive) impacts of structural, institutional, macroeconomic and ownership factors before and during the recent financial crisis episode.

3   Empirical Methodology

3.1   Estimation of the Lerner Index

Following the non-structural approach to the assessment of bank competition, we measure market power using the Lerner index, which is based on individual bank-level data[7]. The Lerner index (L) represents the mark-up of price over marginal cost for each bank i in country n at year t, and is calculated as follows:

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

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:

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

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, ε is an *i.i.d.* error term. Country fixed effects (μ_n) are also introduced to capture unobserved cross-country

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[5]See also Koetter & Noth (2012) who provide evidence that higher bail-out probabilities led to higher mark-ups in the US banking sector during the recent crisis.

[6]Empirical evidence emerging from the crisis suggests that the presence of multinational banks increases the risk of instability from abroad (de Haas & van Lelyveld, 2011; Jeon *et al.*, 2013). This contrasts with previous evidence that foreign banks contribute to credit market stabilization in their host markets (see Haselmann, 2006; de Haas & van Lelyveld, 2006, 2010).

[7]Recent applications of the Lerner index include, among others, Fernández de Guevara *et al.* (2005), Carbó *et al.* (2009), Lozano-Vivas & Weill (2012) and Weill (2013) 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.

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 & 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:

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

Alternatively, Eq. (2) can be estimated separately for each country $n \in \{1, 2, ..., 17\}$ 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:

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

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.

3.2 Market Power Model Specification

In order to evaluate the determinants of market power, we employ an empirical specification that takes the following form:

$$L_{int} = \beta L_{int-1} + \gamma \mathbf{X}_{int} + \delta \mathbf{Y}_{nt} + \vartheta \mathbf{M}_{nt} + \mu_n + u_{int} \tag{M.1}$$

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, contestability and institutional control variables; u is an *i.i.d* error term; and, i, n, t index bank, country, and time, respectively.

Vector $\mathbf{X}$ contains bank-level variables employed in previous studies (see, for example, Angelini & Cetorelli, 2003; Fernández de Guevara *et al.*, 2005; Fungáčová *et al.*, 2010). Specifically, it 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 (see 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.

Vectors $\mathbf{Y}$ and $\mathbf{M}$ encompass exogenous determinants of market power common to all banks in the same country. The variables are chosen in view of the four categories of competitiveness determinants identified in Claessens & Laeven (2004)'s framework: market structure (proxies for concentration and foreign bank penetration), contestability (proxies for activity restrictions imposed on commercial banks and entry barriers), interindustry competition (indicators measuring the degree of competition banks face from capital markets and non-banking financial institutions) and controls for general economic development, macro-economic stability and institutional framework.

Specifically, vector $\mathbf{Y}$ includes 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 (Demirgüç-Kunt & Huizinga, 1999), 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 (Angelini & Cetorelli, 2003)[8].

On the other hand, vector $\mathbf{M}$ includes the normalized Herfindahl index ('HHI') as a measure of the degree of concentration in the market, and the EBRD index of banking sector reform ('Banking Reform') as a measure of the degree of the liberalization of the banking industry and the progress in reforming the supervisory and regulatory framework (see Mamatzakis *et al.*, 2005; Brissimis *et al.*, 2008). We expect that progress in the reform process and improved institutional environment will render the banking system more attractive for new entrants by helping "level-the-playing-field" among banks, and thereby make it more contestable (Anzoategui *et al.*, 2012). Vector $\mathbf{M}$ also includes a number of other market structure, contestability and institutional variables, which, due to collinearity and instrument proliferation risks, are introduced into the model sequentially as robustness checks (see Section 4.2.4 for a discussion of these variables).

Finally, the previous period's Lerner index is included among the explanatory variables to capture persistence over time, which is an important determinant of bank profitability and risk (Goddard *et al.*, 2004; Liu & Wilson, 2012).

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[8]In addition, higher inflation may hamper competition as prices of financial services can become less informative (Claessens & Laeven, 2004).

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:

$$
\begin{aligned}
L_{int} =& \beta L_{int-1} + \gamma \mathbf{X}_{int} + \delta \mathbf{Y}_{nt} + \vartheta \mathbf{M}_{nt} + \xi \text{`Foreign'}_{int} + \rho \text{`State'}_{int} \\
& + \lambda_1 \text{`Growth Gap'}_{int} + \lambda_2 \text{`Inflation Gap'}_{int} + \psi \mathbf{X}^s_{int} * \text{`Foreign'}_{int} \\
& + \mu_n + u_{int}
\end{aligned}
\tag{M.2}
$$

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 $\mathbf{X}$ which contains the same variables apart from the indicators for bank size and market share. As mentioned in Section 2, the origin (home country) of the parent bank can play an important role in explaining the profitability and efficiency of parent banks, and as a result, can influence the relative margins. Following this argument, 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), namely, 'Growth Gap' and 'Inflation Gap'. In the last set of our tests we investigate whether the interactions between the bank's financial condition indicators and ownership status have any effect on market power, and if so, whether these effects have changed during the crisis period. This is done by interacting the variables 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.

We now turn to discuss our choice of the estimation technique for models (M.1) and (M.2). In the context of a dynamic panel data model, the common fixed effects (FE) estimator is severely biased and inconsistent unless the time dimension 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 (small time span, large number of cross sections), 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. In addition, it corrects for the endogeneity of potentially endogenous explanatory variables, like the bank-level variables included in vector $\mathbf{X}$. Given our choice of the system GMM, we need to resolve two key issues. First, the asymptotic standard errors of the two-step GMM estimator tend to have a severe downward bias in small samples. To improve the precision of the two-step estimators for hypothesis testing, we apply the "Windmeijer finite-sample correction" (Windmeijer, 2005) to the reported standard errors. Second, a large number of instruments can make some asymptotic results about the GMM estimators and related specification tests misleading Roodman (see 2009a,b). 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[9]. The consistency of the GMM estimator

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[9]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

depends on the condition of no second-order serial correlation and the validity of instruments. We thus carry out two tests: the Arellano-Bond test for second-order serial correlation of the differenced residuals, and the Hansen test for over-identifying restrictions.

3.3   Data

Financial data (unconsolidated) were obtained from BankScope for 425 banks from 17 CEE countries, covering the period 2002-2010. The countries considered are: Albania, Bosnia and Herzegovina, Bulgaria, Belarus, Czech Republic, Croatia, Hungary, Latvia, Moldova, Montenegro, FYR of Macedonia, Poland, Romania, Serbia, Slovenia, Slovakia, and Ukraine.[10] 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 1,671 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, market structure 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.

4   Empirical Results

4.1   Evolution of the Lerner Indices

We start by exploring the evolution of competitive conditions in the CEE banking systems over the period 2002-2010. Table 1 displays the average Lerner indices for each country and each year, as well as the grand averages for all countries and all years. As noted by Fungáčová *et al.* (2010), the assessment of the macroeconomic effects of changes in bank competition requires assigning different weights to banks depending on their market share. Therefore, the value of the Lerner index for each country is computed as the average of the bank-level Lerner indices in that country, weighted by the market share of each bank in total banking sector customer deposits[11]. We point out three findings. 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 (2013) who reports average Lerner indices for the 12 new EU member states (8 out of which are included in our sample) ranging from 12.03% to 21.33% over the period 2002-2010. 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

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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.

[10]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 selection bias problems and produce misleading inferences.

[11]Notice that using the market share in total banking sector assets as the weight produces similar results regarding the evolution of bank competition in the CEE countries.

than others, and/or exhibiting relatively more competitive practices in certain years[12]. Third, while for the majority 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. The absence of a general movement towards enhanced or hampered banking competition during the crisis years is confirmed when we carry out a test of the hypothesis that the Lerner index for each country is statistically different between the pre-crisis and the crisis periods. Specifically, the results of this test indicate that the Lerner index increases over the crisis years for 2 countries, decreases for 4 countries and remains stable for the remaining 11 countries (see Table 1). The failure to identify common trends or cycles suggests that the CEE countries experienced the crisis differently and underlines the importance of controlling for a broad range of country characteristics when examining the determinants of market power at the bank-level.

< Insert Table 1 here >

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 2002-2007. 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 (2013) who reports convergence towards the same level of bank competition in EU banking markets during the period 2002-2010. 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.

< Insert Figure 1 here >

4.2   What Determines Market Power?

4.2.1   Basic findings

We continue our analysis by estimating model (M.1) for the full sample period 2002-2010 (see column (1) 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

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[12]The negative values on the Lerner indices in Hungary (banks not behaving as optimizing firms) during the period 2007-2010 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 credit to deposit ratios (Andor, 2009).

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[13], 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, there is no indication that higher market share generates higher levels of market power.

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[14]. Furthermore, we fail to find any evidence that the variable 'Banking Reform' is associated with different values of the Lerner index. The latter may be driven by the fact that the impact of financial liberalization and supervisory and regulatory reforms is already captured by the bank-level and macroeconomic variables included in our model.

< Insert Table 2 here >

4.2.2 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 (2) of Table 2, we add to the equation of column (1) 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. 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 (3)), 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

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[13]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-Garcia, 2012).

[14]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.

column (2) 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 column (4)) 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 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 (5) 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.

Finally, in column (6) we test for the existence of alternative channels through which foreign ownership may affect market power by adding the interaction terms 'Inefficiency $*$ Foreign', 'Diversification$*$Foreign' and 'Customer Deposits$*$Foreign'. All three terms enter the regression insignificantly and do not change the inferences on the other covariates, suggesting that the impacts of inefficiency, diversification and customer deposits on margins do not vary between foreign- and domestically-owned banks.

< Insert Table 3 here >

4.2.3 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). Looking at column (1) in both tables, 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. The impact of growth, however, is now statistically insignificant, most likely due to a lack of sufficient time-series variation in the shorter periods. The most interesting result that emerges from this comparison concerns the role of asset risk and capitalization in determining market power. In particular, during the crisis years, our proxy for asset risk ('NPL') has a negative impact on market power, with the coefficient being statistically significant at the 10% confidence level, whereas the positive impact of capitalization is (economically and statistically) less pronounced.

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[15] (see columns (2) and (3) of Table 4 and Table 5). In line with the

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[15]Even though the coefficient on 'Foreign $*$ US' fails to reach statistical significance in Table 4, its size is

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 columns (4) and (5) 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 (3) of Table 5, is clearly driven by domestically-owned banks: the interaction terms 'NPL * Foreign' and 'Capitalization * Foreign' enter the regressions highly statistically significantly and with the opposite sign to the coefficients on the marginal variables 'NPL' and 'Capitalization'. In addition, the coefficients on these added regressors are jointly statistically significant (see columns (4) and (5) 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 lessen 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 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 may 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 (5) 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 pre-crisis years. 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, may imply 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/or due to lower financing costs. When the latter finding and the findings of the previous paragraph are viewed together, another picture emerges: in times of financial turmoil, the market power of foreign banks is more sensitive to differences in the macroeconomic conditions between the home and the host countries, whereas the market power of domestic banks is more responsive to changes in their own micro-level financial conditions.

Two additional results are worth mentioning. First, 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 (5), is 1.77). This may suggest that during

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remarkably the same as that in Table 5.

the crisis years, government-owned banks were considered to be sounder in comparison to privately-owned institutions, leading to higher margins for the former. Second, the coefficient on the variable 'Banking Reform' turns out to be negative during the crisis years and reaches statistical significance in two specifications (see columns (4) and (5) of Table 5). This may imply that the positive impact of banking sector liberalization and the supervisory and regulatory reforms on banks' competitive conduct is particularly pronounced during financial turmoils.

Are the impacts of inefficiency, diversification and customer deposits during the crisis years conditional on the ownership status, as in the case of asset quality and capitalization? The results in column (6) of Table 5 indicate that the answer is no. Specifically, the interaction terms 'Inefficiency * Foreign', 'Diversification * Foreign' and 'Customer Deposits * Foreign' enter the regression with small coefficient estimates and z-statistics (in absolute value) and are jointly statistically insignificant, suggesting that the inclusion of these regressors adds no explanatory power to the model. In addition, calculating the conditional effects of these variables at the values one and zero of the foreign indicator reveals no statistically significant differences between foreign- and domestically-owned banks[16].

<< Insert Table 4 and Table 5 here >>

4.2.4 Robustness tests

To assess the robustness of the above findings we perform several tests. Table 6a and Table 6b display the results of these tests[17]. First, we control for a number of additional variables that have been used in previous studies to explain the competitiveness of the banking system across countries. Specifically, we augment the model specifications with one of the following variables: the EBRD index of reform of non-bank financial institutions ('Non-bank Reform') as an indicator of interindustry competition; the EBRD index of competition policy ('Competition Policy') as an additional proxy for banking market contestability; and the ratios of money and quasi money to GDP ('M2') and private credit to GDP ('Private Credit') as measures of the level of financial sector and banking sector development (relative to the economy), respectively[18]. These additional variables fail to reach statistical significance and the key findings reported in the previous sections remain essentially intact (see Table 6a). Furthermore, we experiment by replacing the variable 'HHI' with the three-bank concentration

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[16]It must be stressed that the inclusion of too many interaction terms generates a great many instruments in the GMM estimation and weakens the Hansen test of the instruments' joint validity. In addition, it may lead to collinearity and identification problems, and thus affect the interpretability of the estimated coefficients. To minimize the risk of interaction terms spuriously capturing other features of the data, we perform a number of t-tests and F-tests and select the most parsimonious specification to interpret our findings and draw conclusions. According to these tests, only the interaction terms with 'NPL' and 'Capitalization' are both individually and jointly statistically significant when added to the model.

[17]For brevity and comparability, Table 6a and Table 6b show the results of robustness tests implemented on the model specification of column (5) in Table 2, Table 4 and Table 5. However, running the same tests using the model specifications of columns (1) through (4) in these tables does not change the findings reported and discussed in this section.

[18]We have also considered additional variables that may affect the dynamics of market power across countries, namely the stock market capitalization to GDP as a proxy for the competition banks face from capital markets, and indices of capital requirements, supervisory power and activity restrictions as measures of different components of regulatory policies (Barth *et al.*, 2008; Agoraki *et al.*, 2011). Data on stock market capitalization to GDP were collected from the World Bank's WDI, whereas data on the regulatory policy indicators were collected from the World Bank's Bank Regulation and Supervision Survey (2003 and 2007 versions). However, due to a large number of missing observations for the sampled countries, we were unable to utilize these measures in our analysis. Notice, however, that the regulatory policy indicators exhibit little time-series variation over the sampled period and that any time-invariant, country-specific effects are already captured in our model by the country dummies.

ratio ('C3') as a measure of the banking system concentration[19], and by adding, among the regressors, the foreign-owned banks' market share in banking sector total assets ('Foreign Bank Share') to capture the spillover effects of foreign penetration on competitive conduct. Estimates based on these alternative specifications are very similar to the estimates reported in the baseline regressions and do not change the inferences drawn (see columns (1)-(2), (5)-(6) and (9)-(10) of Table 6b). The lack of explanatory power for the added measures can partly be attributed to the short time series dimension of our sample and the existence of high correlations with other country-level variables included in our model, such as 'Growth' and 'Banking Reform' (see Table A.3). Moreover, since the start of the transition process, the sampled countries have achieved high levels of convergence with each other (and to a large extent with the advanced European economies) in terms of financial regulatory frameworks and market structures. Therefore, it is not surprising that we find weaker response to these indicators compared to previous studies covering a wider, more heterogeneous cross-section of countries and/or earlier time periods.

As already mentioned, the system-GMM estimator corrects for potential endogeneity problems stemming from the presence of simultaneous relationships between the Lerner index and the bank-level variables included in vector $\mathbf{X}$. However, another endogeneity concern that arises here is that the foreign ownership indicator may not be exogenous relative to the dependent variable. For instance, foreign investors may target banks with higher profitability or bigger market share, known as "cherry picking" (see, for example, Berger *et al.*, 2005; Lanine & Vander Vennet, 2007). In addition, foreign bank penetration may get more extensive in periods of financial turmoil when the barriers to entry are lower, and/or the takeover of domestic banks with financial difficulties is encouraged by the authorities (Havrylchyk & Jurzyk, 2011a). To control for the possibility of selection bias in our results, we re-estimate all regression specifications using the pre-crisis values of foreign ownership; that is, assuming that there is no change in ownership status during the crisis years. Despite the fact that this approach eliminates the short-run effects of foreign acquisition on market power, the estimates obtained provide evidence that validates the findings of the previous sections (see columns (3), (7) and (11) of Table 6b). Notice that, even though the coefficient on the interaction term 'Capitalization ∗ Foreign' appears now marginally statistically insignificant, the conditional effects of capitalization on margins and the associated t-statistics are in line with those reported in Table 3.

We also check whether our results hold when we take into account the severity of the crisis for each country. All the CEE countries were undoubtedly hit hard by the recent episode of financial distress, as a result of heightened risk aversion on the part of international investors towards the region, general deleveraging by financial institutions and a marked contraction in foreign demand (ECB, 2010). However, following Laeven & Valencia (2012), the recent crisis had a systemic nature[20] only for four of the sampled countries, namely Hungary, Latvia, Slovenia and Ukraine - three out of which also had to request EU and IMF-led international financial assistance. Therefore, one can argue that the reported results are mainly driven by these four countries. To test for this, we estimate the same specifications as in the previous sections using weighted regressions, where double weight is assigned to the aforementioned countries. As shown in columns (4), (8) and (12) of Table 6b, the results are not much influenced by this exercise, suggesting that assigning the same weight to all countries does

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[19]The HHI is preferable to a k-bank concentration ratio because it takes into account the entire size distribution and is sensitive to both the total number of firms and the relative distribution of size among firms. See Bikker & Haaf (2002) for a thorough discussion of various measures of concentration.

[20]Laeven & Valencia (2012) define a banking crisis as systemic if the following two conditions are met: (i) significant signs of financial distress in the banking system as indicated by significant bank runs, losses in the banking system and/or bank liquidations; (ii) significant banking policy intervention measures in response to significant losses in the banking system.

not bias our estimates nor lead to misleading inferences.

Finally, we conduct further tests of robustness, such as using the alternative Lerner index described in Section 3.1 as the dependent variable (obtained from country-by-country regressions), adding to the model specifications the difference in M2 between the home and host countries, and employing different instrument structures. Once again, estimates based on these tests are very similar to our baseline estimates (results available upon request).

< Insert Table 6a and Table 6b here >

5   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), Claessens & Laeven (2004), Fernández de Guevara *et al.* (2005), Bikker *et al.* (2007) and Anzoategui *et al.* (2012), 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, three key 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. Third, the market power of foreign banks during the crisis years responds positively to increases (decreases) in the home country growth rates (inflation rates) relative to the corresponding rates in the host country, implying that banks originating from countries with relatively better macroeconomic conditions managed to maintain higher margins.

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.

Acknowledgements

A Appendix

See Table A.1, Table A.2 and Table A.3.

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
C3	percentage of market share in banking sector total assets held by the three largest banks ($\times 100$)	BankScope & OC
Foreign Bank Share	foreign-owned banks' market share in banking sector total assets ($\times 100$)	EBRD
M2	ratio of money and quasi money to GDP in the host country ($\times 100$)	WDI
Private Credit	ratio of private credit to GDP in the host country ($\times 100$)	WDI
Banking Reform	EBRD index of banking sector reform; ranges from 1.0 to 4.0+, with a higher number indicating a better score	EBRD
Non-Bank Reform	EBRD index of reform of non-bank financial institutions; ranges from 1.0 to 4.0+, with a higher number indicating a better score	EBRD
Competition Policy	EBRD index of competition policy; ranges from 1.0 to 4.0+, with a higher number indicating more effective enforcement of competition policy	EBRD
Foreign	0-1 dummy variable; takes value 1 if the bank is foreign-owned (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 state-owned (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 [a]	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 [a]	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
C3	1671	56.87	18.36	27.28	100.00	836	57.87	18.72	27.28	100.00	835	55.87	17.95	29.62	100.00
Foreign Bank Share	1616	66.61	25.39	8.10	99.20	836	61.55	27.64	8.10	97.30	780	72.02	21.46	19.70	99.20
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
Private Credit	1671	44.44	18.85	6.40	104.56	836	32.97	13.65	6.40	87.52	835	55.92	16.16	24.80	104.56
Banking Reform	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-Bank Reform	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
Competition Policy	1578	2.41	0.58	1.00	3.33	781	2.28	0.64	1.00	3.33	797	2.54	0.48	1.67	3.33
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

[a] 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 Reform	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 Reform	-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
	Market Share	Growth	Inflation	HHI	Banking Reform	Non-Bank Reform	Competition Policy	M2	Private Credit	C3	Foreign Bank Share	
Non-bank Reform	-0.06	-0.18	-0.26	-0.05	0.77	1.00						
Competition Policy	0.02	-0.17	-0.25	-0.02	0.75	0.85	1.00					
M2	-0.01	-0.35	-0.44	0.21	0.66	0.37	0.48	1.00				
Private Credit	-0.03	-0.43	-0.11	0.09	0.55	0.37	0.37	0.67	1.00			
C3	0.42	0.02	-0.31	0.80	0.10	-0.12	-0.03	0.11	-0.02	1.00		
Foreign Bank Share	-0.05	-0.18	-0.52	0.45	0.55	0.23	0.18	0.48	0.30	0.26	1.00	

(a) Price (P)

(b) Marginal Cost (MC)

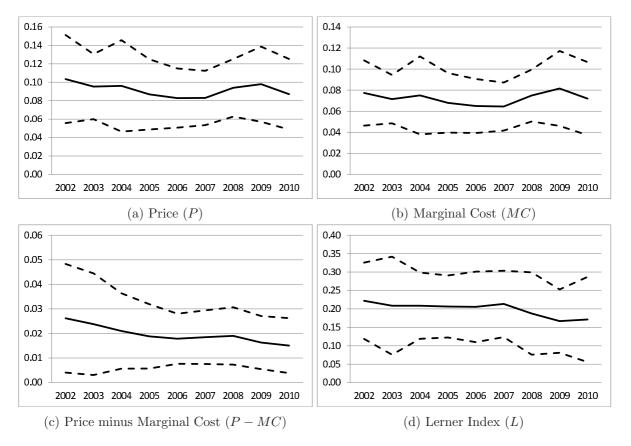(c) Price minus Marginal Cost ($P - MC$)

(d) Lerner Index (L)

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

Table 1: Evolution of market power in CEE banking sectors

Year(s)	Albania	Bosnia and 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	29.04	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
Sign. test[a]	4.20	0.74	-1.31	2.44	12.31***	-5.53**	-16.92	-2.70	-10.84***
	(0.60)	(0.24)	(0.39)	(0.69)	(5.53)	(2.33)	(1.60)	(0.48)	(2.70)

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
Sign. test[a]	-1.92	-3.33	5.42	1.57	-20.48***	-5.86	5.93**	-6.09*	-2.55
	(0.48)	(1.32)	(1.22)	(0.52)	(4.54)	(1.14)	(2.11)	(1.66)	(1.34)

Columns report the yearly weighted average of the bank-level Lerner indices (the weight being the market share in banking sector total customer deposits) for 17 CEE countries over the period 2002-2010. Higher values indicate increased market power; lower values indicate increased competition. [a] Reports the results of a test ($|t|$-statistics in parenthesis), where H_0: the difference in the weighted average of the Lerner index between the pre-crisis years (2002-2006) and the crisis years (2007-2010) is equal to zero. ***,**,* Statistically significant at the 1%, 5% and 10% confidence level, respectively.

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

Dependent variable: Lerner Index ($\times 100$). Method: System Generalized Method of Moments.						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.19***	0.18***	0.18***	0.19***	0.18***	0.17***
	(4.35)	(4.35)	(4.32)	(4.28)	(4.21)	(4.31)
Inefficiency	-0.74***	-0.76***	-0.76***	-0.74***	-0.75***	-0.84***
	(10.58)	(11.31)	(11.09)	(11.68)	(11.93)	(10.87)
Diversification	0.54***	0.52***	0.53***	0.51***	0.51***	0.61***
	(7.30)	(7.84)	(7.82)	(7.38)	(7.91)	(4.94)
Customer Deposits	0.10	0.12*	0.11	0.09	0.09	0.26*
	(1.32)	(1.68)	(1.50)	(1.58)	(1.42)	(1.81)
NPL	-0.16	-0.16	-0.16	-0.27	-0.28	-0.21
	(0.45)	(0.48)	(0.48)	(0.62)	(0.66)	(0.65)
NPL $*$ Foreign				0.25	0.24	0.26
				(0.62)	(0.62)	(0.72)
Capitalization	0.48***	0.53***	0.54***	0.88**	0.90**	0.86**
	(3.52)	(4.53)	(4.74)	(2.19)	(2.33)	(2.25)
Capitalization $*$ Foreign				-0.56	-0.54	-0.50
				(1.18)	(1.15)	(1.12)
Market Share	0.22	0.18	0.19	0.08	0.10	0.12
	(1.36)	(1.27)	(1.29)	(0.56)	(0.70)	(1.05)
Growth	0.21***	0.21***	0.21***	0.22***	0.29***	0.29***
	(2.82)	(2.80)	(2.73)	(3.58)	(3.71)	(3.25)
Inflation	0.08	0.07	0.07	0.06	-0.02	-0.01
	(0.85)	(0.69)	(0.65)	(0.67)	(0.16)	(0.05)
HHI	-0.04	0.01	-0.01	0.02	0.02	0.01
	(0.22)	(0.01)	(0.02)	(0.12)	(0.11)	(0.01)
Banking Reform	-3.21	-3.04	-3.44	-4.91	-4.25	-3.14
	(1.04)	(1.00)	(1.13)	(1.60)	(1.37)	(1.40)
Foreign		3.64***		12.25*	11.47	25.56
		(2.59)		(1.71)	(1.58)	(1.52)
Foreign $*$ EU			3.68**	(1.52)		
			(2.27)			
Foreign $*$ US			10.59***			
			(3.04)			
Foreign $*$ Others			2.42			
			(1.15)			
State		1.59	1.37	1.71	1.94	0.72
		(0.84)	(0.69)	(0.74)	(0.76)	(0.36)
Growth Gap					0.24*	0.20
					(1.65)	(1.43)
Inflation Gap					-0.19	-0.15
					(1.44)	(1.12)
Inefficiency $*$ Foreign						0.06
						(0.90)
Diversification $*$ Foreign						-0.15
						(1.02)
Customer Deposits $*$ Foreign						-0.23
						(1.37)
Number of observations	1103	1068	1068	1068	1068	1068
Number of banks	250	245	245	245	245	245
Number of instruments	161	163	165	191	193	235
AR(2) p-value[a]	0.73	0.67	0.60	0.74	0.63	0.39
Hansen p-value[b]	0.12	0.17	0.14	0.26	0.26	0.63

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

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	-0.28	0.36*	0.90**
	(0.35)	(0.66)	(1.70)	(2.33)
Pre-crisis (2002-2006)	-0.08	0.21	0.94***	0.66*
	(0.44)	(1.24)	(4.91)	(1.85)
Crisis (2007-2010)	-0.25	-2.29**	0.12	0.80***
	(1.01)	(2.07)	(0.42)	(3.56)

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

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

Dependent variable: Lerner Index ($\times 100$). Method: System Generalized Method of Moments.						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.29***	0.29***	0.28***	0.23***	0.21***	0.20***
	(3.66)	(3.84)	(3.72)	(3.53)	(3.09)	(3.64)
Inefficiency	-0.71***	-0.67***	-0.68***	-0.71***	-0.72***	-0.76***
	(4.45)	(4.57)	(4.64)	(4.98)	(4.74)	(5.23)
Diversification	0.42***	0.42***	0.41***	0.48***	0.45***	0.46***
	(3.83)	(4.13)	(3.94)	(3.90)	(3.97)	(3.54)
Customer Deposits	0.16	0.13	0.15	0.12	0.15	0.26
	(1.42)	(1.27)	(1.42)	(1.08)	(1.30)	(1.28)
NPL	0.23	0.26	0.26	0.23	0.21	0.29
	(1.19)	(1.55)	(1.58)	(1.39)	(1.24)	(1.25)
NPL * Foreign				-0.28	-0.28	-0.38
				(1.09)	(1.11)	(1.30)
Capitalization	0.73***	0.73***	0.75***	0.56	0.66*	0.55
	(3.69)	(3.76)	(3.96)	(1.61)	(1.85)	(1.45)
Capitalization * Foreign				0.33	0.28	0.30
				(1.14)	(0.98)	(0.84)
Market Share	0.16	0.18	0.19	0.34**	0.38**	0.41**
	(0.84)	(1.07)	(1.11)	(2.13)	(2.20)	(2.12)
Growth	-0.25	-0.21	-0.22	-0.07	-0.35	-0.01
	(0.82)	(0.70)	(0.77)	(0.22)	(1.12)	(0.01)
Inflation	-0.16	-0.15	-0.15	-0.07	-0.01	0.01
	(0.72)	(0.68)	(0.72)	(0.30)	(0.03)	(0.01)
HHI	-0.18	-0.20	-0.21	-0.28	-0.27	-0.28
	(0.95)	(1.06)	(1.10)	(1.27)	(1.33)	(1.12)
Banking Reform	2.99	3.36	2.91	4.07	4.16	4.96
	(0.92)	(1.04)	(0.89)	(1.17)	(1.26)	(1.51)
Foreign		4.42**		0.79	-0.07	6.80
		(2.34)		(0.16)	(0.01)	(0.44)
Foreign * EU			4.55**			
			(2.27)			
Foreign * US			9.27			
			(1.36)			
Foreign * Others			3.48			
			(1.40)			
State		1.14	1.03	0.48	0.64	1.18
		(0.46)	(0.42)	(0.15)	(0.20)	(0.27)
Growth Gap					-0.71**	-0.43
					(2.17)	(1.59)
Inflation Gap					0.07	0.07
					(0.44)	(0.44)
Inefficiency * Foreign						-0.02
						(0.13)
Diversification * Foreign						0.17
						(1.03)
Customer Deposits * Foreign						-0.18
						(0.83)
Number of observations	451	451	451	451	451	451
Number of banks	177	177	177	177	177	177
Number of instruments	100	102	104	118	120	144
AR(2) p-value[a]	0.12	0.09	0.08	0.14	0.29	0.30
Hansen p-value[b]	0.41	0.48	0.50	0.37	0.41	0.25

See notes for Table 2.

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

Dependent variable: Lerner Index ($\times 100$). Method: System Generalized Method of Moments.						
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Lerner Index	0.16***	0.15***	0.15***	0.14***	0.14***	0.12***
	(4.14)	(4.16)	(4.34)	(3.53)	(3.70)	(3.17)
Inefficiency	-0.81***	-0.84***	-0.84***	-0.86***	-0.88***	-0.95***
	(15.01)	(16.92)	(16.38)	(18.01)	(19.12)	(10.12)
Diversification	0.58***	0.56***	0.56***	0.51***	0.50***	0.67***
	(7.39)	(7.76)	(7.43)	(10.07)	(9.94)	(5.20)
Customer Deposits	0.10	0.15*	0.14*	0.09	0.07	0.22
	(1.17)	(1.88)	(1.72)	(1.13)	(0.87)	(1.09)
NPL	-1.18*	-1.22*	-1.21*	-2.37**	-2.29**	-2.16*
	(1.92)	(1.90)	(1.75)	(2.09)	(2.07)	(1.84)
NPL $*$ Foreign				2.09**	2.04**	2.10*
				(1.99)	(2.01)	(1.77)
Capitalization	0.36**	0.42**	0.39*	0.74***	0.80***	0.92***
	(2.02)	(2.06)	(1.98)	(3.32)	(3.56)	(3.93)
Capitalization $*$ Foreign				-0.70*	-0.68*	-0.75**
				(1.90)	(1.75)	(2.15)
Market Share	0.26	0.19	0.19	0.08	0.05	0.04
	(1.57)	(1.10)	(1.20)	(0.39)	(0.25)	(0.17)
Growth	0.04	0.04	0.03	0.09	0.22	0.24
	(0.26)	(0.28)	(0.26)	(0.66)	(1.62)	(1.48)
Inflation	-0.04	-0.05	-0.04	-0.03	-0.18	-0.16
	(0.23)	(0.30)	(0.27)	(0.17)	(0.97)	(0.94)
HHI	-0.01	0.04	0.02	0.08	0.03	0.10
	(0.01)	(0.13)	(0.07)	(0.36)	(0.13)	(0.50)
Banking Reform	-6.71	-5.55	-5.88	-9.98**	-8.38*	-5.74
	(1.24)	(1.07)	(1.12)	(2.19)	(1.78)	(1.28)
Foreign		4.44**		5.94	4.73	16.42
		(2.45)		(0.81)	(0.69)	(0.79)
Foreign $*$ EU			4.50**			
			(2.13)			
Foreign $*$ US			9.57**			
			(2.23)			
Foreign $*$ Others			3.14			
			(1.23)			
State		3.27	3.23	5.79	6.17*	3.18
		(1.46)	(1.45)	(1.50)	(1.77)	(0.98)
Growth Gap					0.42***	0.34
					(2.93)	(1.47)
Inflation Gap					-0.36**	-0.39*
					(2.06)	(1.87)
Inefficiency $*$ Foreign						0.10
						(1.04)
Diversification $*$ Foreign						-0.26*
						(1.75)
Customer Deposits $*$ Foreign						-0.16
						(0.72)
Number of observations	617	617	617	617	617	617
Number of banks	205	205	205	205	205	205
Number of instruments	140	142	144	166	168	204
AR(2) p-value[a]	0.26	0.26	0.27	0.20	0.23	0.24
Hansen p-value[b]	0.31	0.34	0.32	0.21	0.38	0.58
Joint significance test[c]				0.05	0.08	0.08
Joint significance test[d]						0.12

See notes for Table 2. [c] Reports the χ^2-test p-value, where H_0: the coefficients on the interaction terms between the foreign-ownership indicator and the variables 'NPL', and 'Capitalization' are jointly equal to zero. [d] Reports the χ^2-test p-value, where H_0: the coefficients on the interaction terms between the foreign-ownership indicator and the variables 'Inefficiency', 'Diversification' and 'Customer Deposits' are jointly equal to zero.

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

Dependent variable: Lerner Index (×100). 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	0.18***	0.16***	0.18***	0.18***	0.22***	0.15***	0.21***	0.22***	0.14***	0.13***	0.14***	0.14***
	(4.28)	(3.96)	(4.14)	(4.23)	(3.07)	(2.82)	(3.20)	(3.22)	(3.77)	(3.71)	(3.47)	(3.81)
Inefficiency	-0.75***	-0.78***	-0.75***	-0.75***	-0.71***	-0.93***	-0.73***	-0.70***	-0.88***	-0.88***	-0.89***	-0.87***
	(12.05)	(13.42)	(11.89)	(11.92)	(4.68)	(10.29)	(5.40)	(4.80)	(18.77)	(19.01)	(17.24)	(19.51)
Diversification	0.50***	0.50***	0.48***	0.51***	0.46***	0.41***	0.43***	0.44***	0.50***	0.50***	0.50***	0.50***
	(7.91)	(8.45)	(8.24)	(8.13)	(3.80)	(3.90)	(3.62)	(3.81)	(10.04)	(10.39)	(10.88)	(9.71)
NPL	-0.30	-0.28	-0.31	-0.31	0.21	0.23	0.17	0.19	-2.28**	-2.26*	-2.21**	-2.30**
	(0.71)	(0.76)	(0.75)	(0.73)	(1.15)	(1.03)	(1.00)	(1.13)	(2.14)	(1.99)	(2.19)	(1.98)
NPL * Foreign	0.30	0.28	0.26	0.30	-0.26	-0.20	-0.24	-0.24	2.05**	1.99*	1.92**	2.05*
	(0.74)	(0.77)	(0.67)	(0.74)	(1.02)	(0.64)	(0.98)	(0.94)	(2.09)	(1.88)	(2.01)	(1.92)
Capitalization	0.92**	0.86**	0.89**	0.88**	0.65*	0.53**	0.64*	0.63*	0.78***	0.80***	0.83***	0.79***
	(2.44)	(2.26)	(2.39)	(2.31)	(1.83)	(2.14)	(1.91)	(1.79)	(3.56)	(3.55)	(3.59)	(3.34)
Capitalization * Foreign	-0.56	-0.62	-0.55	-0.50	0.29	0.20	0.27	0.27	-0.68*	-0.67*	-0.78*	-0.66*
	(1.21)	(1.37)	(1.11)	(1.12)	(1.03)	(0.86)	(0.94)	(0.93)	(1.77)	(1.82)	(1.87)	(1.69)
Growth	0.27***	0.26***	0.25***	0.24***	-0.36	-0.37	-0.39	-0.33	0.18	0.18	0.20	0.17
	(3.41)	(3.02)	(2.94)	(2.96)	(1.23)	(1.47)	(1.29)	(1.02)	(1.27)	(1.30)	(1.39)	(1.27)
Inflation	0.01	-0.03	-0.01	0.03	-0.01	-0.15	-0.01	0.01	-0.16	-0.16	-0.17	-0.15
	(0.07)	(0.25)	(0.10)	(0.26)	(0.05)	(0.72)	(0.01)	(0.03)	(0.90)	(0.89)	(0.91)	(0.73)
Banking Reform	-2.7	-3.86	-3.84	-1.42	3.89	2.99	3.86	3.87	-7.00	-5.94	-7.98	-6.67
	(1.09)	(1.37)	(1.25)	(0.51)	(1.16)	(1.11)	(1.15)	(0.94)	(1.59)	(1.37)	(1.60)	(1.37)
Growth Gap	0.22	0.21	0.22	0.20	-0.72**	-0.68**	-0.73**	-0.69**	0.37**	0.39***	0.38**	0.41***
	(1.53)	(1.44)	(1.48)	(1.45)	(2.25)	(2.29)	(2.29)	(2.17)	(2.29)	(2.59)	(2.37)	(2.83)
Inflation Gap	-0.16	-0.18	-0.19	-0.18	0.05	0.02	0.06	0.06	-0.33*	-0.36**	-0.32*	-0.36**
	(1.22)	(1.35)	(1.51)	(1.32)	(0.32)	(0.14)	(0.40)	(0.39)	(1.87)	(2.09)	(1.95)	(1.97)
Non-Bank Reform	-3.35				2.10				-5.61			
	(1.24)				(0.73)				(1.43)			
Competition Policy		-3.53				-0.05					-4.21	
		(1.61)				(0.02)					(1.55)	
M2			-0.07				-0.06				0.03	
			(0.73)				(0.26)				(0.22)	
Private Credit				-0.06				-0.01				-0.06
				(1.40)				(0.06)				(1.25)
Number of observations	1068	1042	1059	1068	451	425	451	451	617	617	608	617
Number of banks	245	236	245	245	177	168	177	177	205	205	205	205
Number of instruments	194	192	194	195	121	119	121	122	169	169	169	170
AR(2) p-value[a]	0.69	0.56	0.36	0.68	0.25	0.14	0.39	0.39	0.23	0.31	0.07	0.29
Hansen p-value[b]	0.24	0.31	0.18	0.19	0.49	0.55	0.44	0.50	0.44	0.40	0.34	0.41

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

Table 6b: Market power in CEE banking sectors: robustness tests (continued)

Dependent variable: Lerner Index (×100). 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	0.18***	0.18***	0.21***	0.25***	0.22***	0.21***	0.21***	0.24***	0.14***	0.13***	0.15***	0.19***
	(4.17)	(4.37)	(4.23)	(3.26)	(3.46)	(3.14)	(3.09)	(2.93)	(3.86)	(3.75)	(3.03)	(2.92)
Inefficiency	-0.74***	-0.74***	-0.75***	-0.69***	-0.72***	-0.68***	-0.72***	-0.71***	-0.88***	-0.87***	-0.86***	-0.84***
	(11.92)	(11.10)	(11.70)	(8.67)	(4.92)	(4.94)	(4.74)	(4.68)	(18.64)	(16.65)	(15.21)	(10.51)
Diversification	0.50***	0.51***	0.52***	0.50***	0.45***	0.43***	0.45***	0.51***	0.50***	0.50***	0.52***	0.50***
	(7.93)	(7.91)	(9.00)	(7.07)	(3.58)	(3.23)	(3.97)	(3.95)	(9.73)	(9.40)	(8.05)	(8.14)
NPL	-0.31	-0.37	-0.19	-0.58	0.19	0.21	0.21	0.27	-2.26**	-2.35*	-2.51*	-2.76**
	(0.72)	(0.88)	(0.53)	(0.81)	(1.16)	(1.23)	(1.24)	(1.07)	(1.98)	(1.87)	(1.95)	(2.17)
NPL ∗ Foreign	0.25	0.36	0.05	0.49	-0.28	-0.23	-0.28	-0.36	1.99*	2.10*	2.10*	2.50**
	(0.61)	(0.87)	(0.17)	(0.83)	(1.19)	(0.86)	(1.11)	(1.10)	(1.85)	(1.80)	(1.75)	(2.17)
Capitalization	0.89**	0.95**	0.71**	0.96**	0.64**	0.61*	0.66*	0.62*	0.81***	0.87***	0.67***	0.75***
	(2.25)	(2.41)	(1.96)	(1.99)	(2.07)	(1.78)	(1.85)	(1.91)	(3.68)	(4.12)	(3.13)	(3.40)
Capitalization ∗ Foreign	-0.54	-0.65	-0.31	-0.76	0.27	0.29	0.28	0.33	-0.69*	-0.75**	-0.53	-0.70*
	(1.11)	(1.20)	(0.69)	(1.09)	(0.98)	(1.03)	(0.98)	(1.21)	(1.85)	(2.31)	(1.58)	(1.77)
Growth	0.28***	0.24***	0.30***	0.28***	-0.28	-0.31	-0.35	-0.24	0.22*	0.16	0.24*	0.21
	(3.58)	(2.84)	(3.93)	(2.93)	(1.04)	(1.07)	(1.12)	(0.79)	(1.82)	(0.95)	(1.72)	(1.44)
Inflation	-0.02	0.06	0.01	-0.01	0.01	-0.01	-0.01	0.03	-0.21	-0.15	-0.18	-0.25
	(0.15)	(0.43)	(0.06)	(0.07)	(0.05)	(0.01)	(0.03)	(0.11)	(1.11)	(0.75)	(0.97)	(1.36)
Banking Reform	-5.04	-2.54	-2.09	-5.87	4.43	2.16	4.16	4.03	-8.00*	-8.51*	-5.24	-7.47
	(1.56)	(0.96)	(0.85)	(1.31)	(1.24)	(0.55)	(1.26)	(1.17)	(1.72)	(1.86)	(1.16)	(1.36)
Growth Gap	0.23	0.18	0.25*	0.30*	-0.72**	-0.73**	-0.71**	-0.62**	0.40***	0.31	0.46***	0.42**
	(1.59)	(1.21)	(1.78)	(1.70)	(2.25)	(2.46)	(2.17)	(1.96)	(2.79)	(1.58)	(2.81)	(2.28)
Inflation Gap	-0.21	-0.16	-0.17	-0.20	0.05	0.04	0.07	0.10	-0.40**	-0.37**	-0.37**	-0.38**
	(1.52)	(1.11)	(1.39)	(1.36)	(0.30)	(0.24)	(0.44)	(0.55)	(2.26)	(2.25)	(2.43)	(2.14)
C3	0.13				-0.07				0.19			
	(1.37)				(0.64)				(1.21)			
Foreign Bank Share		-0.08				0.07				-0.10		
		(1.09)				(1.24)				(1.04)		
Number of observations	1068	1040	1068	1068	451	451	451	451	617	589	617	617
Number of banks	245	243	245	245	177	177	177	177	205	203	205	205
Number of instruments	193	194	193	193	120	121	120	120	168	169	168	168
AR(2) p-value[a]	0.56	0.89	0.64	0.95	0.26	0.25	0.29	0.24	0.20	0.32	0.24	0.54
Hansen p-value[b]	0.24	0.20	0.25	0.23	0.49	0.43	0.41	0.34	0.44	0.44	0.39	0.48

See notes for Table 2. For brevity, the estimated coefficients on 'Customer Deposits', 'Market Share', 'HHI', 'Foreign' and 'State' are not displayed. Equations in columns (1), (5) and (9) exclude the variable 'HHI'. Equations in columns (3), (7) and (11) are estimated using the pre-crisis values of foreign ownership. Equations in columns (4), (8) and (12) are estimated using weighted regressions, where double weight is assigned to the countries for which the crisis had a systemic nature.

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