Essays on foreign ownership in transition banking

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Chapter 3

Determinants of Cross-Border Bank Acquisitions: The Role of Institutions

3.1 Introduction

During the last decade, foreign investors acquired many banks in former socialist economies (FSEs). As a consequence, the share of foreign banks in the total assets of the banking sector in these countries has increased substantially. In the Central and Eastern European countries (CEEC), foreign bank presence has soared from 11% in 1995 to more than 75% in 2005 (EBRD, 2005). In contrast, cross-border bank mergers and acquisitions in advanced economies are rare compared to domestic takeovers (Buch and DeLong, 2004).

What makes banks in FSEs lucrative targets for foreign investors? In most of the previous studies, cross-border bank acquisitions have been analyzed at the aggregate (macro) level (see De Haan and Naaborg, 2004). Variables like geographical distance, language, and cultural similarities with the home country, and regulatory and supervisory structures are important determinants for the decision of foreign

banks to enter a country (Berger et al., 2001). Also the level of economic development of the host country seems to play a role in cross-border takeovers (Focarelli and Pozzolo, 2001, Buch and DeLong, 2004). Banks located in countries with a stable macroeconomic environment are more likely to be targeted by foreign investors than those in countries with an unstable environment. For the FSEs, economic reforms are also argued to affect the intensity of foreign bank entry (Lensink and De Haan, 2002).

More recent studies focus on the individual characteristics of target and acquiring banks in FSEs. These micro-level studies show that characteristics of target banks, including size, performance, and efficiency, are important variables predicting the likelihood of a takeover (Bonin et al., 2005, Lanine and Vander Vennet, 2007, Williams and Liao, 2008). Claessens and van Horen (2008) report that banks enter those countries where they have an institutional competitive advantage over competitor banks.

Although it is now widely acknowledged that both country-level and bank-level variables influence cross-border bank acquisitions, the importance of bank-level factors conditional on country-level determinants has not been treated systematically in previous work.[1] Such an analysis is especially important for the transition countries as they not only have diverse economic environments but they are also very different with respect to institutions. Some of the transition countries have become members of the European Union (EU) and have high economic growth rates, while others have been less successful in their economic development. This implies that

[1] Lensink et al. (2008) examine the impact of the quality of institutions on the foreign ownership-bank efficiency relationship for a broad sample of commercial banks in 105 countries. Another paper that comes close to ours is the recent study by Claessens and van Horen (2008), who examine to what extent institutional similarities between host and home country affect bank entry. In contrast to the present analysis, these papers do not focus on FSEs. They also do not examine whether the influence of bank-level factors is conditional on country-level determinants, which is the focus of our analysis. Poghosyan and Poghosyan (2009) analyze post-entry performance of target banks and show that foreign entry results in (delayed) efficiency improvement and decline in market power. However, they do not explore the role of target banks' characteristics and institutional environment of their host countries as determinants of cross-border acquisitions.

the impact of microeconomic characteristics of a domestic bank on the likelihood of being taken over by a foreign bank may be subject to variation depending on the characteristics of the host country.

In this chapter, we address this issue by using a multilevel mixed-effect logit model for a sample of 2,175 observations from 11 transition countries over the period 1992-2006. Altogether, 109 banks in our sample have been taken over. Our estimations lend support to the view that the relative strength of microeconomic factors determining cross-border bank takeovers varies across different groups of countries. Hence, pooled estimates of the logistic model for all transition countries, as used by, for instance, Lanine and Vander Vennet (2007), might provide misleading results. We find that foreign banks are targeting relatively large and efficient banks in transition economies with weak institutions, thus providing support for the *market power* hypothesis according to which banks are acquired with the objective to increase market power of the acquiring bank. However, when entering more developed transition economies that have made progress in economic reform, foreign banks acquire relatively less efficient banks, supporting the *efficiency* hypothesis according to which banks are acquired with the objective of upgrading the efficiency of the target bank.

The remainder of this chapter is structured as follows. Section 3.2 offers a theoretical background, while section 3.3 describes the empirical methodology and the data used. Section 3.4 discusses the estimation results. The final section concludes.

3.2 Theoretical Background

The theoretical literature on the determinants cross-border bank takeovers has taken a fairly eclectic approach (see Berger et al., 1999). A very common explanation is that takeovers allow the consolidating banks to enhance their efficiency and profitability, by exploiting economies of scale or scope and improving the efficiency of

the consolidating banks. Alternatively, takeovers may enable the merged banks to increase their market power. Lanine and Vander Vennet (2007) therefore distinguish two competing hypotheses explaining cross-border bank acquisitions, namely the *efficiency* and the *market power* hypothesis. According to the *efficiency* hypothesis, acquisitions are undertaken with the objective of upgrading the efficiency of the target banks. According to the *market power* hypothesis, acquisitions are used to gain access to a market and build up market share without necessarily improving the efficiency of the acquired banks. Their empirical results lend support to the *market power* hypothesis. We build upon Lanine and Vander Vennet (2007) and examine whether the impact of bank-level factors is conditional on institutional differences between countries.[2]

There are various reasons to expect that a home country's institutional setting may affect a foreign bank's strategy. It is widely believed that – at least at the beginning of the transition – foreign banks have a competitive advantage compared to domestic banks, as they have more advanced technologies, better corporate control, higher educated employees, and better risk management instruments (De Haan and Naaborg, 2004). However, domestic banks incur lower costs for providing services at home, because they have better information about their country and customers. Taking over a domestic bank and increasing its efficiency may therefore be a more attractive entry strategy than a greenfield investment. However, improving the efficiency of the target bank may be hampered by the institutions of the host country. For instance, if regulations and legal frameworks are very detached from international standards, it may be hard to introduce the risk management practices of the foreign bank. To make the investment profitable, the foreign bank may in such

[2] The study of Lanine and Vander Vennet (2007) differs in various ways from our study. Whereas we focus on a sample of 11 CEEC countries over the period 1992-2006, Lanine and Vander Vennet's sample covers only the period 1995-2002. Furthermore, Lanine and Vander Vennet measure cross-border deals using their announcement date, while our measure is based on the date when the deal was completed. As it may take a while before the deal is settled and not all announced deals are eventually settled, we prefer this measure.

circumstances focus on increasing market power.

Similarly, Mian (2006) argues that a foreign bank in a *distant* economy faces extra informational and agency costs in making relational loans. Likewise, Galindo et al. (2003) point to the cost of learning that will also depend on *distance*. For instance, learning how to work in a corrupt system can be costly for a banker whose lifetime experience has been in Switzerland. Broadly speaking, *distance* here could reflect a number of factors, including institutional distance between the foreign bank's country of origin and its subsidiary. The more the host country's institutions are similar to those of the home country, the lower these various costs will be and therefore the more efficient the foreign bank can operate. Consistent with this hypothesis, Lensink et al. (2008) report for a sample of 2095 commercial banks in 105 countries that less institutional distance between the host and the home country governance increases foreign bank efficiency. In case foreign banks cannot realize efficiency gains due to a poor institutional framework in the host country they may try to get compensation by acquiring market power.

When deciding on entering a transition country, a foreign bank arguably faces a trade-off between expected return and its variability (Buch, 2000). As the growth perspectives of transition countries are good and there may exist ample opportunities for efficiency improvement of target banks, the latter may offer high rates of return. At the same time, due to the transition process the variability of the rate of return is likely to be higher than those of other investment opportunities. Arguably, it is easier to achieve efficiency gains in host countries with better institutions (Berger et al., 2001). Likewise, the more underdeveloped the host country's institutions are, the higher the volatility of expected returns will be, which needs to be compensated for by higher returns. In case efficiency improvements are not sufficient, the extra revenues needed to compensate for higher volatility may be acquired by increasing market power.

3.3 Methodology and Data

3.3.1 Multilevel mixed-effect logistic regression

We use a multilevel mixed-effect logit model (MMEL) to examine the impact of bank-specific factors driving the cross-border bank takeovers in transition economies conditional on their institutional characteristics.[3] Like the logistic regression model – used for studying cross-border bank acquisitions, among others, by Focarelli and Pozzolo (2001), Focarelli and Pozzolo (2008), Focarelli et al. (2002), Lanine and Vander Vennet (2007) – the multilevel mixed-effect modeling approach is based on the principle of likelihood maximization. However, it is more general as it allows for conditioning the impact of important acquisition determinants, such as efficiency and market power, on institutional characteristics of host countries. In addition, the MMEL nests simple logistic regression used in previous studies and provides a flexible tool for testing the importance of institutional heterogeneity in host countries for foreign bank entry by the means of the likelihood ratio test.

Our dependent variable (y_{it}) is a dummy that takes the value of one at the time when a cross-border bank acquisition was made. The general specification of the MMEL model in log odd's ratio form is:

$$\log\left(\frac{P_{ijt}}{1-P_{ijt}}\right) = \beta_0 + \beta_{1jt} INEFF_{ijt} + \beta_{2jt} MP_{ijt} + \beta_3 CONTROLS_{ijt} \qquad (3.1)$$

where $P_{ijt} = Prob(y_{ijt} = 1 | INEFF_{ijt}, MP_{ijt}, CONTROLS_{ijt})$ is the probability that bank i located in country j will be acquired at time t conditional on a set of explanatory variables, $INEFF$ denotes the inefficiency of the target bank, MP denotes the market power of the target bank, $CONTROL$ is a vector of bank-specific and

[3] A detailed description of the MMEL methodology is available in Rabe-Hesketh and Skrondal (2005). An alternative to the discrete choice modeling approach is an event-study methodology used by Williams and Liao (2008), among others. Haselmann (2006) uses an alternative approach. He estimates a model for the lending behavior of banks to examine their strategy and concludes that the decision of foreign banks to enter the CEE economies seems to be driven by long-term strategic goals. This conclusion is based on the absence of a relationship between the macroeconomic conditions in the foreign banks' country of origin and their loan supply.

country-specific control variables, and β's are parameters to be estimated. In the above specification, we relax the assumption that the impact of the target bank's inefficiency (β_{1ij}) and market power (β_{2ij}) on the likelihood of its acquisition by foreign investors is constant across host countries and over time. More specifically, we explicitly test for the possibility that the *efficiency* and *market power* hypotheses differ depending on the institutional characteristics of host countries using the following equations for the slope coefficients:

$$\begin{aligned} \beta_{1jt} &= \beta_1 + \beta_{11} INST_{jt} + \mu_j \\ \beta_{2jt} &= \beta_2 + \beta_{22} INST_{jt} + \omega_j \end{aligned} \tag{3.2}$$

where $INST_{jt}$ is a variable measuring the quality of institutions in country j at time t (increase in $INST$ indicates better quality), and $\mu_j \sim N(0, \sigma_\mu)$ and $\omega_j \sim N(0, \sigma_\omega)$ are country-specific random effects that represent the combined effect of all omitted country-specific determinants apart from institutional characteristics of host countries that may influence the likelihood of foreign acquisition.

The simple logistic regression as used in previous studies is a special case of specifications (3.1) and (3.2), when $\beta_{11} = \beta_{22} = 0$ and $\sigma_\mu = \sigma_\omega = 0$. The latter condition implies that the *efficiency* and *market power* hypotheses are invariant to institutional characteristics of host countries and can be tested by the means of the likelihood ratio test. In the presence of significant effects of quality of institutions on the *efficiency* and *market power* hypotheses, the signs of the coefficients β_{11} and β_{22} would indicate the direction of the impact. For example, when β_{11} (β_{22}) is positive and significant the *efficiency* (*market power*) hypothesis is more pertinent to transition countries with better institutional quality.

3.3.2 Data

We obtained data from different sources to study cross-country bank takeovers in transition economies. First, we obtained a list of takeovers during the 1992-2006

period from the Securities Data Company (SDC) mergers and acquisitions database produced by Thompson Financial. This data set contains information on the announcement and effective dates of the acquisition, the names of the bidder and target banks, the country of their ultimate parents, and the percentage of shares owned after the acquisition.[4] From this data set, we selected completed acquisitions that involve target banks in transition economies. In our analysis we only included cross-border acquisitions (i.e., parents of bidder and target banks are from different countries), which resulted in the control of ownership by the bidder bank exceeding 50% of the equity.

Second, we extracted bank level balance sheet and income statement information from Bankscope that is maintained by Bureau van Dijk. We retrieved information for all banks located in the 11 transition countries under research, including those that were and those that were not engaged in a takeover (target and peer banks, respectively). Our sample covers 388 banks and contains 2,175 observations. Altogether, there have been 109 takeover events recorded. Table (3.1) provides the distribution of these events across countries and over time.

Third, we used different sources to obtain information on institutional characteristics of the countries in our sample. To proxy economic reform we use the first principal component of various EBRD indicators of economic reform available for the total sample period (referring to small- and large-scale privatization, enterprise reforms, price liberalization, foreign exchange and trade liberalization, competition policy, banking and non-banking sector reforms, reforms in infrastructure). This indicator is available for our full sample period. To proxy the political regime of a country we use the first principal component of the governance indicators of Kaufmann et al. (2007) that refer to different dimensions of the political system available for the period 1996-2006 (voice and accountability, political stability and absence of

[4] We thank Iman van Leyveld and Emilia Jurzyk for kindly sharing their data on bank ownership.

violence, government effectiveness, regulatory quality, rule of law, control of corruption).[5]

Finally, we obtained information on various macroeconomic indicators and financial market conditions as additional control variables using the World Bank's Word Development Indicators. Table (3.2) contains details of the data sets employed in our analysis.

We improve upon Lanine and Vander Vennet (2007) by utilizing direct measures of bank market power and efficiency.[6] For this purpose, we use the stochastic frontier methodology, according to which the efficiency of individual banks is identified by benchmarking their performance against a common frontier determined by the best-performing banks in the sample. We utilize the time-varying bank-specific inefficiency scores (INEFF) instead of the proxies employed by Lanine and Vander Vennet to test for the *efficiency* hypothesis (see Appendix 1 for further details). Unlike the cost-to-income ratio, the inefficiency score provides a direct measure of relative performance of the particular bank in comparison to similar banks. In particular, it compares the actual level of bank cost to its optimal level (cost frontier) given the volume of output produced and input prices. Furthermore, we calculate Lerner's indices using cost function estimates obtained from the stochastic frontier model as indicators of bank market power (see Appendix 2 for further details). In addition to efficiency and market power, we augment the specification by various

[5] As we use generated regressors, the standard errors of the estimated coefficients may be affected, although the consistency of the obtained coefficients is preserved. To check whether this generated regressor problem affects our results about the impact of institutions, we have re-estimated the model but instead of using the first principal component of the institutional indices we used their average values. The estimation results (available on request) suggest that our qualitative findings do not change.

[6] Lanine and Vander Vennet (2007) use three indicators of market power of a bank (i.e., the logarithm of a bank's total assets, and its share of loans and deposits of all banks) and two indicators of efficiency (i.e., the cost-to-income ratio, and the non-interest expense ratio). However, these measures do not allow for a direct measurement of market power and efficiency and cannot be compared across countries. For instance, since the financial sector in Poland is much larger than the financial sector in Estonia, the market share of banks in Poland tends to be smaller than that of banks in Estonia. Likewise, cost ratios don't take the position of a bank in comparison to similar banks into account.

bank-specific (capitalization, return on equity, loans to assets, and deposits to assets ratios) and country-specific (real GDP growth, per capita GDP, share of private sector, and ratio of credit to GDP) control variables.

Table (3.3) provides details of the variables used in our analysis, while Table (3.4) displays descriptive statistics.

3.4 Empirical Results

3.4.1 Do institutions matter?

The first step in our empirical investigation is to estimate the logistic regression model of Lanine and Vander Vennet (2007) using a more general mixed-effect formulation (3.1)-(3.2). As the simple logistic regression is equivalent to the mixed-effect logistic regression with the slope coefficients restricted to be constant ($\beta_{1jt} = \beta_1$ and $\beta_{2jt} = \beta_2$), this exercise allows us to test whether by conditioning the variation in slope coefficients on institutional developments in host countries we are able to improve the fit of the model. Note that the regressions in which the EBRD indicator proxies institutions refer to the period 1992-2006, while the regressions in which the Kaufman indicator is used refer to the period 1996-2006 as this indicator is only available for those years.

We start by estimating the model (3.1)-(3.2) separately for each measure of institutional development using only bank-specific variables. The fit of each model is compared to the simple logistic model (with constant slopes β_1 and β_2) using the likelihood ratio test. The results as reported in Table (3.5) suggest that the MMEL model outperforms the simple logistic regression. In economic terms, this finding implies that the relative strength of the *efficiency* and *market power* hypotheses varies across countries and over time, depending on the dynamics of institutional development of host countries.

In both specifications, we obtain negative and significant coefficients β_1 and posi-

tive and significant coefficients β_2. This suggests that, taken institutional characteristics as given, there is significant evidence supporting the *market power* hypothesis and rejecting the *efficiency* hypothesis. In other words, if foreign banks can choose between two banks located in two countries having a comparable level of institutional development, they acquire a bank that has larger market power and is more efficient. The former result is in line with the findings of Lanine and Vander Vennet (2007). However, the positive and significant β_{11} coefficients obtained in both models suggest that support for the *market power* hypothesis weakens as the level of institutional development of the host country increases. Similarly, the negative and significant β_{22} coefficients obtained in both models suggest that the *efficiency* hypothesis finds greater support with the improvement of the institutional development of the host country.

The economic effect of market power as a determinant of cross-border acquisitions is, on average, less sizable compared to bank efficiency. Moreover, the impact of institutional development on the odds of acquisition is also mostly channeled through its impact on the likelihood of targeting inefficient banks. Comparison of Hungary and Romania as countries with highest and lowest average level of institutional development according to the EBRD index helps to illustrate this point. Our estimations suggest that the likelihood of acquisition of an inefficient bank in Hungary is 14.09% larger than in Romania, while the likelihood of acquisition of a bank possessing large market power in Hungary is only 0.85% lower than in Romania. Similarly, comparison of Slovenia and Romania as countries with highest and lowest average level of institutional development according to the Kaufman index suggests that the likelihood of acquisition of an inefficient bank in Slovenia is 15.63% larger than in Romania, while the likelihood of acquisition of a bank possessing large market power in Slovenia is only 2.24% lower than in Romania. These results suggest that foreign investors put large weight on the level of host countries' institutional

development when acquiring banks with the purpose of upgrading their efficiency.

Among the bank-specific control variables, we find that foreign banks target better-capitalized banks and banks with greater deposit-funding capacity, while the impact of profitability is not significant.

To summarize, our results suggest that the quality of the institutions of the host country matters for the acquisition strategy of foreign banks. The better the institutions of the host country, the more (less) support there is for the *efficiency* hypothesis (*market power* hypothesis). In the next subsection we will check the robustness of our results by introducing time fixed effects and macroeconomic control variables.

3.4.2 Sensitivity analysis

We estimated two additional models to check the sensitivity of our results. First, we introduced time dummies to control for time-specific common shocks that might have influenced foreign banks to enter transition economies. Second, we introduced country-specific macroeconomic control variables relevant for the decision of foreign banks to go abroad, such as per capita GDP, real GDP growth, share of private sector in the economy, and share of private credit in GDP. Estimation results for these two sensitivity checks are reported in Table (3.6). The estimation results in both cases are qualitatively similar to our earlier results concerning the *efficiency* and *market power* hypothesis testing. The coefficients β_2 (β_1) and β_{11} (β_{22}) remain positive (negative). The impact of bank-specific control variables is also broadly consistent with previous results. Among the macroeconomic variables, only the private sector share in GDP has a significant positive effect on the decision of foreign banks to enter transition countries.

To summarize, this section shows that previous results on the importance of institutional development for the decision of foreign banks to go abroad holds when controlling for the impact of other macroeconomic variables and time effects.

3.4.3 Analyzing the *efficiency* and *market power* hypotheses across countries and over time

After confirming the importance of the institutional environment for foreign bank entry, we finally analyze the magnitude of variation of coefficients measuring the *market power* and *efficiency* hypotheses (β_{1jt} and β_{2jt}) across countries and over time. For this purpose, we use the Bayesian shrinkage estimator (Rabe-Hesketh and Skrondal, 2005) to obtain estimates of β_{1jt} and β_{2jt}, and calculate their average values across countries ($E[\beta_{1j}] = \sum_t \frac{\beta_{1jt}}{T}$ and $E[\beta_{2j}] = \sum_t \frac{\beta_{2jt}}{T}$) and over time ($E[\beta_{1t}] = \sum_j \frac{\beta_{1jt}}{J}$ and $E[\beta_{2t}] = \sum_j \frac{\beta_{2jt}}{J}$). Figures (3.1) and (3.2) show obtained estimates for models with EBRD and Kaufman indices as measures of institutional quality, respectively.

Examination of these figures provides several useful insights. First, in all cases we find support for the *market power* hypothesis, since average values of coefficients β_{2jt} are always positive. This is also in line with our previous discussion on the economic significance of market power as a determinant of cross-border acquisitions. Second, cross-country variation of average coefficients implies that the *efficiency* hypothesis is largely supported (positive average values of β_{1jt}) for relatively more developed countries, such as the Czech Republic, Hungary and Poland for the case of model 1 and also Estonia, Slovenia and Slovakia for the case of model 2. Third, the time dynamics of the coefficients suggests that the relative importance of the *market power* and *efficiency* hypotheses has been changing over time. During the 1990s, foreign banks were targeting largely efficient banks (rejection of the *efficiency* hypothesis) and banks having greater market power (support for the *market power* hypothesis). In more recent times, perhaps due to the fact that the *cream* has been already skimmed, foreign banks started targeting inefficient banks and banks with relatively lower market power.

3.5 Conclusions

We analyze the microeconomic determinants of cross-border bank acquisitions in 11 transition economies over the period 1992-2006. By using a multilevel mixed-effect logit model we explicitly incorporate the macro-economic and institutional heterogeneity of the transition economies into our analysis. We find that foreign banks are targeting relatively large and efficient banks in transition economies with weak institutions, thus providing support for the *market power* hypothesis according to which banks are acquired with the objective to increase market power of the acquiring bank. However, when entering transition economies that have made progress in economic and institutional reform, foreign banks acquire relatively less efficient banks, supporting the *efficiency* hypothesis according to which banks are acquired with the objective of upgrading the efficiency of the target bank.

Our findings suggest that the concerns of Lanine and Vander Vennet (2007) regarding the limitations with respect to the commonly accepted view that foreign entry will contribute to the competitiveness and efficiency of banking systems in transition are only partially justified. We show that these concerns are not valid for a small subsample of target banks located in transition economies that have made significant progress in terms of institutional development and the restructuring of their economies. Foreign investors enter these countries with the aim of upgrading the efficiency of the acquired bank and utilizing the unexploited profit opportunities. In contrast, foreign investors seem to be hesitant in entering transition countries lagging behind in terms of economic reforms.

Our analysis also suggests that the relative importance of the *market power* and *efficiency* hypotheses has been changing over time. During the 1990s, foreign banks were targeting largely efficient banks and banks having greater market power. In more recent times, perhaps due to the fact that the *cream* has been already skimmed, foreign banks started targeting inefficient banks and banks with relatively lower market power.

Appendix 1

Obtaining individual bank cost efficiency scores using the stochastic efficiency frontier model

Following a recent stream of the literature (e.g., Bonin et al., 2005, Fries and Taci, 2005, Poghosyan and Borovicka, 2007), we apply frontier analysis for modeling cost efficiency of banks in FSEs. For the stochastic cost frontier, we follow the modified production approach (see Berger and Humphrey, 1991) and use two types of bank outputs: total loans ($y_{1,it}$) and total deposits ($y_{2,it}$). The banks provide their services using two inputs, i.e., physical capital and labor. Accordingly, the price of physical capital is measured as a ratio of non-interest expenses to total assets ($w_{1,it}$), while the price of labor is proxied by the ratio of total personnel expenses to total assets ($w_{2,it}$). The production technology might also be influenced by the technological progress, for which we control by using a time trend (t). The dependent variable in the frontier is the total cost of a bank (c_{it}), which includes both interest and operating expenses. To account for the country-specific environmental characteristics that might have an impact on the bank's technology, we augment the frontier by introducing real GDP growth (GDP_GR), real GDP per capita in US dollars (GDP_PC), and the share of domestic credit in GDP (CRED) variables. The final translog specification for the cost function takes the following form:

$$\begin{aligned}
\ln \tfrac{c_{it}}{w_{it,1}} &= \alpha + \sum_{s=2}^{S} \beta_s \ln \tfrac{w_{it,2}}{w_{it,1}} + \sum_{l=2}^{L} \gamma_l \ln y_{it,l} + \tfrac{1}{2} \sum_{s=2}^{S} \sum_{l=2}^{S} \delta_{sl} \ln \tfrac{w_{it,s}}{w_{it,1}} \ln \tfrac{w_{it,l}}{w_{it,1}} + \\
&+ \tfrac{1}{2} \sum_{s=1}^{L} \sum_{l=1}^{L} \varphi_{sl} \ln y_{it,s} \ln y_{it,l} + \tfrac{1}{2} \sum_{s=2}^{S} \sum_{l=1}^{L} \theta_{sl} \ln \tfrac{w_{it,s}}{w_{it,1}} \ln y_{it,l} + \rho_1 t + \tfrac{1}{2} \rho_2 t^2 + \\
&+ \sum_{s=2}^{S} \rho_s^w t \ln \tfrac{w_{it,s}}{w_{it,1}} + \sum_{l=1}^{L} \rho_s^y \ln y_{it,l} + \psi_1 GDP_GR + \psi_2 GDP_PC + \\
&+ \psi_3 CRED + v_{it} + u_{it}
\end{aligned} \tag{3.3}$$

where i and t are bank and time indices, respectively. The linear homogeneity restrictions are satisfied by expressing all variables in terms of a ratio with respect

to one of the input prices, and inefficiency is modeled as a function of time using the specification of Battese and Coelli (1992):

$$u_{it} = u_i^{\eta(t-T)} \tag{3.4}$$

where u_i is the bank-specific inefficiency term that is assumed to have a non-negative truncated normal distribution with zero mean and variance σ_u^2, and T is the last period in the sample. The overall inefficiency of each individual bank, u_{it}, is varying over time at the exponential rate η to be estimated. The intuition behind this parameterization is that the inefficiency term is assumed to be monotonically increasing (positive and significant η), monotonically decreasing (negative and significant η) or neutral (insignificant η) over time. To estimate the model using a maximum likelihood method we additionally assume that the random error term, v_{it}, follows a normal distribution with zero mean and constant variance, σ_v^2.

Appendix 2

Obtaining Lerner's indices as measures of banks' market power

Following Angelini and Cetorelli (2003) and Maudos and Fernandez de Guevara (2007), we estimate Lerner's index to assess the competitive behavior of individual banks as follows:

$$MP_{ijt} = \frac{AR_{ijt} - MC_{ijt}}{AR_{ijt}} \tag{3.5}$$

where AR_{ijt} is the ratio of total operating income to total earning assets as a proxy for average price of bank products, and MC_{ijt} is the marginal cost of banks obtained by differentiating the cost function estimate (3.3) with respect to bank outputs. In fully competitive markets, marginal costs of banks equal their marginal revenues and Lerner's index is approaching zero. Therefore, larger values of the Lerner's index indicate larger market power possessed by individual banks.

Table 3.1. Cross-border bank acquisitions in FSEs, 1992-2006

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
BG	0	0	0	0	0	0	0	0	0	0	2	1	0	1	1	**5**
CZ	0	2	0	0	2	2	2	2	2	1	0	1	0	0	0	**14**
EE	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	**4**
HR	0	0	0	0	0	3	1	1	2	1	0	0	0	1	1	**10**
HU	0	0	0	0	4	1	1	0	1	0	2	0	0	0	0	**9**
LT	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	**4**
LV	0	0	1	0	0	1	1	0	1	3	0	0	0	0	1	**8**
PL	0	1	0	1	3	2	1	6	4	2	1	0	0	0	0	**21**
RO	0	0	0	0	0	2	3	1	2	1	3	3	0	0	0	**15**
SI	0	0	0	1	0	0	0	0	0	2	2	0	0	0	0	**5**
SK	1	0	0	2	0	2	1	0	3	3	2	0	0	0	0	**14**
Total	**1**	**3**	**1**	**4**	**9**	**13**	**11**	**11**	**18**	**14**	**13**	**5**	**1**	**2**	**3**	**109**

Notes: BG=Bulgaria, CZ=The Czech Republic, EE=Estonia, HR=Croatia, HU=Hungary, LT=Latvia, LV=Lithuania, PL = Poland, RO = Romania, RS = Serbia, SI=Slovenia, SK=Slovakia.

Table 3.2. Data sources

Variable	Definition	Source
Cross-border bank acquisition	A dummy variable changing its value from 0 to 1 at the time when the acquisition took place.	Thompson Financial
Bank financial indicators	Balance sheet items and income statements	Bankscope of Bureau van Dijk
Reforms	Indices ranging from 1 (worst) to 4 (best) and indicating the progress of reforms in the following nine areas: small- and large-scale privatization, enterprise reforms, price liberalization, forex and trade liberalization, competition policy, banking and non-banking sector reforms, reforms in infrastructure.	EBRD Transition Reports
Governance	Indices ranging from -2.5 (worst) to 2.5 (best) and indicating the progress of governance in following six areas: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, control of corruption.	Kaufman et al. (2007)
Macro data	Real GDP growth, GDP per capita (real, USD), share of private sector in GDP, and ratio of domestic credit to GDP.	World Bank World Development Indicators, EBRD

Table 3.3. Data description

Variable	Description
Efficiency	
INEFF	Cost inefficiency of banks obtained using the stochastic efficiency frontier model. Larger values indicate greater inefficiency.
Market power	
MP	Lerner's index, calculated as difference between average revenues and marginal costs divided over average revenues. Larger values indicate greater market power.
Bank-specific control variables	
CAP	Capital adequacy ratio, calculated as ratio of bank equity to total assets
ROE	Return on equity, calculated as the ratio of pre-tax profits and total equity
LTA	Intensity of loan provision, calculated as the ratio of loans to total assets
DEP	Deposit funding, calculated as the ratio of total deposits to total assets
Country-specific control variables	
GDPGR	Real GDP growth
GDPPC	GDP per capita (in thousands of USD)
PRIV	Private sector share in the economy
CREDGDP	Share of credit to the private sector in GDP
Institutional measures	
EBRD	First principal component of nine EBRD indices measuring reforms in various sectors in the economy
KAUF	First principal component of six Kaufman indices measuring governance

Table 3.4. Descriptive statistics

	Mean	Median	St. Dev.	Min	Max	Skewness	Kurtosis
INEFF	0.6776	0.6685	0.1537	0.2142	0.9824	-0.0167	2.2100
MP	30.0325	30.1135	0.6703	17.9268	30.7580	-9.9603	138.2745
CAP	0.1455	0.1079	0.1244	0.0435	0.9692	3.3181	16.7740
ROE	0.1062	0.1164	0.2811	-5.2137	1.1120	-6.6187	96.9797
LTA	0.4519	0.4623	0.1789	0.0000	0.9724	-0.2011	2.9898
DEP	0.7377	0.7873	0.1673	0.0018	0.9503	-1.9444	7.2768
GDPGR	4.3063	4.5240	2.8109	-16.2270	12.2350	-1.1232	7.7949
GDPPC	4392.0	4066.0	1953.9	1615.9	12340.8	1.5884	6.1060
PRIV	0.6695	0.6500	0.0967	0.3000	0.8000	-0.6627	3.4584
CREDGDP	0.3112	0.2920	0.1396	0.0430	0.7790	0.5151	3.0021
EBRD	7.7912	7.8204	1.0267	3.9821	10.1288	-0.2397	2.9952
KAUF	7.1359	7.5005	1.1366	4.5462	9.0207	-0.4662	2.1817

Table 3.5. Estimates of equations (1) and (2)

	Without institutions		**With EBRD index**		**With Kaufman index**	
	Coefficients	**Marginal effects**	**Coefficients**	**Marginal effects**	**Coefficients**	**Marginal effects**
β_0	-5.1483***	–	-5.1661***	–	-4.8882***	–
	(1.0860)	–	(1.0880)	–	(1.1330)	–
β_1	-0.5617	-0.0253	-11.0603**	-0.4653**	-7.5442*	-0.3419
	(0.6508)	(0.0294)	(5.1110)	(0.2262)	(4.5110)	(0.2088)
β_2	0.3224**	0.0140***	0.9601*	0.0415*	1.4442**	0.0659**
	(0.0989)	(0.0035)	(0.5063)	(0.0223)	(0.6286)	(0.0289)
β_{11}	–	–	1.3651**	0.0575**	1.0783*	0.0489*
	–	–	(0.6549)	(0.0292)	(0.6274)	(0.0292)
β_{22}	–	–	-0.0844*	-0.0036*	-0.1550*	-0.0070*
	–	–	(0.0431)	(0.0016)	(0.0810)	(0.0037)
Capital adequacy ratio	4.7820***	0.2203***	4.9082***	0.2256***	4.9231***	0.2348***
	(1.2040)	(0.0553)	(1.2190)	(0.0559)	(1.2900)	(0.0616)
Return on equity	0.0063	0.0002	0.0052	0.0003	0.004	0.0002
	(0.0336)	(0.0013)	(0.0304)	(0.0016)	(0.0263)	(0.0013)
Intensity of loan provision	-1.0142*	-0.0494*	-0.9561	-0.0477*	-1.1210*	-0.0553*
	(0.5848)	(0.0262)	(0.5855)	(0.0261)	(0.6221)	(0.0292)
Deposit funding	2.4871**	0.1179**	2.4514**	0.1198**	2.2120*	-0.1089*
	(1.1530)	(0.0519)	(1.1570)	(0.0522)	(1.1900)	(0.0056)
Statistics						
Number of observations	2175.0		2175.0		1891.0	
LR-test (p-value)	–		0.0642		0.0648	

Notes: Standard errors are reported in brackets. ***, **, and * denote significance at 10, 5, and 1% confidence levels, respectively. The reported marginal effects are evaluated at sample means.

Table 3.6. Sensitivity analysis: Time dummies and macro variables added

	With macroeconomic control variables			With time fixed effects		
	Without institutions	**With EBRD index**	**With Kaufman index**	**Without institutions**	**With EBRD index**	**With Kaufman index**
β_0	-5.6170	-7.1560*	-6.9340*	-4.7881**	-4.4015**	-4.8256***
	(3.6830)	(3.7710)	(3.9001)	(1.5122)	(1.5259)	(1.3136)
β_1	-0.5811	-11.3401**	-8.6304*	-0.6150	-8.8839**	-2.8334*
	(0.6544)	(5.0990)	(4.7500)	(0.6903)	(4.1579)	(1.4779)
β_2	.3181**	1.0440**	1.6270**	0.3415**	1.0732**	0.8086**
	(0.1045)	(0.5171)	(0.6554)	(0.1159)	(0.4515)	(0.2796)
β_{11}	–	1.3850**	1.2250*	–	1.3489**	0.5840*
	–	(0.6478)	(0.6547)	–	(0.6637)	(0.3468)
β_{22}	–	-0.0954*	-.1787**	–	-0.1194*	-0.0921**
	–	(0.0481)	(0.0837)	–	(0.0692)	(0.0453)
Capital adequacy ratio	4.7981***	4.9683***	4.9212***	4.9622***	5.0890***	4.9624***
	(1.1920)	(1.2060)	(1.2780)	(1.2423)	(1.2585)	(1.3203)
Return on equity	0.0063	0.0050	0.0039	0.0039	0.0037	0.0034
	(0.0311)	(0.0274)	(0.0237)	(0.0230)	(0.0225)	(0.0220)
Intensity of loan provision	-0.8571	-0.8534	-0.9046	-0.9393	-0.9018	-0.8653
	(0.5770)	(0.5754)	(0.6178)	(0.6180)	(0.6187)	(0.6519)
Deposit funding	2.3302**	2.3542**	1.9714*	2.5366**	2.4824**	2.2729*
	(1.1120)	(1.1170)	(1.1500)	(1.1845)	(1.1916)	(1.2254)
Real GDP growth	-0.03582	0.00593	0.01166	–	–	–
	(0.1258)	(0.1270)	(0.1321)	–	–	–
GDP per capita	-0.2335	-0.1147	-0.1002	–	–	–
	(0.3690)	(0.3727)	(0.3852)	–	–	–
Private sector share	4.2523**	4.8711**	4.9962**	–	–	–
	(1.9360)	(1.9590)	(2.0610)	–	–	–
Private sector credit	-0.8897	-1.1680	-1.5270	–	–	–
	(1.3140)	(1.3200)	(1.3860)	–	–	–
Statistics						
Number of observations	2175	2175	1891	2175	2175	1891
LR-test (p-value)		0.0507	0.0391		0.0558	0.0661

Notes: Standard errors are reported in brackets. ***, **, and * denote significance at 10, 5, and 1% confidence levels, respectively. Coefficients on time dummies are omitted to conserve space.

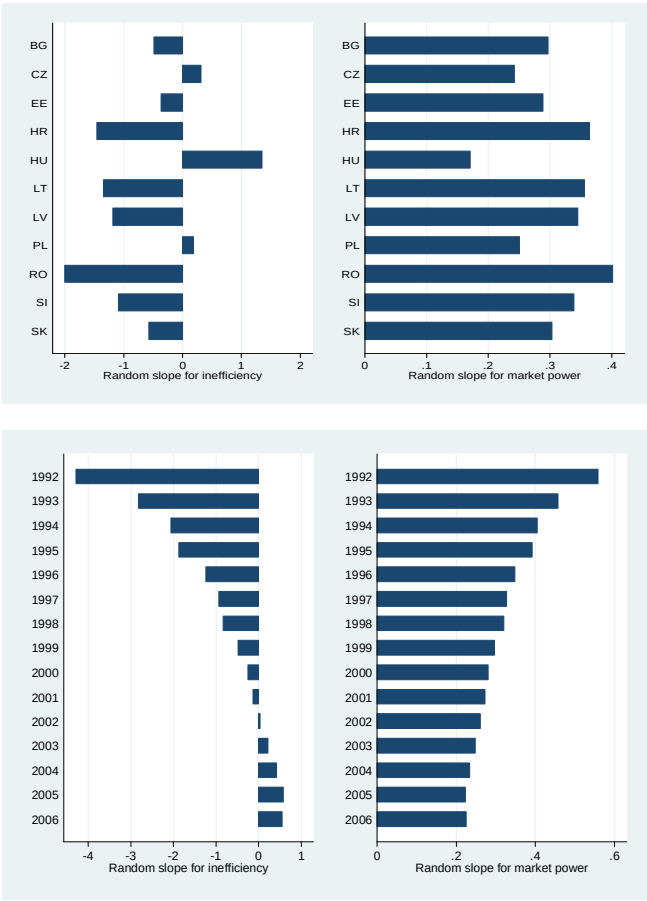

Figure 3.1. Model 1: Average values of inefficiency (β_{1jt}) and market power (β_{2jt}) coefficients across countries and over time

Notes: BG - Bulgaria, CZ - Czech Republic, EE - Estonia, HR - Croatia, HU - Hungary, LT - Lithuania, LV - Latvia, PL - Poland, RO - Romania, SI - Slovenia, SK - Slovakia.

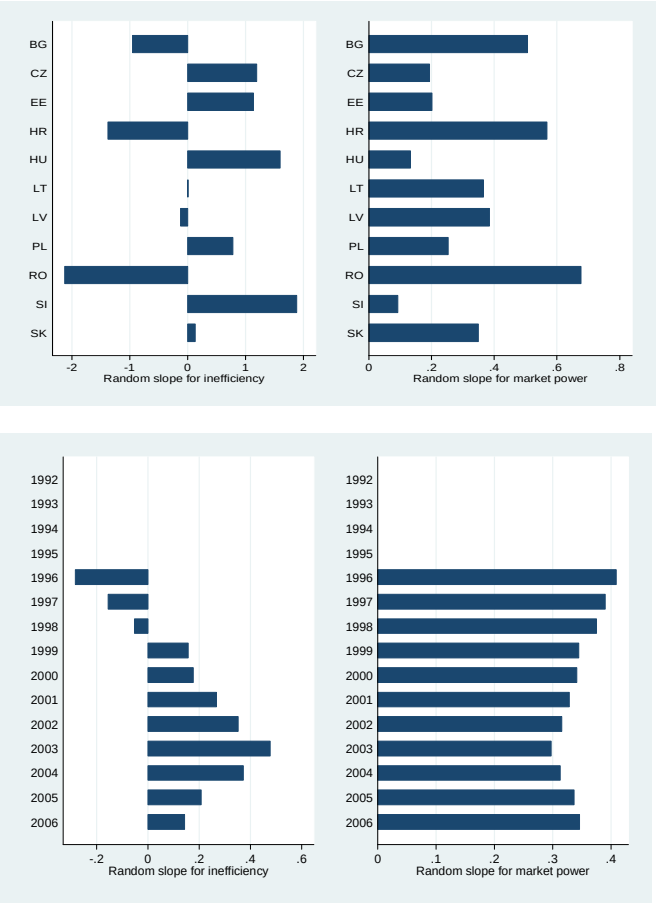

Figure 3.2. Model 2: Average values of inefficiency (β_{1jt}) and market power (β_{2jt}) coefficients across countries and over time

Notes: BG - Bulgaria, CZ - Czech Republic, EE - Estonia, HR - Croatia, HU - Hungary, LT - Lithuania, LV - Latvia, PL - Poland, RO - Romania, SI - Slovenia, SK - Slovakia.