Essays on foreign ownership in transition banking

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Chapter 4

Heterogeneity of Technological Regimes and Bank Efficiency

4.1 Introduction

Given the key role of banks as financial intermediaries in the process of transformation from a plan to a market economy, empirical assessment of efficiency of banking institutions in former socialist economies (FSE) has been given considerable attention in the recent empirical literature. Table 4.1 provides a brief overview of these studies, which share several common features. First, all of them are based on the efficiency frontier methodology, according to which each bank's performance is benchmarked against a frontier reflecting the characteristics of the best-performing banks in the sample.[1] Most of the studies employ stochastic frontier analysis (SFA), a parametric method that is less sensitive to the measurement errors in the sample, relative to the alternative non-parametric method, the data envelopment analysis

[1] Coelli et al. (2005) contains a textbook exposition of the efficiency frontier methodology. Berger and Mester (1997) and Hughes and Mester (2008) review applications of these methods in the banking industry.

(DEA). Next, efficiency analysis is conducted for two important measures of bank performance: costs and profits. In both cases, the variables determining technology of banks include the amount of outputs (such as loans, investments, other earning assets) and the level of input prices (such as cost of capital, labor, financial funds).[2] Finally, all studies assume that banks share a common production technology. In other words, production capacity of all banks are described by an identical production possibility frontier.

The aim of this chapter is to relax the latter restrictive assumption by allowing for multiple technology regimes, conditional on differences in economic environments in which banks operate. The main criticism of the homogenous technological regime assumption adopted by all studies reviewed in Table 4.1 is the potential bias in the frontier estimates and, thus, the obtained efficiency scores (Orea and Kumbhakar, 2004). Specifically, if the *true* technology is heterogenous, then the omitted technological differences might be inappropriately labeled as inefficiency in single-frontier estimations. Consequently, the measures of the impact of inefficiency determinants will be affected. Another drawback of the homogenous technological regime assumption is that it imposes restrictions on certain important characteristics of banking activity, such as technical progress and scale economies.

There are several approaches how one can deal with the impact of technological differences. One approach is to include country-specific environmental variables that are likely to influence technologies of banks, such as the level of economic development and institutional background, as additional explanatory variables in the frontier (Berger, 2007). In fact, most of the cross-country studies reviewed in Table 4.1 augment the frontier by country-specific variables (Fries and Taci, 2005, Bonin

[2] In most studies, the theoretical foundation for the choice of frontier determinants is either the intermediation approach (Sealey and Lindley, 1977) or the modified production approach (Berger and Humphrey, 1991).

et al., 2005, Yildirim and Philippatos, 2007, Poghosyan and Borovicka, 2007, Green et al., 2007). The main disadvantage of this approach is that the introduction of the environmental variables only affects the intercept of the frontier specification, leaving the slope parameters unaffected (Bos and Schmiedel, 2007). Thus, although more flexibility in intercepts may partially alleviate the bias in inefficiency estimates (Valverde et al., 2007), the constancy of the slope parameters will still impose restrictions on technical progress and scale economies of banks. Another drawback of this approach is that technological differences are assumed to be country-specific, which rules out the possibility that banks located within the same country may employ different business models.

An alternative approach to alleviate the impact of technological differences is a priori sample restriction. The sample restriction can be based, for instance, on the organizational structure of banks (Mester, 1993, Altunbas et al., 2001), or their geographical location (Mester, 1996, Bos and Schmiedel, 2007). The main disadvantage of this approach is that a priori restriction of sample groups is to some extent arbitrary. For instance, Koetter and Poghosyan (2009) show that even banks having similar organizational structure can operate under different technological regimes.

In this study, we account for differences in technological regimes using a latent class stochastic frontier analysis (LCSFA), which addresses the disadvantages associated with the aforementioned alternative approaches (Orea and Kumbhakar, 2004, Greene, 2005).[3] Unlike the first approach, the impact of the environmental factors is not only reflected in the magnitude of the intercepts, but also affects the slope coefficients. Here, the environmental variables enter as latent class determinants rather than as a part of the frontier and thus influence both estimates of the technological regime of banks and their efficiency simultaneously. Unlike the second approach, the

[3] To our best knowledge, this is the first application of the LCSFA for studying efficiency of banks in FSE.

latent class method does not require a priori grouping of banks. Instead, it utilizes all information available in the sample and identifies separate technological regimes based on the maximum likelihood principle.

Our estimations suggest that banks in FSE operate under three distinct technological regimes. Not only do we observe technological differences between new EU member FSE countries and the rest, but also technological regimes differ within the new EU members. Differences in technological regimes also have implications for the impact of foreign bank participation on bank efficiency. In line with the findings in Chapter 3, we show that foreign bank participation improves efficiency of banks located in the new members of European Union, with a relatively high level of economic development, while the impact of foreign ownership on banks in less developed CIS countries is ambiguous.

The remainder of this chapter is structured as follows. The next section presents the LCSFA model and estimation details. A data description is provided in section 3, while the estimation results are reviewed in section 4. The last section concludes.

4.2 Accounting for Heterogeneity of Banking Technologies: A Latent Class Stochastic Frontier Model

In our LCSFA model, we assume that the technology is represented by a cost function in the translog form. Following Orea and Kumbhakar (2004), the translog cost function for class j may be written as:

$$\ln C_{it} = \ln C(y_{it}, w_{it}, t; \beta_k) + u_{it|k} + v_{it|k}, \tag{4.1}$$

where subscripts $i = 1,...,N$, $t = 1,...,T_i$, and $k = 1,...,K$ stand for bank, time, and class, respectively; C_{it} is individual bank total cost; y_{it} and w_{it} indicate vectors of outputs and input prices; and β_k is a class-specific vector of parameters to be estimated. The two-sided random error term $v_{it|k}$ is assumed to be independent of the non-negative cost inefficiency variable $u_{it|k}$ for each class.

To estimate the model using maximum likelihood we assume that the random error term for class k ($v_{it|k}$) follows a normal distribution with zero mean and constant variance, σ^2_{vk}. In addition, the inefficiency term for class k ($u_{it|k}$) is assumed to be a product of a time-invariant individual bank effect, $u_{i|k}$ and a parametric function of time and other explanatory variables (inefficiency determinants), λ_{it}. The $u_{i|k}$ term is assumed to have a non-negative truncated normal distribution with zero mean and variance, σ^2_{uk}.

Similarly to Orea and Kumbhakar (2004), we specify the inefficiency variable $u_{it|k}$ in general form as:

$$u_{it|k} = \lambda_{it}(\eta_k)u_{i|k} = exp(z'_{it}\eta_k)u_{i|k}, \tag{4.2}$$

where $u_{i|k} \geq 0$; $\eta_k = (\eta_{1k},...,\eta_{Hk})'$ is a $H \times 1$ vector of parameters and $z_{it} = (z_{1it},...,z_{Hit})'$ is a $H \times 1$ vector of inefficiency determinants, including the Battese and Coelli (1992) trend specification: $z_{it} = (T - t)$, where $T = max(T_i)$ is the final time period in the panel.

The conditional likelihood function for bank i at time t can be written (see Greene, 2005) as:

$$\ln LF_{it}(\theta_k) = \frac{\Phi\left(-\varepsilon_{it|k}\frac{\sigma_{uk}}{\sigma_{vk}\sqrt{\sigma^2_{vk}+\sigma^2_{uk}}}\right)}{\Phi(0)} \frac{1}{\sqrt{\sigma^2_{vk}+\sigma^2_{uk}}}\phi\left(\frac{\varepsilon_{it|k}}{\sqrt{\sigma^2_{vk}+\sigma^2_{uk}}}\right), \tag{4.3}$$

where $\varepsilon_{it|k} = u_{it|k} + v_{it|k}$ is the compounded disturbance term; $\theta_k = (\beta_k, \sigma^2_{vk}, \sigma^2_{uk}, \eta_k)$

are parameters describing the technology of banks belonging to class k; $\Phi(.)$ and $\phi(.)$ are standard normal cumulative and density functions, respectively. Following Greene (2005), we assume that bank observations are independent over time, thus the overall contribution of bank i to the conditional likelihood can be derived using a product of likelihood functions: $LF_{ik}(\theta_k) = \prod_{t=1}^{T_i} LF_{it}(\theta_k)$.[4]

The unconditional likelihood of bank i is obtained as a weighted sum of the k-class likelihood functions. The weights are the class membership probabilities reflecting the uncertainty regarding the true membership in the sample. A convenient way to parameterize the class probabilities is to employ a multinomial logit model:

$$P_{ik}(\delta_k) = \frac{exp(\delta_k' q_i)}{\sum_{k=1}^{K} \exp(\delta_k' q_i)}, \tag{4.4}$$

where $k = 1, ..., K$ denote classes; $\delta_K = 0$ is a parameter normalization for the reference class and q_i is a vector of bank-specific and time-invariant class determinants. Using weights P_{ik} from equation (4.4), the unconditional likelihood for bank i can be written as:

$$LF_i(\theta, \delta) = \sum_{k=1}^{K} LF_{ik}(\theta_k) P_{ik}(\delta_k), \tag{4.5}$$

where $0 \leq P_{ik} \leq 1$ and $\sum_{k=1}^{K} P_{ik} = 1$. Combining (4.3) and (4.4) results in an overall likelihood function of parameters θ and δ:

$$\ln LF(\theta, \delta) = \sum_{i=1}^{N} \ln LF_i(\theta, \delta) = \sum_{i=1}^{N} \ln \left\{ \sum_{k=1}^{K} LF_{ik}(\theta_k) P_{ik} \delta_k \right\}. \tag{4.6}$$

Notice that to identify the parameters of latent class probabilities, the sample has to be generated from different technological regimes in which the banks are oper-

[4] It is important to notice that the inefficiency term $u_{it|k}$ is a deterministic function of time, i.e., $u_{it|k} = \lambda_{it}(.) u_{i|k}$.

ating. Hence, the number of classes K determined by the means of information criteria should not exceed the number of true regimes in the sample, otherwise the parameters cannot be identified.

Unlike the standard stochastic frontier approach, where the cost frontier is the same for each bank, in the latent class stochastic frontier model we estimate several frontiers equal to the number of classes. How can the inefficiency term be estimated now that there are several benchmarks? One possibility is to assign class membership for an individual bank based on the highest probability and, consequently, use the stochastic frontier estimated for that class as a benchmark against which the inefficiency can be computed. However, this approach imposes arbitrary class membership, while the posterior probabilities of class membership are far from certain. An alternative approach, used by Greene (2005), is based on the weighted average of the inefficiency terms:

$$\ln EF_{it} = \sum_{k=1}^{K} P(k|i) \ln EF_{it}(k), \tag{4.7}$$

where $P(k|i)$ is the posterior probability of class-k membership for bank i; and $EF_{it}(k)$ is the bank's efficiency using class-k technology as a reference. In this case, technologies from every class are taken into account in estimating the overall efficiency.

4.3 Data

We use bank-level data for various FSE, including both former Soviet republics and Central and Eastern European countries, for the 1995-2005 period. The bank-level data is extracted from financial reports (balance sheets and income statements) available though the BankScope database of Bureau van Dijk.[5] The data set is

[5] To alleviate the impact of randomness in our estimation outcomes, we restrict the data set to those banks which are present in the sample for 5 or more years in a row.

complemented by historical ownership information collected from individual bank web-pages and from the EBRD internal database.[6] The resulting sample covers information on banks from the following twenty countries: Albania (AL), Armenia (AZ), Azerbaijan (AZ), Bulgaria (BG), Bosnia and Herzegovina (BY), Czech Republic (CZ), Estonia (EE), Georgia (GE), Croatia (HR), Hungary (HU), Kazakhstan (KZ), Lithuania (LT), Latvia (LV), Moldova (MD), Poland (PL), Romania (RO), Russia (RU), Slovenia (SI), Slovakia (SK), and Ukraine (UA).

The latent class stochastic frontier model described in the previous section requires three sets of variables determining (i) the stochastic frontier (C_{it},y_{it},t,w_{it}), (ii) the inefficiency term (z_{it}), and (iii) the class membership (q_{it}). 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 produce their services using two inputs, physical capital and labor. Accordingly, the price of the 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 ($w_{2,it}$).[7] The dependent variable in the frontier is the total cost of banks (c_{it}), which includes both interest and operating expenses.

The inefficiency term is measured as a function of the following determinants z_{it}.[8] The first determinant is the foreign ownership dummy variable ($FOREIGN$). This variable takes a value of one if more than 50% of bank capital is owned by foreigners. The coefficient of this variable enables testing the relative efficiency hypothesis of banks depending on their ownership structure. The second determinant

[6] We thank Anita Taci from the EBRD for kindly sharing her data set.

[7] In the absence of a reliable information on the number of bank employees, it has become customary in the literature to proxy labor costs by deflating labor expenses over total assets (see, for instance, Fries and Taci, 2005 or Rossi et al., 2004).

[8] The selection of inefficiency determinants assumes that these variables can be influenced by the decision of bank managers. The environmental variables that are out of control of bank managers are expected to influence the technology regimes of banks.

is the interest rate margin ($MARGIN$), which we incorporate as a measure of market power enjoyed by a particular bank. The coefficient of this variable explains the relationship between market structure and bank efficiency. Finally, the third determinant is the Battese and Coelli (1992) time trend variable ($TIME$). This specification assumes that the inefficiency term is either increasing, or decreasing, or staying constant over time.

To account for possible heterogeneity due to different production technologies we employ four country-specific variables q_{it} as latent class determinants: progress in financial sector reforms proxied by the index of banking sector reforms ($BSRF$), progress in market liberalization reforms proxied by the index of economic freedom ($FRDM$), the level of GDP expressed in US dollars (GDP), and the interbank rate ($RATE$).[9] All these variables are not controlled by bank managers, but can potentially influence the banking technology. They have been employed in previous studies either as variables shifting the cost frontier, or influencing the inefficiency term. The novelty of our approach is that, instead of imposing a structural relation between these variables and the cost frontier, we test whether banking technology varies across countries with different characteristics using the maximum likelihood principle.

Descriptive statistics of variables employed in our estimations are displayed in Table 4.2. The decomposition of statistics across different countries shows that there is a great deal of variation in terms of total costs, outputs, and input prices. In most cases, the new EU member countries are characterized by relatively higher costs accompanied by larger outputs and input prices. These countries are also the lead-

[9] All variables are time invariant and measured as average values per country (see also equation (4.4)). The index of economic freedom is measured on a yearly basis by the Heritage Foundation and covers a wide range of economic areas, including business, trade, monetary and fiscal policies, property rights, corruption etc. More detailed information about the index is available at: http://www.heritage.org/research/features/index/.

ing performers in terms of banking sector reforms. Whether superior institutional characteristics can influence banking technology is the question we investigate in the next step.

The final specification of our latent class cost frontier model takes the following form:

$$\begin{aligned}\ln\frac{c_{it}}{w_{it,1}} &= \alpha_{ik}+\sum_{s=2}^{S}\beta_{sk}\ln\frac{w_{it,s}}{w_{it,1}}+\sum_{l=1}^{L}\gamma_{lk}\ln y_{it,l}+\frac{1}{2}\sum_{s=2}^{S}\sum_{l=2}^{S}\delta_{slk}\ln\frac{w_{it,s}}{w_{itk,1}}\ln\frac{w_{it,l}}{w_{it,1}}+\\ &+\frac{1}{2}\sum_{s=1}^{L}\sum_{l=1}^{L}\psi_{slk}\ln y_{it,s}\ln y_{it,l}+\sum_{s=2}^{S}\sum_{l=1}^{L}\theta_{slk}\ln\frac{w_{it,s}}{w_{it,1}}\ln y_{it,l}+\\ &+\rho_{1k}t+\frac{1}{2}\rho_{2k}t^2+\sum_{s=2}^{S}\rho_{sk}^{w}t\ln\frac{w_{it,s}}{w_{it,1}}+\sum_{l=1}^{L}\rho_{lk}^{y}t\ln y_{it,l}+v_{it|k}+u_{it|k}, \quad (4.8)\end{aligned}$$

where index $k = 1, ..., K$ expresses class membership. The inefficiency term for each class is measured using a fixed effects estimator (α_{ik}), while linear homogeneity restrictions are satisfied by expressing all variables in terms of a ratio with respect to one of the input prices (capital costs). Inefficiency is modeled as a function of its determinants:

$$u_{it|k} = exp[\eta_{1k}FOREIGN + \eta_{2k}MARGIN + \eta_{3k}(T-t)]u_i, \quad (4.9)$$

where T is the last period in the sample. The latent class probabilities are specified as:

$$P_{ik}(\delta_k) = \frac{exp[\delta_{0k}+\delta_{1k}GDP+\delta_{2k}BSRF+\delta_{3k}NMS]}{\sum_{k=1}^{K} exp[\delta_{0k}+\delta_{1k}GDP+\delta_{2k}BSRF+\delta_{3k}NMS]}. \quad (4.10)$$

4.4 Estimation Results

4.4.1 Selection of the number of classes

In estimating equations (4.8), (4.9), and (4.10) one needs to evaluate the appropriate number of classes K. A customary way of selecting the number of classes is to draw on the information criteria. We have computed BIC (Schwartz's criterion) statistic for up to three classes.[10] The statistic increases with number of classes, which suggests that the preferred model is the one with three latent classes (see Table 4.3).[11]

To cross-check the class size selection from the inefficiency term point of view, we estimate the model for one, two, and three classes and compare the average efficiency scores for each of these models. As can be observed from Table 4.4, the average efficiency monotonically increases with the number of classes. This relationship implies that the country-specific heterogeneity in banking technologies, if not taken into account, would lead to downward-biased efficiency score estimates.

The high posterior class probabilities (around 90% on average) reported in Table 4.3 suggest that the country-specific variables chosen as class determinants in our estimations provide quite a precise group classification. Therefore, classification of banks into three groups according to their maximum probabilities can be performed with pretty high level of confidence.

[10] The BIC statistic can be written as: $BIC(K) = 2\ln LF(K) - \Pi(K)\ln\left(\sum_{i=1}^{N} T_i\right)$, where K is the number of latent classes, $\Pi(K)$ is the number of parameters to estimate for specification with K latent classes and T_i is the number of observations for bank i. The best model is the one with the highest BIC statistic.

[11] Models with more than three latent classes are overspecified and could not be estimated using the maximum likelihood methodology.

4.4.2 Parameter estimates and analysis of class-specific efficiency scores

Estimates of class-specific parameters are displayed in Table 4.5. In most cases, the parameters representing the efficiency frontiers are significant at conventional confidence levels. However, the individual coefficients do not have an economic meaning. Instead, one has to estimate auxiliary measures based on the estimated frontier parameters to provide an economic interpretation of the estimation outcomes. The first measure is technical progress, which in our case is assumed to be an exogenous variable proxied as a function of time. The derivative of total costs with respect to time ($\partial \ln C / \partial t$) calculated at sample means thus measures the change in banking production technology following innovations not explained by outputs and income prices. A negative sign for this measure implies technological progress (decrease in bank costs over time). We find that banks in the second and third classes exhibit technological progress, while the first class is characterized by a frontier with increasing bank costs over time.

The second measure is the returns to scale estimated as one minus the sum of elasticities of total costs with respect to outputs ($RTS = 1 - \sum_k \partial \ln C / \partial \ln y_k$). For constant returns to scale technology, this measure should be equal to zero. A negative measure implies that banks are operating at the decreasing returns to scale part of the cost function. Our estimation results suggest that all three technological regimes exhibit decreasing returns to scale technology, although with different degrees of intensity.

Average cost efficiency estimates for different classes reported in Table 4.6 show that the first class represents banks with the highest efficiency scores (80.3%), while the second class represents the worst performing banks (72.8%). The majority of banks, representing 46% of the sample, are characterized by an average efficiency

level (73.3%) and clustered in the third class.

Estimates for the class determining variables reported in Table 4.5 imply that the first class represents banks from small countries with relatively high interest rates compared to the third class, while the second class represents banks from countries with a high level of economic freedom and high interest rates.

4.4.3 Economic interpretation of heterogeneous technologies

The next step in our investigation is to search for a pattern between class-membership of banks and their country of origin. We assign observations for each of the countries under research to the three classes based on their maximum probabilities (see Table 4.7). As already mentioned before, the possible imprecision in doing this is low given very large posterior class membership probabilities (about 90% on average).

The results suggest that five out of the eight new EU member countries are assigned to the (average performing) third class, and the rest is classified to the worst performing second class. Although these classes are not characterized by high efficiency levels, they exhibit positive technological progress over time. This result is remarkable, since it implies that banks in new EU member countries may have benefited from spillover effects coming from core EU countries and enjoyed technological progress. However, EU membership did not result in improvement of the efficiency of the banking system as a whole.

On the contrary, banks from many former Soviet republics with a low level of economic development are assigned to the best performing first class. Although relatively more efficient, the first class is also the one that does not exhibit technological progress. Thus, our results suggest that there seems to be a tradeoff between efficiency of the banking sector and technological progress in the banking industry.

The impact of inefficiency determinants also varies across classes. Foreign-owned

banks are more efficient in countries assigned to the third class. However, this variable is not significant in other classes. This finding should be interpreted with care, since it might be biased due to sample selection (Berger, 2007, Poghosyan and Borovicka, 2007).

Finally, banks with a higher interest margin (i.e., banks with more market power) are more efficient than banks belonging to the third class. This finding indicates efficiency-enhancing effect of consolidation of the banking sector in countries belonging to this class. Market structure is not a significant determinant of inefficiency in other classes.

4.5 Conclusions

This study provides evidence on the heterogeneity of technology regimes in FSE banking. Using a novel LCSFA methodology, we show that environmental variables, such as the level of economic development, progress in economic reforms, and institutional background, have an important influence on the technology regime employed by banks. Our analysis suggests that single-frontier methods employed in previous studies, which do not account for technological differences, result in an upward-bias of inefficiency estimates, since technological differences are mistakenly attributed to inefficiency.

We identify three distinct technology regimes, characterized by different levels of technological progress and scale economies. Further analysis of the results reveals the existence of a tradeoff between bank efficiency and technological progress. Banks in the new EU member countries exhibit a higher degree of technological progress, but lower efficiency levels, while former Soviet republics are largely characterized by efficient banking systems that do not show technological progress over time.

We also find that differences in technology regimes have implications for the

impact of foreign ownership on bank efficiency. In line with the results reported in Chapter 3, we find that foreign ownership has a positive impact on bank efficiency in FSE with a relatively higher level of economic development, such as some of the new EU members. On the contrary, foreign ownership does not have a significant influence on bank efficiency in most CIS countries, which are still lagging behind in terms of economic reform.

Overall, our results signify the importance of accounting for differences in technology regimes when analyzing bank efficiency in FSE. A failure to account for technological differences may lead to erroneous conclusions regarding various aspects of banking, including the impact of foreign ownership on bank efficiency.

Table 4.1. Overview of the literature

Authors	Sample/Countries	Methodology	Outputs	Inputs	Environmental variables	X-inefficiency type	Average X-inefficiency
Single-country studies							
Hasan and Marton (2003)	1993-1998 HU	SFA	total loans, total investments (other earning assets), noninterest or fee related income, total interest bearing borrowed funds	borrowed funds, labor	–	cost profit	29% 35%
Jemric and Vujcic (2002)	1995-2000 HR	DEA	total loans, short-term securities, interest and non-interest related revenues	borrowed funds, labor, capital	–	cost service provision	17% 34%
Kraft and Tirtiroglu (1998)	1994-1995 HR	SFA	total loans, total deposits	labor, capital, loanable funds	–	cost	24%
Nikiel and Opiela (2002)	1997-2000 PL	SFA	loans, securities	borrowed funds, labor	–	cost profit	39% 22%
Cross-country studies							
Weil (2003)	1997 PL, CZ	SFA	loans, investment assets	borrowed funds, labor, capital	country dummies, equity	cost	34%
Rossi, Schwaiger and Winkler (2004)	1995-2002 CZ, EE, HU, LV, LT, PL, RO, SK, SI	SFA	loans, deposits, other earning assets	labor, capital, deposits	fourier terms	cost profit	26% 57%
Fries and Taci (2005)	1994-2001 BG, HR, CZ, EE, MK, HU, KZ, LV, LT, PL, RO, RU, SK, SI, UA	SFA	loans, deposits	labor, capital	per capita GDP, interest rate, density of deposits per square kilometer, asset market concentration, share of foreign bank assets, intermediation ratio (loans/deposits)	cost	39%
Bonin, Hasan and Wachtel (2005)	1996-2000 CZ, HU, PL, SK, BG, HR, RO, SI, EE, LV, LT	SFA	loans, deposits, liquid assets and investments	borrowed funds, capital	year dummies, country dummies	cost profit	27% 42%
Grigorian and Manole (2006)	1995-1998 CZ, HU, PL, SK, SI, BG, HR, EE, LV, LT, RO, AM, BY, KZ, MD, RU, UA	DEA	deposits, revenues, net loans, liquid assets	labor, fixed assets, interest expenditures	none	service provision profit generation	52% 47%
Yildirim and Philippatos (2007)	1993-2000 CZ, EE, HR, HU, LV, LT, MD, PL, RO, RU, SI, SK	DFA, SFA	loans, investments, deposits	borrowed funds, labor, capital	equity	cost-DFA cost-SFA profit-DFA profit-SFA	28% 24% 34% 50%
Poghosyan and Borovicka (2007)	1995-2004 AL, AM, AZ, BG, BY, CZ, EE, GE, HR, HU, KZ, LT, LV, MD, MK, PL, RO, SI, SK, UA	SFA	loans, deposits	labor, capital	per capita GDP, interest rate, index of banking sector reforms, index of economic freedom	cost	45%
Green, Murinde and Nikolov (2007)	1995-1999 BG, HR, CZ, EE, HU, LV, LT, PL, RO	SFA	loans, other earning assets, non-interest income	borrowed funds, labor, capital	foreign bank entry dummy	cost	N/A

Notes: AL - Albania, AM - Armenia, AZ - Azerbaijan, BG - Bulgaria, BY - Bosnia and Herzegovina, CZ - Czech Republic, EE - Estonia, GE - Georgia, HR - Croatia, HU - Hungary, KZ - Kazakhstan, LT - Lithuania, LV - Latvia, MD - Moldova, MK - Macedonia, PL - Poland, RO - Romania, RU - Russia, SI - Slovenia, SK - Slovakia, UA - Ukraine.

Table 4.2. Descriptive statistics

	AL	AM	AZ	BG	BY	CZ	EE	GE	HR	HU	KZ	LT	LV	MD	PL	RO	RU	SI	SK	UA
Dependent variable																				
Total costs (c)	21.7	4.3	6.8	64.1	177.4	247.9	89.9	7.1	56.5	254.4	52.1	30.7	23.7	4.9	262	158.7	147.3	105.5	112.7	39.6
St. Dev.	35.3	2.7	13.2	21.7	401	417.6	94.3	6.4	103.9	373.6	79.6	37.4	31.7	3.6	408.3	347.3	640	156.3	138.5	67.4
Frontier variables																				
Total loans (y_1)	31.2	11.4	36.1	554.9	587.8	1274.0	670.6	27.8	370.9	1301.1	312.8	310.6	180.0	19.3	1173.5	313.2	738.0	685.9	521.4	158.8
St. Dev.	31.6	9.2	79.0	375.3	1415.6	2068.6	839.8	25.8	796.2	2015.8	599.4	557.5	355.1	17.0	1836.2	609.7	3423.6	1123.3	612.0	290.2
Total deposits (y_2)	319.9	31.2	69.5	874.1	880.3	2667.8	870.1	35.7	575.7	1963.8	357.9	452.0	317.7	25.6	2008.9	685.1	1189.4	1026.8	1211.6	221.2
St. Dev.	516.4	26.0	150.3	292.5	2415.2	4472.1	1101.5	38.7	1234.2	2821.7	538.7	729.3	478.4	22.6	3246.2	1271.5	5069.4	1521.5	1587.0	384.6
Cost of capital (w_1)	4.8	10.8	9.9	5.4	12.8	3.8	7.4	11.3	6.6	5.2	9.6	6.9	6.0	10.0	5.2	9.4	7.9	4.5	6.3	10.2
St. Dev.	4.5	7.4	5.3	0.3	4.1	4.6	3.3	3.3	4.6	2.9	4.3	3.1	3.6	3.5	2.1	5.6	4.4	1.2	15.9	6.0
Cost of labor (w_2)	0.01	0.03	0.02	0.01	0.04	0.01	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.03	0.02	0.01	0.03
St. Dev.	0.01	0.02	0.02	0.00	0.02	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.00	0.02
Inefficiency determinants																				
Foreign ownership (z_1)	0.8	0.7	0.1	1	0.4	0.7	0.7	0.5	0.3	0.8	0.2	0.6	0.4	0.3	0.6	0.6	0.2	0.3	0.8	0.4
St. Dev.	0.4	0.5	0.3	0	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.5
Interest margin (z_2)	4.4	12	7	6.2	10.4	2.8	5.5	15.7	5.3	5	7.4	4.7	4.4	11	4.9	9.4	8.3	3.8	3.4	10.1
St. Dev.	1.8	6.8	3.8	1	5.3	2.4	1.4	5.3	2.6	4	2.7	1.9	2.3	4.2	3.1	5.3	5.7	1.8	1.1	7.3
Class determinants																				
Banking sector reforms (q_1)	2.3	2.3	2.2	3.3	1.4	3.5	3.6	2.4	3.3	4.0	2.6	3.1	3.3	2.3	3.3	2.7	1.9	3.2	3.2	2.1
St. Dev.	0.2	0.0	0.1	0.3	0.4	0.3	0.2	0.1	0.4	0.0	0.3	0.1	0.4	0.2	0.1	0.2	0.2	0.1	0.3	0.1
Index of economic freedom (q_2)	2.6	2.9	2.1	2.8	1.9	3.7	3.8	2.4	2.6	3.4	2.2	3.4	3.4	2.7	3.2	2.5	2.3	2.9	3.1	2.2
St. Dev.	0.2	0.4	0.4	0.2	0.1	0.1	0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.3	0.2
GDP (q_3)	4779	2206	6071	18280	15446	70784	5701	3580	23264	62430	25665	14312	8694	2038	181882	47756	388107	22369	26079	43098
St. Dev.	1505	521	1415	4798	4168	18634	716	746	5119	18913	7506	4281	2472	569	32094	13249	110605	4590	7658	10473
Interest rate (q_4)	10.7	18.6	20.4	2.3	48.2	5.9	8.5	22.9	7.3	12.1	8.6	6.5	4.0	17.5	13.7	46.6	23.2	5.8	9.7	20.7
St. Dev.	5.7	10.1	2.0	1.1	30.9	4.5	6.1	9.6	4.5	3.4	6.5	2.6	1.5	8.9	6.6	39.2	12.3	1.9	6.6	18.4
Number of obs.																				
total	38	42	56	4	39	169	23	42	223	102	95	59	104	57	222	122	290	108	96	162
foreign-owned banks	31	29	7	4	16	122	15	19	67	84	23	34	44	18	139	79	51	28	72	64
Number of banks	7	6	9	1	7	26	4	7	34	16	16	9	16	9	34	19	64	17	16	28

Notes: AL - Albania, AM - Armenia, AZ - Azerbaijan, BG - Bulgaria, BY - Bosnia and Herzegovina, CZ - Czech Republic, EE - Estonia, GE - Georgia, HR - Croatia, HU - Hungary, KZ - Kazakhstan, LT - Lithuania, LV - Latvia, MD - Moldova, PL - Poland, RO - Romania, RU - Russia, SI - Slovenia, SK - Slovakia, UA - Ukraine.

Table 4.3. Selection of the number of classes

Number of classes	Number of parameters	Log-likelihood	BIC	Posterior class probability
1	21	-355.1	-866.3	0.880
2	43	-50.4	-420.5	0.933
3	65	109.0	-265.3	0.884

Notes: the table features SFA estimations for 1, 2, and 3 latent classes using 2,058 observations for the period 1995-2005. The BIC statistic is calculated as: $BIC(K) = 2\ln LF(K) - \Pi(K)\ln\left(\sum_{i=1}^{N} T_i\right)$, where K is the number of latent classes, $\Pi(K)$ is the number of parameters to estimate for specification with K latent classes and T_i is the number of observations for bank i (the best model is the one with the highest BIC statistic). The posterior class probability reflects the degree of precision with which banks were classified to classes (higher probability implies higher precision).

Table 4.4. Average efficiency scores for LCM with different number of classes

Year	SFA model with 3 latent classes	SFA model with 2 latent classes	SFA model with 1 latent class
1995	0.763	0.720	0.614
1996	0.743	0.720	0.694
1997	0.732	0.720	0.690
1998	0.742	0.720	0.694
1999	0.749	0.725	0.702
2000	0.747	0.720	0.708
2001	0.757	0.730	0.725
2002	0.755	0.730	0.730
2003	0.754	0.728	0.734
2004	0.750	0.726	0.737
Total	0.750	0.726	0.718

Notes: the table features average efficiency scores obtained for SFA models with 1, 2, and 3 latent classes using 2,058 observations for the period 1995-2005.

Table 4.5. LCM estimation results

	Class 1		Class 2		Class 3	
	Coeff.	**t-ratio**	**Coeff.**	**t-ratio**	**Coeff.**	**t-ratio**
Intercept	-1.4675	-1.6590	3.6120	1.4230	6.0129	8.1120
Total loans	-0.4614	-1.4420	-0.5235	-1.7140	-0.3826	-2.3950
Total deposits	1.3361	4.4810	1.6195	5.6780	1.2858	8.3210
Price of labor/Price of capital	0.3220	1.3430	-0.7347	-1.0480	-2.0698	-9.1420
Trend	0.2079	2.6980	-0.3123	-2.0310	-0.1247	-2.7020
(Total loans)^2	-0.0115	-0.8030	0.1523	7.5240	0.2118	15.4680
(Total loans)*(Total deposits)	-0.0337	-2.0630	-0.1160	-4.3260	-0.2417	-19.6840
(Total loans)*(Price of labor/Price of capital)	0.1033	2.0350	0.0860	1.5640	0.1606	6.2750
(Total loans)*Trend	0.0041	0.4070	0.0404	3.0700	0.0098	1.7280
(Total deposits)^2	0.1616	7.0920	0.0787	1.8540	0.3213	23.0500
(Total deposits)*(Price of labor/Price of capital)	-0.1360	-2.9180	-0.1113	-2.0450	-0.1705	-6.8540
(Total deposits)*Trend	-0.0163	-1.7040	-0.0371	-2.4780	-0.0277	-5.4910
(Price of labor/Price of capital)^2	0.1186	3.7120	0.2123	2.1090	0.4608	12.4120
(Price of labor/Price of capital)*Trend	-0.0334	-2.8140	0.0364	1.8890	0.0409	5.7570
(Trend)^2	0.0010	0.2080	0.0013	0.1490	-0.0028	-1.2340
Sigma	0.8206	3.0070	0.9741	32.7780	0.9211	27.1560
Lambda	0.1586	0.1130	3.3844	0.0020	0.1963	0.1140
Inefficiency determinants						
Intercept	-0.0706	-0.1050	-2.8224	-0.1510	0.2336	1.1020
Foreign ownership	0.1489	0.4560	-1.7880	-0.3040	-0.2696	1.7410
Interest margin	-0.0603	-0.6940	-0.7098	-0.2390	-0.0495	-2.1370
Trend	0.1349	6.3160	-0.0312	-1.6510	-0.0054	-0.6450
Class probability determinants						
Intercept	0.2983	0.1210	-9.1528	-3.3340	–	–
Banking sector reforms	0.6579	0.8930	0.1371	0.1980	–	–
Index of economic freedom	-0.3230	-0.3920	1.4317	1.9390	–	–
GDP (in USD)	-0.3423	-2.4300	0.1847	1.0830	–	–
Interbank rate	0.1243	2.6310	0.1393	2.9160	–	–
Auxiliary measures at data means						
Technological progress	0.02		-0.32		-0.04	
Returns to scale	-1.53		-0.27		-2.66	
Prior class probabilities at data means						
	0.30		0.24		0.46	

Notes: 2,053 observations for the 1995-2005 period. Dependent variable is $\ln \frac{C_{it}}{w_{it,1}}$.

Table 4.6. Comparison of efficiency scores

Year	Class-1	Class-2	Class-3	Average
1995	0.9512	0.7631	0.6691	0.7631
1996	0.8767	0.7941	0.6555	0.7429
1997	0.8429	0.6929	0.7092	0.7318
1998	0.8451	0.6805	0.7249	0.7420
1999	0.8353	0.7194	0.7201	0.7490
2000	0.8210	0.7107	0.7206	0.7471
2001	0.8096	0.7377	0.7393	0.7572
2002	0.7907	0.7365	0.7437	0.7548
2003	0.7760	0.7504	0.7435	0.7538
2004	0.7531	0.7498	0.7487	0.7502
Total	0.8029	0.7281	0.7331	0.7499

Notes: the table features average efficiency scores obtained for the SFA model 3 latent classes using 2,058 observations for the period 1995-2005. The classification of banks by classes is performed using the maximum probability principle (e.g., the bank is assigned to class 1 if the probability of being in class 1 is higher than probabilities obtained for classes 2 and 3).

Table 4.7. Assigning class membership

	Number of obs.				**Frequency**				
	Class-1	**Class-2**	**Class-3**	**Total**	**Class-1**	**Class-2**	**Class-3**	**Class membership**	**EU member**
AL	14		24	38	37%		63%	3	
AM	26	8	8	42	62%	19%	19%	1	
AZ	51		5	56	91%		9%	1	
BG			4	4			100%	3	
BY	22	17		39	56%	44%		1	
CZ	4	84	81	169	2%	50%	48%	2	YES
EE			23	23			100%	3	YES
GE	21		21	42	50%		50%	1/3	
HR	24	14	185	223	11%	6%	83%	3	
HU	30	41	31	102	29%	40%	30%	2	YES
KZ	17	11	67	95	18%	12%	71%	3	
LT	4		55	59	7%		93%	3	YES
LV	23	14	67	104	22%	13%	64%	3	YES
MD	33		24	57	58%		42%	1	
PL	39	62	121	222	18%	28%	55%	3	YES
RO	63	59		122	52%	48%		1	
RU	41	102	147	290	14%	35%	51%	3	
SI	29	4	75	108	27%	4%	69%	3	YES
SK	12	48	36	96	13%	50%	38%	2	YES
UA	79	39	44	162	49%	24%	27%	1	

Notes: AL - Albania, AM - Armenia, AZ - Azerbaijan, BG - Bulgaria, BY - Bosnia and Herzegovina, CZ - Czech Republic, EE - Estonia, GE - Georgia, HR - Croatia, HU - Hungary, KZ - Kazakhstan, LT - Lithuania, LV - Latvia, MD - Moldova, PL - Poland, RO - Romania, RU - Russia, SI - Slovenia, SK - Slovakia, UA - Ukraine.

to the system approach used in Shaffer (1989). For this purpose, these studies assume that the marginal cost (C_{L_i}) in equation (5.7) is a linear function of bank output (L_i) and input prices (w). This assumption, however, is not innocuous. It disregards the cost efficiency of banks, which was found to be an important determinant of net interest margins in several recent studies (see, for instance, Maudos and Fernandez de Guevara, 2004). More efficient banks have the opportunity to operate with a lower margin due to the gains from the less expensive conduct of intermediation activities. Therefore, the analysis in this paper improves upon previous work by explicitly taking cost efficiency of banks into account when evaluating their marginal costs. The next subsection provides the details of our empirical approach.

5.2.2 Empirical methodology

The empirical assessment of the market power possessed by domestic and foreign banks in at least one of the markets (loan or deposit) is based on the estimation of the equation (5.7), which can be represented in terms of a linear model:

$$r_{L_{it}} = \beta_0 + \beta_1 \tilde{r}^d_{D_{it}} + \beta_2(\tilde{r}^d_{D_{it}} * D^{GF}) + \beta_3(\tilde{r}^d_{D_{it}} * D^A) + \beta_4 C_{L_{it}}, \tag{5.8}$$

where indices i and t denote bank and time, respectively, $r_{L_{it}}$ is the implicit loan rate, $\tilde{r}^d_{D_{it}} = \frac{r^d_{D_{it}}}{1-\rho_i}$ is the implicit deposit rate adjusted for the impact of financial taxation,[11] D^{GF} and D^A are dummy variables for foreign greenfield and acquired banks, and $C_{L_{it}}$ is the marginal cost of producing an extra unit of output for bank i at time t. Abstracting from interaction terms, a value of coefficient β_1 significantly larger than one would indicate the presence of market power in at least one of the

[11] The level of financial taxation ρ_i is an approximate measure, which serves only as a guideline for banks in their intermediation activities. In reality, banks often hold excess reserves in their accounts at the central bank for liquidity reasons. In addition, banks borrow money from the central bank in case their reserves are not sufficient to fulfill the reserve requirements set up by the regulators. In the empirical estimations, we use country-specific reserve requirements information from the international survey on banking regulation available in Barth et al. (2008).

markets (loans or deposits) for the whole banking industry, including both domestic and foreign banks. Introduction of the interaction terms allows to identify whether the extent of market power differs between domestic and foreign banks. For instance, a significantly negative (positive) coefficient β_2 would suggest that market power of foreign greenfield banks is lower (higher) than market power of domestic banks. The magnitude and sign of the coefficient β_3 can be interpreted in a similar way.

To carry out an estimation of equation (5.8), one needs to introduce a measure of marginal costs. Instead of pursuing the strategy of Barajas et al. (1999) and Vera et al. (2007) and proxying the linear relationship between marginal costs and their underlying factors in an *ad hoc* way, the marginal costs are obtained directly from the data using the stochastic efficiency frontier methodology.[12] The advantage of this approach is that it explicitly takes the impact of the cost efficiency of banks on the marginal cost of producing an additional unit of output into account. By including the *inefficiency-free* measure of marginal costs, we also control for the possible relationship between market power of banks and their efficiency.[13] In addition, using information on the timing of cross-border bank acquisitions, we are able to evaluate whether domestic banks taken over by foreigners improve their operational efficiency after the acquisition or not.

Consistent with the intermediation model described above, let us assume that banks produce one unit of output (L) using labor, capital and borrowed funds as inputs. Let w_1, w_2 and w_3 denote the prices of labor, capital and borrowed funds. To capture the technological progress experienced by banks in CEECs during the

[12] A comprehensive textbook exposition of the stochastic efficiency frontier methodology can be found in Kumbhakar and Lovell (2000) and Coelli et al. (2005).

[13] Efficiency of banks can affect their pricing strategy. For example, more cost efficient banks incur lower marginal costs and can set lower prices compared to the less cost efficient banks. Application of the *inefficiency-free* measure of marginal costs makes it possible to compare the market power parameters (measured as a relative wedge between prices and marginal costs) across banks with different efficiency levels.

last decade,[14] a time trend (*Trend*) is introduced among the determinants of the cost frontier. In line with previous cross-country studies, we also control for possible shifts in the cost frontiers across countries due to differences in macroeconomic conditions and institutional backgrounds by introducing country-specific (C_n) and time-specific (T_m) dummy variables. The final translog specification of the cost function for the stochastic frontier analysis takes the following form:[15]

$$\begin{aligned}
\ln \frac{C_{it}}{w_{it,1}} &= \alpha_{i0} + \alpha_1 \ln L_{it} + \alpha_2 \ln\left(\frac{w_{it,2}}{w_{it,1}}\right) + \alpha_3 \ln\left(\frac{w_{it,3}}{w_{it,1}}\right) + \alpha_4 Trend + \\
&+ \delta_{11}\frac{1}{2}\left(\ln L_{it}\right)^2 + \delta_{12} \ln L_{it} \ln\left(\frac{w_{it,2}}{w_{it,1}}\right) + \delta_{13} \ln L_{it} \ln\left(\frac{w_{it,3}}{w_{it,1}}\right) + \delta_{14} \ln L_{it} Trend + \\
&+ \gamma_{11}\frac{1}{2}\left(\ln\left(\frac{w_{it,2}}{w_{it,1}}\right)\right)^2 + \gamma_{12} \ln\left(\frac{w_{it,2}}{w_{it,1}}\right) \ln\left(\frac{w_{it,3}}{w_{it,1}}\right) + \gamma_{13} \ln\left(\frac{w_{it,2}}{w_{it,1}}\right) Trend + \\
&+ \theta_{11}\frac{1}{2}\left(\ln\left(\frac{w_{it,3}}{w_{it,1}}\right)\right)^2 + \theta_{12} \ln\left(\frac{w_{it,3}}{w_{it,1}}\right) Trend + \rho_{11}\frac{1}{2}(Trend)^2 + \\
&+ \sum_{n=1}^{N} \phi_n C_n + \sum_{m=1}^{M} \phi_m T_m + u_{it} + v_{it}, \qquad (5.9)
\end{aligned}$$

where α_{i0} captures individual bank random effects, $v_{it} \sim N(0, \sigma_v^2)$ is the i.i.d. error term and $u_{it} = B_t u_i$ is the positive inefficiency term varying across banks and over time, which is composed of two parts: a non-stochastic positive time component, $B_t > 0$, that is time-varying but the same for all banks and a stochastic individual component, $u_i \sim N^+(\mu, \sigma_u^2)$, which follows a truncated normal distribution with a conditional mean parameter μ. The inefficiency term can be expressed in a general form as:

$$u_{it} = exp(\eta' Z_{it}) u_i, \qquad (5.10)$$

where Z_{it} is a vector of factors affecting bank efficiency and η is a vector of parame-

[14] See Fries and Taci (2005), Bonin et al. (2005) and Poghosyan and Borovicka (2007) for the recent empirical evidence of the impact of technological progress in transition banking.

[15] This formulation takes into account the adding-up and symmetry restrictions imposed by theory. In addition, the linear homogeneity restriction is satisfied by deflating costs and the second input price by the first input price.

ters. We use several determinants of bank efficiency. First, the efficiency is modeled as a function of time using the specification of Kumbhakar and Wang (2005): $(t - \underline{t})$, where $\underline{t}$ is the beginning of the sample. A significant positive (negative) parameter estimate of this variable would indicate that over the whole sample period, efficiency of banks in CEECs has deteriorated (improved). Since the sample period was marked by increased foreign bank participation, the coefficient of this variable can be interpreted in terms of the overall impact of foreign bank participation on bank efficiency in CEECs. Next, in order to discern the differences in cost efficiency across domestic and foreign banks, we introduce dummy variables for foreign greenfield (D^{GF}) and foreign acquired banks (D^{A}) into the inefficiency specification (5.10). A significant positive (negative) coefficient of these dummy variables would indicate that the post-entry efficiency of the corresponding foreign-owned banks is on average lower (higher), in comparison to their peers. Finally, in a separate set of estimations, we introduce current and lagged dummy variables for the year when the domestic bank was taken over in order to evaluate the dynamic effect of cross-border bank acquisitions on the banks' performance.

Using results from the stochastic frontier model, the estimate of the marginal cost term for bank i at time t ($\hat{C}_{L_{it}}$) is obtained through the partial derivative of the translog function:

$$\hat{C}_{L_{it}} = \frac{C_{it}}{L_{it}} \frac{\partial \ln C_{it}}{\partial \ln L_{it}} = \frac{C_{it}}{L_{it}} \left[\hat{\alpha}_1 + \hat{\delta}_{11} \ln L_{it} + \hat{\delta}_{12} \ln \left(\frac{w_{it,2}}{w_{it,1}} \right) + \hat{\delta}_{13} \ln \left(\frac{w_{it,3}}{w_{it,1}} \right) + \hat{\delta}_{14} Trend \right]. \tag{5.11}$$

The marginal cost term $\hat{C}_{L_{it}}$ is adjusted for the influence of bank inefficiency and can enter as an explanatory variable in equation (5.8). Using the generated regressor $\hat{C}_{L_{it}}$ on the right hand side of (5.8) will influence the efficiency of the coefficient esti-

mates due to the biased standard errors (see Pagan, 1984). Therefore, the standard errors of the coefficient estimates are bootstrapped using 2000 replications to ensure the robustness of our results.[16]

5.3 Data Description

The main source for the bank-specific information is the BankScope database of Bureau Van Dijk, from which the information on individual banks operating in 11 CEECs (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) is retrieved for the 1992-2006 period. The data set contains information on balance sheets and income statements of 364 commercial, cooperative and savings banks.[17] Unfortunately, BankScope does not provide historical information on bank ownership, which is crucial for our analysis. Therefore, we utilize the information on foreign-owned banks for the years 1992-2004 from the extended data set of De Haas and Van Lelyveld (2006) employed in Havrylchyk and Jurzyk (2008).[18] This data set categorizes foreign-owned banks into two groups: greenfield establishments and banks taken over as a result of a cross-border acquisition. For the remaining two years, we update the missing foreign ownership information using a list of cross-border bank acquisitions from Securities Data Company (SDC) mergers and acquisitions database produced by Thompson Financial. From this source, data on completed (effective) cross-border acquisitions are extracted (i.e. parents of bidder and target banks have different countries of origin), which involve target banks from CEECs and that result in the control of ownership by the bidder bank exceeding 50% of the total equity outstanding.

Table 5.1 displays the evolution of foreign bank entry into CEECs. The dominant

[16] The number of bootstrap replications is chosen based on the optimal criteria suggested by Andrews and Buchinsky (2000).

[17] We use unconsolidated statements of banks, replacing them by consolidated statements whenever information on unconsolidated statements is not available.

[18] We thank Emilia Jurzyk and Iman Van Lelyveld for kindly sharing their data on bank ownership.

mode of foreign entry in the initial stage of transition has been the establishment of greenfield subsidiaries. The number of greenfield banks has grown rapidly by the mid 1990's, remaining at comparable level afterwards. Cross-border acquisitions became a popular mode of entry after the mid 1990's, growing at an accelerating pace with EU enlargement. In the last year of the sample, the share of total banking system assets controlled by foreign banks amounted to 65.3%.[19] Decomposition of this share by the entry modes reveals that 15.1% of banking system assets is controlled by greenfield banks, while the remaining 50.2% is under control of foreign acquired banks.

Table 5.2 lists and describes the variables used and their sources. Before proceeding with the empirical analysis, observations with missing information in at least one of the variables listed in Table 5.2 are dropped. Furthermore, to tackle the influence of extreme observations and reporting errors, all variables are winsorized at the 1^{st} and 99^{th} percentiles.

Descriptive statistics of the resulting data set are reported in Table 5.3. The Table shows that foreign greenfield banks have lower scale of operations and incur lower costs in comparison to the foreign acquired and domestic banks. This is due to the fact that the main mission of greenfield banks is to serve their clients abroad, rather than to engage into full scale operational activities in CEECs. There is also high variation in terms of loan rates: domestic and foreign greenfield banks charge on average more for their loans that foreign acquired banks. However, the variation of deposit rates across banks is relatively modest. This observation can be explained by the fact that depositors find it easier to switch banks when discrepancy in deposit rates is high, while lending rates are to a large extent influenced by relationships of

[19] Difference between the share of total assets controlled by foreign-owned banks in the sample and the EBRD information reported in Figure 5.5 is due to the fact that BankScope does not cover all banks in the economy. In addition, our estimates refer to commercial, cooperative and savings banks only, while the EBRD data covers all banks in the country.

banks with their clients (Petersen and Rajan, 1994). Domestic and foreign banks also differ in terms of the riskiness of their loan portfolios: domestic and foreign acquired banks have higher loan-loss provision reserves relative to the foreign greenfield banks.

To sum up, the preliminary analysis of the descriptive statistics highlights apparent differences between domestic, foreign greenfield, and foreign acquired banks in terms of the scale of their operations, incurred costs, and riskiness. These differences may be related to different missions and strategies employed by these banks, reflected in their portfolio mix. However, the simple comparison made using summary statistics lacks theoretical argumentation and does not allow drawing firm conclusions regarding foreign bank entry effects on efficiency and market power. In the remainder of the paper, these issues are addressed using a more formal framework.

5.4 Estimation Results

5.4.1 Foreign bank entry and cost efficiency

The empirical approach for evaluating the impact of foreign entry on bank efficiency is based on the stochastic efficiency frontier methodology (SFA). We follow the intermediation approach widely used in the banking literature (Sealey and Lindley, 1977) and assume that banks are minimizing their costs given the optimal amount of earning assets to be generated, prices for inputs (labor, capital and financial resources) and technological constraints. Bank costs (C) are measured as the total operating expenses incurred by banks. Bank output (L) is proxied by the total earning assets in the bank's portfolio.[20] Following the literature on bank efficiency, labor prices are

[20] In a separate set of estimations, we subdivided bank output into two categories: total loans and total security holdings. We also did estimations using only total loans as an output. In both cases, the estimation results yielded qualitatively similar outcomes and are available upon request. The possible reason for the similar outcomes is the dominating share of total loans in total earning assets (about 90%) due to underdeveloped securities market in CEECs. Therefore, in the remainder of the text we refer to the total earning assets as bank output L and use terms total earning assets

measured as the ratio of personnel expenses to total assets (w_1), capital prices as the ratio of administrative expenses (other than personnel expenses) to total assets (w_2) and prices of borrowed funds as the ratio of interest expenses to a sum of total deposits and other funding (w_3). We control for the possible influence of environmental differences across countries (e.g., macroeconomic developments, institutional background) and over time (e.g., shocks common to all CEECs), by using country and time dummies.

The outcomes of the SFA model estimations are summarized in Table 5.4. The main focus of this analysis is the determinants of cost inefficiency, shown in the middle panel of the Table. Let us start by introducing time trend as inefficiency determinant in the specification (I). The negative significant coefficient of the trend variable suggests that efficiency of banks in CEECs has on average improved over time, which is in line with the evidence provided by Rossi et al. (2004). Increased foreign bank participation has possibly influenced this general efficiency improvement directly (through the higher efficiency of foreign banks) or indirectly (through the increased competition due to foreign entry and knowledge spillovers).[21]

In order to evaluate the direct impact of foreign bank participation, in specifications (II) and (III) dummy variables for foreign greenfield and foreign acquired banks are introduced. The estimation results suggest that foreign greenfield banks have higher efficiency than domestic and foreign acquired banks. Introducing both dummy variables simultaneously as inefficiency determinants in the specification (IV) does not alter this result. This finding has important policy implications: it highlights the importance of the entry mode on the performance of foreign banks. It

and total loans interchangeably.

[21] In a separate set of regressions, we replaced the time trend by the yearly series on the market share of foreign bank assets from EBRD (2007). In these estimations (available upon request), a significant negative coefficient of the foreign market share variable was obtained, suggesting that the efficiency improvement is correlated with the increased foreign bank participation.

also suggests that the primary motivation behind foreign entry affects the post-entry performance of banks. While foreign greenfield banks are mainly established with the purpose to serve the clients of their parent banks, the entry via cross-border acquisitions is primarily motivated by the efficiency improvements and market power considerations (Lanine and Vander Vennet, 2007). As argued by Detragiache et al. (2008), bank costs after the takeover can increase due to additional expenses related to the need to increase the quality of monitoring activities.[22] In order to capture this dynamic effect, in specifications (V) - (VIII) current and lagged dummy variables for the year when the bank was taken over are introduced.[23] We find two offsetting effects on the efficiency following the foreign acquisition: the immediate impact is significantly positive (deterioration of bank efficiency), while the one period lagged impact is significantly negative (improvement of bank efficiency). These two offsetting effects together with the fact that efficiency gains disappear in the second period, as shown in the specifications (VII) and (VIII), might explain the insignificant overall impact of the acquisition dummy variable in the specifications (III) and (IV).

These findings are also in line with various case studies on foreign bank acquisitions in CEECs. For instance, Abarbanell and Bonin (1997) discuss the impact of privatization of the Polish Bank Slaski (BSK) to a foreign investor in the 1990s. The authors find that the privatization of the bank by foreign investors did not lead to an immediate improvement of its managerial performance. One explanation is that the top management who ran the bank prior to the privatization did not change

[22] Another explanation for the insignificant relationship between the bank acquisition and its subsequent efficiency improvement might be the additional costs incurred in the process of reorganization and restructuring, which most of the banks undergo following the takeover. Still another possibility might be that target banks introduce new services, which requires installation of new equipment and facilities causing an upsurge of costs in the short-run.

[23] This dummy variable captures 64 cross-border bank acquisition events. The number of feasible observations for cross-border acquisitions decreases to 53 (44) when the impact of the takeover is evaluated with a one period (two periods) time lag.

following the privatization, due to the "...strength of personality, political influence, and superior knowledge of banking..." (Abarbanell and Bonin, 1997, p. 46). Similar evidence has been documented in a case study on privatization of the Russian Zhilsotsbank (Abarbanell and Meyendorff, 1997). However, the authors caution that the results of privatization should not be judged only on the basis of the short-run financial performance and that a "...critical lesson to be learned from the privatization of BSK is the importance of a foreign financial investor taking an active role in the development of bank strategy to bring about the fundamental changes necessary to realize the potential franchise value." (Abarbanell and Bonin, 1997, p. 57).

To sum up, we find that the mode of foreign entry has different implications for bank efficiency. Foreign greenfield banks outperform domestic banks in terms of cost efficiency, while the efficiency of foreign acquired banks is not significantly different from that of domestic banks. The later result can be explained by offsetting effects on efficiency following the foreign acquisition.

5.4.2 Foreign bank entry and market power

In order to evaluate the market power of banks, the following variables are used in model (5.8): the implicit lending rate ($r_{L_{it}}$) is defined as the ratio of total interest income to total loans, and the implicit deposit rate ($r_{D_{it}}$) is proxied by the ratio of total interest expenses to total deposits. The deposit rates are adjusted by the corresponding reserve requirement ratios in each of the CEECs (see Table 5.2). To evaluate the impact of foreign ownership on market power of banks, interaction terms of the average deposit rate with a foreign greenfield bank dummy ($r_{D_{it}} * D^{GF}$) and with a foreign greenfield bank dummy ($r_{D_{it}} * D^{A}$) are introduced. Together with the marginal cost estimates ($\hat{MC}$) obtained from the SFA specification (IV) in Table 5.4, these variables can be used for conducting the market power test using model (5.8).

Table 5.5 shows the estimation results of (the augmented) equation (5.8). We account for heterogeneity across banks located in different CEECs with varying levels of economic development and regulatory structures by applying a panel data estimation technique. All estimations are done by fixed-effects method, which was found to outperform the random-effects method based on the Hausman test. Standard errors are estimated using residuals clustered by countries, to relax the assumption of cross-sectional independence. Panel test for serial correlation based on the procedure of Drukker (2003) suggests that residuals in all specifications are free from first order autocorrelation effects.

Specification (I) describes the baseline model. The coefficient of the deposit rate variable is significant and larger than one. The Wald test indicates that the market power coefficient is significantly larger than one, suggesting rejection of the competitive market structure hypothesis for CEECs banking sector as a whole. This finding applies to all banks in CEECs, regardless of their ownership. To evaluate the impact of bank ownership on market power, the corresponding interaction terms are included in specifications (II) and (III). The coefficients of interaction terms suggest that foreign acquired banks have a significantly lower market power compared to domestic and foreign greenfield banks. This finding does not alter when both interaction terms are added to the model simultaneously in the specification (IV). The Wald test suggests that market power coefficient of foreign acquired banks is not significantly different from one, supporting the competitive market structure hypothesis for these banks. This result contrasts the prediction of the Claeys and Hainz (2007) model, in which competition in the domestic banking markets is stronger for the greenfield entry, compared to the acquisition entry.[24] Our results suggest that

[24] Claeys and Hainz (2007) do not consider the *follow clients abroad* motive for foreign bank entry in their model, which might explain this contradictory result.

cross-border bank acquisitions result in a more competitive banking environment, which has important policy implications.

Robustness check

There are several important aspects of banking that are not captured in the theoretical model of market power. The first is the presence of uncertainty and credit risk. To control for the impact of risk, we follow Barajas et al. (1999) and Vera et al. (2007) and introduce the share of loan-loss provisions in total loans as a proxy of quality of bank loan portfolio.[25] The second aspect is the presence of non-interest banking services, which might be considered as additional revenue for banks and might influence their degree of riskiness and market power (Lepetit et al., 2008). To control for the impact of fee-generating activities of banks, we follow Maudos and Fernandez de Guevara (2004) and augment our specification by introducing the ratio of non-interest revenues to total assets as a proxy for implicit interest revenues of banks. Finally, macroeconomic fundamentals might influence the depth of financial intermediation in the country (Cotarelli et al., 2005) and decision of banks to go abroad. We control for the macroeconomic environment by introducing real GDP growth, inflation and exchange rate changes in our specification.

The introduction of additional variables to control for banking risks (LLP), service incomes ($IMPL$) and macroeconomic environment (GDP, $INFL$ and FX) in specifications (V), (VI), and (VII) does not change the main results. In particular, the coefficient of the interaction term with foreign greenfield dummy remains insignificant, implying that even after accounting for credit risks, non-interest banking activities and macroeconomic variables, greenfield banks do not exhibit lower

[25] A more direct measure of loan portfolio quality would be the share of non-performing loans in total loans. However, BankScope is missing information on non-performing loans for more than half of banks in the sample, for which reason we rely on loan-loss provisions as an indicator of loan portfolio quality.

market power than domestic banks. This insignificant decrease in market power can be explained by the absence of alternative sources of bank financing for the customers of greenfield banks, who already established relationships with their long-term partner banks.

In line with the theoretical prediction, banks with riskier loan portfolios and higher share of non-interest banking activities charge higher lending rates.[26] The later result supports the findings of Lepetit et al. (2008), according to which banks expanding to non-interest income activities are riskier than banks focused on lending, which is reflected in higher loan rates. Among macroeconomic variables, we find positive and significant effect of exchange rate depreciation on loan rates, which suggests that currency stability has important implications for lending decisions of banks.

To sum up, the estimation results reject the competitive market structure hypothesis in CEECs, as the estimated market power coefficients are significantly larger than one. This indicates that banks in CEECs possess market power at least in one of the markets (loans or deposits).[27] The market power of foreign acquired banks is significantly lower than that of domestic and foreign greenfield banks, suggesting that increase in competition as a result of the foreign entry is mainly driven by cross-border acquisitions.

[26] Since interest income of banks can be affected by the quality of loan portfolio, using LLP among explanatory variables may introduce endogeneity bias in coefficient estimates. To control for possible endogeneity, in a separate set of regressions we use lagged LLP among explanatory variables. The estimation results are qualitatively similar to the specification with contemporaneous LLP and are available upon request.

[27] Since the deposit market is likely to be more competitive than the loan market due to the negligible bank switching costs for depositors and prevalence of relationship-based lending, we suggest that the main part of the market power comes from the loan markets. Relatively lower variation of deposit rates relative to the loan rates in our sample lends support for this argumentation (see also discussion in Section 5.3).

5.5 Conclusions

This paper has studied the implications of the recent sharp increase in foreign bank participation in CEECs for the post-entry banking performance. The study has highlighted the existence of a complex relationship between different modes of foreign bank entry and both cost efficiency and market power of banks.

Foreign greenfield banks exhibit superior operational efficiency in comparison to domestic and foreign acquired banks. This can be explained by the specialization of greenfield banks to serve customers of their parent banks abroad and already established banking relationships. The performance of foreign acquired banks exhibits an offsetting dynamic pattern: the efficiency deteriorates in the initial year of acquisition, slightly improving in the subsequent year. The overall impact on the post-acquisition performance evaluated for the whole sample is insignificant, which can be due to the poor managerial and financial characteristics of target banks in CEECs inherited by foreign investors.

We also find evidence on differences in market power across domestic and foreign banks. Market power of foreign greenfield banks is not significantly lower than that of domestic banks. This result holds when the impact of credit risks, non-interest banking activities and macroeconomic environment are taken into account, contrasting the evidence from studies, which do not control for the cost efficiency of banks when analyzing market power. Unlike greenfield entrants, foreign acquired banks exhibit a substantially lower degree of market power, which can be explained by their strategic considerations to expand activities in CEECs and subsequent increase of the competitive pressure.

The analysis conducted in this study provides important policy implications. It documents a significant improvement of banking performance in CEECs measured

by cost efficiency during the sample period corresponding to an increase in foreign bank participation. CEECs banks and customers have benefited from foreign participation both directly (superior post-entry performance of greenfield banks) and indirectly (overall increase in bank efficiency due to spillover effects to domestic banks). Opening the borders for foreign entry has also contributed to the competitiveness of the banking industry in CEECs, but largely due to cross-border acquisitions. In this sense, the findings in this study provide support for the conventional belief by the policymakers that liberalization of domestic banking industry and promotion of foreign entry would have a positive impact.

However, these conclusions should be interpreted with caution, since this study has not addressed the issue of financial stability in CEECs. During the recent financial crisis, banking sectors in CEECs have proven to be very vulnerable to systemic external shocks. The impact of the increased foreign bank participation on financial stability is an important topic, which requires the attention of policymakers and needs to be addressed in the future research.

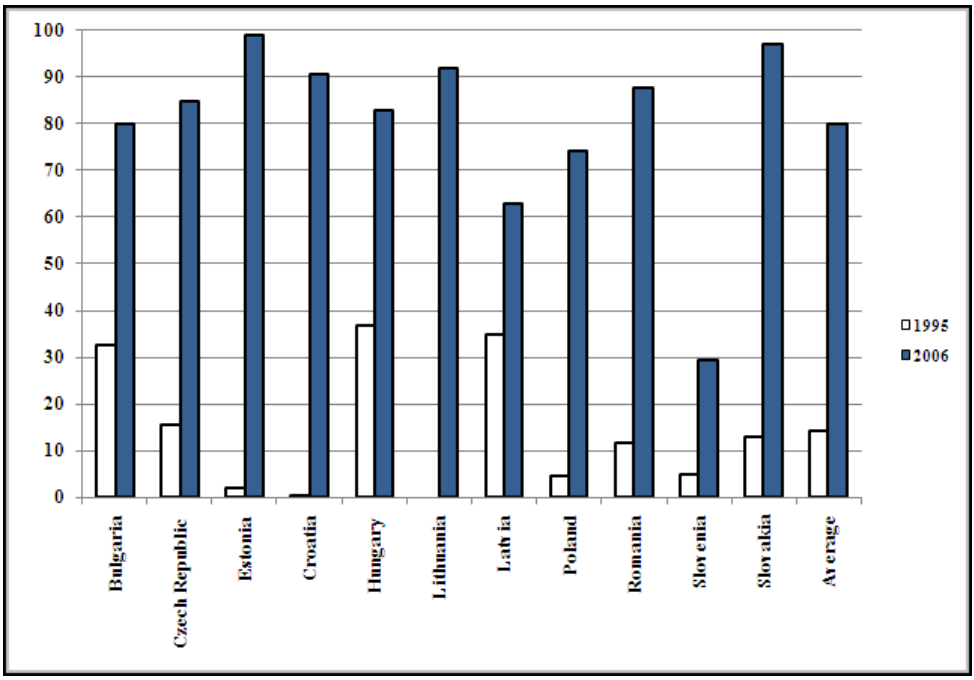

Figure 5.1. Share of foreign-owned banks in terms of total assets (%), 1995 and 2006

Source: EBRD (2007).

Table 5.1. Number of observations for domestic and foreign (acquired and greenfield) banks

Countries	Ownership	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
Bulgaria	Domestic	4	9	12	15	17	21	23	17	14	14	12	11	11	10	9	199
	Foreign greenfield	0	0	0	1	2	2	2	3	4	6	7	7	7	7	7	55
	Foreign acquired	0	0	0	0	0	0	1	4	7	7	9	10	9	10	11	68
Croatia	Domestic	12	22	28	31	37	45	38	33	27	26	26	30	19	18	17	409
	Foreign greenfield	0	0	1	1	1	4	4	6	6	6	5	4	2	2	2	44
	Foreign acquired	0	0	0	0	0	0	1	1	4	5	4	4	4	5	6	34
Czech Republic	Domestic	10	14	19	20	22	21	19	16	9	8	7	6	6	6	5	188
	Foreign greenfield	3	7	8	10	12	12	10	10	11	10	10	9	9	9	9	139
	Foreign acquired	0	0	0	0	0	1	3	4	6	7	7	8	7	7	8	58
Estonia	Domestic	3	8	11	16	19	20	8	7	2	2	4	4	3	2	2	111
	Foreign greenfield	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Foreign acquired	0	0	0	0	0	0	1	2	3	3	3	3	3	4	4	26
Hungary	Domestic	18	23	30	34	30	23	19	18	10	10	11	10	8	8	8	260
	Foreign greenfield	4	7	9	11	12	12	11	15	16	13	13	13	12	12	12	172
	Foreign acquired	0	0	0	0	2	6	8	9	8	8	8	8	7	7	7	78
Latvia	Domestic	3	9	16	20	21	25	25	23	16	14	14	15	14	14	13	242
	Foreign greenfield	0	0	1	1	1	2	2	2	2	3	3	3	3	3	3	29
	Foreign acquired	0	0	0	0	0	1	2	2	2	4	4	4	5	5	6	35
Lithuania	Domestic	1	5	9	11	14	17	16	15	8	6	5	5	5	4	4	125
	Foreign greenfield	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Foreign acquired	0	0	0	0	0	0	0	0	2	3	4	4	4	5	5	27
Poland	Domestic	17	24	35	37	41	40	32	28	18	14	12	14	14	13	13	352
	Foreign greenfield	2	4	5	7	11	11	13	11	11	11	13	13	12	12	12	148
	Foreign acquired	0	0	0	0	1	3	4	10	14	16	16	15	15	16	16	126
Romania	Domestic	4	5	9	12	11	13	24	23	16	14	14	11	10	10	8	184
	Foreign greenfield	0	0	0	0	1	3	8	9	9	9	10	10	10	10	10	89
	Foreign acquired	0	0	0	0	0	0	1	1	3	5	6	9	9	9	11	54
Slovakia	Domestic	4	6	9	11	13	16	16	15	10	7	5	4	3	3	3	125
	Foreign greenfield	1	1	2	4	7	9	10	8	10	9	9	9	8	8	8	103
	Foreign acquired	0	0	0	0	0	0	0	0	2	5	7	7	6	6	6	39
Slovenia	Domestic	7	10	13	20	28	27	23	24	17	14	10	12	10	10	9	234
	Foreign greenfield	1	2	2	3	3	3	2	2	2	2	2	2	2	2	2	32
	Foreign acquired	0	0	0	0	0	1	1	1	1	2	4	4	4	4	5	27
Total	**Domestic**	**83**	**135**	**191**	**227**	**253**	**268**	**243**	**219**	**147**	**129**	**120**	**122**	**103**	**98**	**91**	**2,429**
	Foreign greenfield	**11**	**21**	**28**	**38**	**50**	**58**	**62**	**66**	**71**	**69**	**72**	**70**	**65**	**65**	**65**	**811**
	Foreign acquired	**0**	**0**	**0**	**0**	**3**	**12**	**22**	**34**	**52**	**65**	**72**	**76**	**73**	**78**	**85**	**572**

Source: BankScope, Thompson Financial SDC Platinum Database, De Haas and Van Lelyveld (2006) and Havrylchyk and Jurzyk (2008).

Table 5.2. Variable definitions and sources

Variable	Definition	Measure	Source
C	Bank costs	Total operating expenses	BankScope
L	Earning assets	Total earning assets	BankScope
w_1	Price of labor	Ratio of personnel expenses to total assets	BankScope
w_2	Price of capital	Ratio of administrative expenses (other than personnel expenses) to total assets	BankScope
w_3	Price of borrowed funds	Ratio of interest expenses to a sum of total deposits and other funding	BankScope
D^{GF}	Foreign greenfield	Dummy variable that takes value of 1 for greenfield establishments of foreign banks	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzyk (2008)
D^{A}	Foreign acquired	Dummy variable that takes value of 1 for domestic banks acquired by a foreign bank	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzyk (2008), and Thomson's SDC Platinum Database
D^{FE}	Foreign entry	Dummy variable that takes value of 1 in the year when a domestic bank was taken over by a foreign bank	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzyk (2008), and Thomson's SDC Platinum Database
r_L	Implicit loan rate	Ratio of interest expenses to total loans	BankScope
r_D	Implicit deposit rate	Ratio of interest expenses to total deposits	BankScope
MC	Marginal costs	Derivative of the cost function obtained from the stochastic frontier model with respect to output quantity	BankScope and own estimations
LLP	Loan-loss provisions	Ratio of loan-loss provisions to total loans	BankScope
$IMPL$	Implicit interest revenue	Ratio of the net non-interest revenues to total assets	BankScope
ρ	Reserve requirements ratio (%)	Bulgaria=8, the Czech Republic = 2, Estonia = 16, Croatia = 19, Hungary = 5, Latvia = 8, Lithuania = 6, Poland = 3.5, Romania = 20, Slovakia = 2, Slovenia = 2.	Barth et al. (2008)
GDP	Economic activity	Annual real GDP growth	World Development Indicators (WorldBank)
$INFL$	Inflation	Annual growth in consumer price index (CPI)	World Development Indicators (WorldBank)
FX	Currency stability	Annual growth of average exchange rate *vis-a-vis* US dollar	International Financial Statistics (IMF)

Table 5.3. Descriptive statistics

		Bank costs	**Earning assets**	**Price of labor**	**Price of capital**	**Price of borrowed funds**	**Loan rate**	**Deposit rate**	**Marginal costs**	**Loan loss provisions**	**Implicit interest revenues**
		C	L	w_1	w_2	w_3	r_L	r_D	MC	LLP	$IMPL$
Domestic banks	Mean	748.6	17335.5	0.512	0.023	0.068	0.246	0.079	0.076	0.097	0.083
	Median	231.0	3959.8	0.524	0.020	0.054	0.189	0.066	0.068	0.060	0.072
	St. Dev.	1339.6	31630.5	0.201	0.012	0.045	0.186	0.052	0.035	0.106	0.040
	Maximum	9701.8	193000.0	0.849	0.071	0.324	1.847	0.336	0.225	1.000	0.310
	Minimum	13.7	145.0	0.042	0.004	0.011	0.066	0.012	0.012	0.000	0.014
Foreign greenfield banks	Mean	199.2	6311.4	0.585	0.014	0.053	0.265	0.061	0.049	0.019	0.054
	Median	104.3	4663.8	0.643	0.010	0.046	0.161	0.054	0.041	0.016	0.048
	St. Dev.	256.2	6560.5	0.194	0.010	0.037	0.367	0.045	0.027	0.016	0.027
	Maximum	1303.1	30823.7	0.838	0.049	0.244	2.309	0.305	0.148	0.075	0.171
	Minimum	14.8	218.1	0.095	0.004	0.011	0.054	0.013	0.014	0.000	0.019
Foreign acquired banks	Mean	1267.1	28641.7	0.556	0.018	0.046	0.171	0.053	0.066	0.073	0.064
	Median	473.3	13231.3	0.569	0.015	0.036	0.133	0.040	0.054	0.053	0.054
	St. Dev.	2388.1	43985.1	0.173	0.010	0.035	0.111	0.043	0.034	0.076	0.030
	Maximum	21324.9	193000.0	0.845	0.072	0.214	0.605	0.288	0.191	0.361	0.185
	Minimum	18.1	340.0	0.194	0.006	0.012	0.050	0.013	0.021	0.000	0.024
Total (all banks)	Mean	793.0	18371.3	0.524	0.021	0.063	0.235	0.074	0.072	0.088	0.078
	Median	235.9	4583.6	0.540	0.019	0.050	0.179	0.060	0.064	0.054	0.067
	St. Dev.	1536.0	33298.8	0.198	0.012	0.044	0.197	0.051	0.035	0.100	0.039
	Maximum	21324.9	193000.0	0.849	0.072	0.324	2.309	0.336	0.225	1.000	0.310
	Minimum	13.7	145.0	0.042	0.004	0.011	0.050	0.012	0.012	0.000	0.014

Notes: bank costs and earning assets are measured in thousands of US dollars and deflated by the consumer price index (extracted from the World Bank's World Development Indicators database), using 1995 as a reference year. To confront the influence of extreme observations and reporting errors, all variables have been winsorized at the 1^{st} and 99^{th} percentiles.

Table 5.4. Impact of foreign bank participation on cost efficiency: Stochastic efficiency frontier analysis (model (5.9))

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Frontier								
Earning assets	0.5583***	0.5661***	0.5579***	0.5635***	0.5636***	0.5912***	0.6480***	0.6135***
Price of labor/Price of capital	0.5484***	0.5544***	0.5487***	0.5561***	0.5457***	0.5756***	0.5733***	0.5837***
Price of borrowed funds/Price of capital	-0.0751	-0.0774	-0.075	-0.0772	-0.078	-0.1182	-0.2028**	-0.1598
Time trend	0.0028	-0.0009	0.0026	-0.0018	-0.0222	-0.0087	-0.0068	0.0148
(Earning assets)^2	0.0438***	0.0423***	0.0439***	0.0425***	0.0444***	0.0426***	0.0332**	0.0389***
(Earning assets)*(Price of labor/Price of capital)	-0.0009	-0.0008	-0.001	-0.001	-0.0019	0.0004	0.002	0.0059
(Earning assets)*(Price of borrowed funds/Price of capital)	0.0095	0.0104	0.0095	0.0103	0.0078	0.0104	0.0169	0.0076
(Earning assets)*(Time trend)	0.0043**	0.0044**	0.0043**	0.0045**	0.0042**	0.0025	0.0035	0.0012
(Price of labor/Price of capital)^2	-0.0327***	-0.0340***	-0.0327***	-0.0338***	-0.0357***	-0.0516***	-0.0552***	-0.0793***
(Price of labor/Price of capital)*(Price of borrowed funds/Price of capital)	0.0210**	0.0205**	0.0210**	0.0204**	0.0273**	0.0350***	0.0390**	0.0463***
(Price of labor/Price of capital)*(Time trend)	-0.0177***	-0.0175***	-0.0178***	-0.0176***	-0.0160***	-0.0150***	-0.0138***	-0.0097***
(Price of borrowed funds/Price of capital)^2	-0.0583**	-0.0602***	-0.0582**	-0.0598**	-0.0655***	-0.0742***	-0.0729**	-0.0542**
(Time trend)^2	0.0006	0.0007	0.0006	0.0007	0.0012	0.0008	-0.0006	-0.0023
Constant	1.3176***	1.2953***	1.3193***	1.3050***	1.4700***	1.5039***	0.9721**	1.2934**
Inefficiency determinants								
Time trend	-0.0290**	-0.0250**	-0.0287**	-0.0237*				
Foreign greenfield		-0.3727***		-0.3786***				
Foreign acquired			-0.005	-0.0275				
Foreign entry					0.3190***			0.1611*
Foreign entry (1 year lag)						-0.3232**		-0.4637**
Foreign entry (2 years lag)							-0.0701	-0.0563
Constant	-0.4256***	-0.3421**	-0.4358***	-0.4036	-0.7732***	-0.7779***	-0.8076***	-0.8525***
Statistics								
Number of observations	2,067	2,067	2,067	2,067	2,067	1,613	1,290	1,290
Number of parameters	40	41	41	42	40	39	38	40
Log likelihood	-174.4958	-168.9294	-174.4923	-168.8235	-165.812	-52.6434	-64.6417	-2.0239
$\log(\sigma_u^2)$	-0.4128	-0.5215	-0.3929	-0.4018	-0.1867	-0.3858	-0.2521	-0.276
$\log(\sigma_v^2)$	-2.9981***	-2.9965***	-2.9982***	-2.9974***	-3.0042***	-3.1017***	-3.0930***	-3.1885***

Notes: the dependent variable is the ratio of total operating expenses to the price of capital. All variables (except from the time trend) are expressed in the logarithmic form. Estimations are performed using maximum likelihood method based on the Broyden–Fletcher–Goldfarb–Shanno (BFGS) optimization algorithm. σ_u^2 and σ_v^2 stand for the standard deviation of the inefficiency and random error terms, respectively. Each specification also contains dummy variables for countries and time (not shown in the table to conserve space). *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table 5.5. Impact of foreign bank participation on market power (model (5.8))

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Model							
Deposit rate	2.1462***	2.1571***	2.1270***	2.1364***	2.0572***	1.8219***	1.6451***
Marginal costs	0.4856**	0.4843**	0.4852**	0.4840**	0.2339*	0.2350*	0.3869*
Interaction term (deposit rate × foreign greenfield dummy)		-0.0587		-0.0508	0.4651	0.1334	0.0771
Interaction term (deposit rate × foreign acquired dummy)			-0.6900**	-0.6897**	-0.3720**	-0.4535**	-0.6361**
Non-performing loans					0.1487**		
Implicit interest revenue						1.2013***	
Real GDP growth							-0.0044
CPI inflation							0.0008
Exchange rate changes							0.0018*
Constant	0.0455*	0.0456*	0.0531*	0.0532*	0.0532*	0.0015*	0.0968***
Market power test							
H0: Deposit rate coefficient = 1	10.22	9.32	9.54	8.66	5.78	6.87	3.31
(p-value)	0.0095	0.0122	0.0115	0.0147	0.0371	0.0256	0.0987
H0: Deposit rate coefficient + Interaction term (deposit rate and foreign greenfield dummy) = 1	–	5.32	–	5.37	7.13	4.14	3.74
(p-value)	–	0.0438	–	0.0430	0.0235	0.0691	0.0820
H0: Deposit rate coefficient + Interaction term (deposit rate and foreign acquired dummy) = 1	–	–	1.03	1.17	2.38	1.72	0.00
(p-value)	–	–	0.3341	0.3053	0.1543	0.2187	0.9796
Statistics							
Number of observations	1,988	1,988	1,988	1,988	1,615	1,988	1,966
R^2	0.2178	0.2172	0.2245	0.2241	0.2493	0.2555	0.2668
Log-likelihood	1305.8	1305.9	1314.4	1314.4	1202.8	1381.1	1347.8
Hausman test (p-value)	0.0255	0.0371	0.0153	0.0250	0.0007	0.0447	0.0088
Panel autocorrelation test (p-value)	0.1539	0.1948	0.1398	0.2436	0.1743	0.2195	0.1298

Notes: the dependent variable is the ratio of total interest expenses to total loans. Estimations are performed using fixed effects method with bootsrapped standard errors using 2000 replications. Standard errors are estimated using residuals clustered by country to allow for possible interdependence between banks located in the same country. The Hausman test tests the null hypothesis that random effects model is consistent and efficient (i.e., no systematic difference between coefficient estimates for the fixed effects and random effects models). Panel autocorrelation test (null hypothesis: no first order autocorrelation) is based on the procedure of Drukker (2003). Market power hypotheses are tested using Wald test statistic. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Chapter 6

Re-examining the Impact of Foreign Bank Participation on Interest Margins

6.1 Introduction

In the absence of developed bond and stock markets, banks continue to play a major role as financial intermediaries in former socialist economies (FSEs) (Berglof and Bolton, 2002; Bonin et al., 1998; Bonin and Wachtel, 2003). As a result, the costs of financial intermediation services offered by banks remain crucial for the economic development of FSEs. The observed massive increase of foreign bank participation during the last decade inevitably raises the question to what extent foreign entry has influenced bank interest margins, which is a commonly used measure of financial intermediation costs offered by banks.

There is an established theoretical literature on the determinants of interest margins initiated by the *dealership* model of Ho and Saunders (1981). This model assumes that bank serves as a risk-averse dealer in the deposit and loan markets, bearing the risk of refinancing due to the possible mismatch between the arrival of

deposits and demand for loans. This mismatch is dealt with by the bank through its activities in the money market, which creates a link between the optimal level of the net interest margin set by the bank and the volatility of the money market rate (the market risk). Some simplifying assumptions of the Ho and Saunders (1981) model were later on relaxed by introducing heterogeneous bank products (Allen, 1988), credit risk (Angbanzo, 1997), and operating costs (Maudos and Fernandez de Guevara, 2004) as important additional determinants of the bank interest margin. The most recent development of the bank *dealership* model is provided by the model of Maudos and Fernandez de Guevara (2004), in which the set of theoretically motivated determinants of the net interest margin includes market structure, operating costs, managerial risk aversion, credit and market risks, and the size of bank operations.

A notable feature of the *dealership* model is that foreign ownership is not considered to be a determinant of interest margins. This is in sharp contrast to a different stream of theoretical literature, which underscores the problem of asymmetric information between entrant (foreign) and incumbent (domestic) banks that might influence the margin. Foreign banks have better screening technologies to identify good borrowers based on *hard* information, while domestic banks possess superior *soft* information (Dell'Ariccia and Marquez, 2004). Differences in information distribution may result in a *cream-skimming* caused by foreign entry: in equilibrium foreign banks would focus on providing services to less risky and large borrowers, while domestic banks would concentrate their lending to more opaque and small firms (Sengupta, 2007).[1]

Generally speaking, foreign entry can influence banks in host countries through

[1] Depending on the relative strength of the two opposite effects, the host countries can even experience a decline in total lending following foreign bank entry, which has been empirically documented in some less developed countries (Detragiache et al., 2008).

various direct and indirect channels (Lehner and Schnitzer, 2008). One possible channel is spillover effects from foreign to domestic banks in terms of better screening facilities, technology utilization, and transfer of *know-how*. These indirect benefits from increased foreign bank participation should result in lower average unit costs associated with the financial intermediation process, reflected in lower equilibrium margins. Another possible channel is the increase in competition due to opening up of the banking market for foreign competitors. The mode of foreign entry (acquisition versus greenfield investment) has important implications in this respect. While greenfield investments increase the number of banks in the economy, entry through foreign acquisition only affects ownership distribution of existing banks and does not influence the total number of banks. Therefore, theoretically, the entry via foreign greenfield investments should result in more competition than the entry via foreign acquisition.[2] In addition, the advantage of acquisition over greenfield entry is that the foreign bank acquires information about the quality of incumbent borrowers using the credit information inherited from the target bank. The average quality of incumbent borrowers may influence the lending rate demanded by the acquired banks for extending new loans, giving rise to the *portfolio composition effect* (Claeys and Hainz, 2007).

Surprisingly, this apparent contradiction between the predictions of the *dealership* model and the other stream of theoretical literature has not been examined in previous empirical studies analyzing the impact of foreign bank participation on interest margins. Most of these studies took an *ad hoc* approach by analyzing various determinants that are likely to affect bank interest margins (some of which partially overlap with the theoretically motivated determinants of the *dealership* model). The

[2] Although in theory the number of banks and market concentration are considered to be important determinants of the level of competition, empirical studies do not find support for this argumentation (Claessens and Laeven, 2004).

impact of foreign ownership is commonly estimated by introducing a dummy variable for foreign-owned banks (direct effect due to the magnitude of margins set by foreign banks) and/or a country-wide measure of foreign bank participation, such as the market share of foreign-owned banks (indirect effect due to spillovers).

Based on this approach, the empirical literature provides mixed evidence on the impact of foreign bank participation on interest margins in emerging economies. Among cross-country studies, Demirguc-Kunt and Huizinga (2000) found that foreign bank participation had a positive effect on interest margins in a worldwide sample of 80 countries during 1988-1995. Schwaiger and Liebeg (2008) came to a similar conclusion using a sample of 11 FSEs during 2000-2005. In contrast, the impact of foreign entry was found to be negative in 5 Latin American countries during 1995-2000 (Martinez Peria and Mody, 2004), in 11 FSEs during 1993-1999 (Drakos, 2003), and in 13 FSEs during 1994-2001 (Claeys and Vander Vennet, 2008).[3] The evidence is also mixed in single-county studies: Dabla-Norris and Floerkmeier (2007) did not find any significant association between foreign ownership and interest margins in Armenia, whereas Denizer (2000) and Barajas et al. (2000) found that foreign entry has driven down interest margins in Turkey and Colombia, respectively. All in all, due to the absence of a unified theoretical framework and inconclusive empirical evidence, the overall impact of foreign bank participation on interest margins remains unclear.

The aim of this chapter is to fill this gap in the literature by re-examining the empirical relationship between foreign bank participation and interest margins using a more formal approach. Unlike most of the previous studies, we try to account for theoretically motivated determinants of (the most advanced version of) the *dealer-*

[3] In Martinez Peria and Mody (2004), the decrease is largely attributed to the participation of greenfield foreign banks, whereas indirect effects due to foreign bank participation were found to play a crucial role in Claeys and Vander Vennet (2008).

ship model by Maudos and Fernandez de Guevara (2004) and the other stream of literature theorizing on the impact of foreign bank participation on interest margins. Careful analysis of the later literature suggests that most of the channels through which foreign bank participation is expected to influence the margins are already accounted for by the *dealership* model. For instance, Martinez Peria and Mody (2004) argue that one of the channels through which increased foreign bank participation can affect the margins is its impact on the cost of operations. However, the empirical specification inspired by the *dealership* model already includes this variable among interest margin determinants. Similarly, Bonin et al. (2005) and Lehner and Schnitzer (2008) argue that foreign banks are able to charge lower margins due to their superior efficiency. However, cost efficiency is taken into account by the *dealership* model as determinant of the margins, too. Lastly, Claeys and Hainz (2007) hypothesize that the possible negative impact of foreign bank participation may be due to the portfolio effect, since foreign banks tend to be largely involved in financing relatively safer clients. The *dealership* model, however, also considers the riskiness of bank's portfolio as an important factor influencing margins.

As a result, we conclude that there is no particular reason to expect that foreign bank participation affects bank interest margins after the theoretically motivated determinants of the *dealership* model are fully taken into account in the empirical specification. Our empirical analysis supports this conclusion, as we find that after controlling for the theoretically motivated determinants described in the *dealership* model, various indicators of foreign bank participation (such as dummy variables for greenfield and acquired foreign banks, a country-wide measure of foreign bank participation) do not elicit a significant impact on interest margins. Intuitively, this result suggests that both direct and indirect channels, through which the impact of foreign bank participation on margins is expected to materialize (e.g., market

structure), are fully accounted for by the *dealership* model. Our findings call for re-examination of some of the previous studies, in which foreign bank participation was found to have a significant own impact on interest margins.

The remainder of this chapter is structured as follows. Section 6.2 describes the empirical methodology and data. Section 6.3 presents the estimation results and their discussion. The last section concludes.

6.2 Methodology and Data

6.2.1 Empirical model

We estimate the *dealership* model using a fixed effect estimator to capture unobserved heterogeneity at the individual bank level. The Maudos and Fernandez de Guevara (2004) model is taken as a baseline specification, which we augment by introducing two measures of foreign participation at the individual bank-level (foreign greenfield banks and banks that entered through cross-border acquisitions) and one measure at the country level (market share of foreign banks). We test the robustness of our results regarding the impact of foreign participation by adding several macroeconomic variables.

The general specification takes the following form:

$$\begin{aligned} Margin_{ijt} &= \alpha_i + \sum_{n=1}^{N} \beta_n Theoretical_{nijt-1} + \sum_{m=1}^{M} \gamma_m Environmental_{mijt-1} + \\ &+ \lambda_1 * D^{GF} + \lambda_2 * D^{A} + \lambda_3 * ForeignShare_{jt} + Macro_{jt} + D^{YEAR} + \varepsilon_{ijt} \end{aligned} \tag{6.1}$$

where i, j, and t indices stand for bank, country, and time, respectively, *Margin* is the interest margin, *Theoretical* and *Environmental* are vectors of bank-specific (*pure margin* determinants) and environmental variables as defined in Maudos and Fernandez de Guevara (2004), D^{GF} is a dummy variable for greenfield foreign banks, D^{A} is a dummy variable for acquired foreign banks, *ForeignShare* is a percentage of

banking system assets in the country controlled by the foreign-owned banks, *Macro* is a set of macroeconomic control variables, and ε_{ijt} is an i.i.d. random error. The individual bank heterogeneity is captured by the fixed effects intercept term α_i and the time-specific variation is captured by a vector of time dummies D^{YEAR}.

Table 6.1 provides a description of all variables and their sources. The net interest margin is measured as the ratio of the net interest income over total earning assets. We use the following *pure margin* determinants in our estimations (see Maudos and Fernandez de Guevara, 2004). *Market structure* is captured by the Herfindahl index measured as the sum of squares of individual bank market shares for each country.[4] *Operating costs* are measured as a ratio of operating expenses to total assets. *Risk aversion* is proxied by the equity-to-total assets ratio, implying higher risk aversion for banks having higher ratios. *Market risk* is captured by the standard deviation of monthly interbank money market rates.[5] *Credit risk* is measured by the ratio of loan loss provisions to net loans.[6] The *interaction of market and credit risk* is controlled for by introducing the interaction term of the above two risk measures into the specification. The *size of operations* is captured by the logarithm of net loans.

Furthermore, we control for environmental factors influencing interest margins using three variables. *Implicit interest payments* are measured by the ratio of operating expenses net of non-interest revenues to total assets. Higher implicit interest payments should be compensated by an increase in interest margins. *Opportunity costs of bank reserves* are measured by the ratio of liquid assets to total assets. More

[4] Total assets are used as a measure of banking activity.

[5] In the absence of money market rates for some of the FSEs, the government T-Bill rates are used as a measure of market rates.

[6] Due to a large amount of missing data, we cannot proxy credit risk by the ratio of non-performing loans to total assets. Although a second best option, our measure of credit risk is still an improvement compared to the ratio of loans to total assets used by Maudos and Fernandez de Guevara (2004).

liquid banks are expected to have higher margins in order to compensate for opportunity costs of holding extra liquidity. Finally, the *managerial quality* is proxied by the cost-to-income ratio. Banks having a more qualified management are expected to decrease interest margins due to lower cost-to-income ratio.

The model with the aforementioned theoretically-motivated and environmental variables is based on the specification used in Maudos and Fernandez de Guevara (2004), in which there is no role for the impact of the ownership structure on bank interest margins. To test for the impact of foreign bank presence, we augment the model by including proxies for foreign bank participation that are hypothesized to affect the margin through a set of direct and indirect channels. By introducing the D^{GF} and D^{A} dummies it is tested whether the average margins for foreign banks (new and acquired) are significantly different from the average margin of the rest of the banking institutions. By introducing *ForeignShare* variable, we test whether there is a spillover effect arising from the presence of foreign banks in the banking systems of host countries. That is, we test whether the overall level of foreign bank participation in the banking system raises or lowers the margin after controlling for individual bank ownership effects.

Given that the differences in margins across countries may be affected by the macroeconomic environment in which banks operate, we control for the following commonly used variables to check the robustness of our results. *GDPPC* is per capita GDP in US dollars and *GDPGR* is the real GDP growth rate for each of the countries capturing the influence of the level of economic development and economic growth on interest margins, respectively. *Inflation* is the CPI-based inflation rate.[7]

[7] In a separate set of regressions, we also included institutional characteristics of countries proxied by the arithmetic average of EBRD indices covering small- and large-scale privatization, enterprise reforms, price liberalization, forex and trade liberalization, competition policy, banking and non-banking sector reforms, and reforms in infrastructure as an additional control variable. We obtained insignificant coefficients, probably reflecting that the institutional characteristics of the CEECs in our sample are relatively homogenous.

In order to avoid simultaneity problems, we take lagged values of the theoretically-motivated and environmental variables. A bias due to simultaneity can arise when dependent and independent variables are contemporaneously related due to an accounting identity or via a functional form. Using lagged values of independent variables rules out the possibility of a simultaneous interaction, as the independent variables become predetermined with respect to the dependent variable.[8]

6.2.2 Data

We combine information from different data sources for our analysis. The main data source is the BankScope database of Bureau van Dijk, from which we extract information on individual bank balance sheets and profit and loss accounts. Our sample is an unbalanced panel of 2,044 observations for 387 commercial, cooperative, and savings banks from 11 CEECs for the period 1995-2006.[9] Since BankScope provides information only on current ownership of banks, we complement this data set by collecting historical information on foreign ownership from different sources. First, we use information on foreign-owned banks from the extended data set of De Haas and Van Lelyveld (2006) employed in Havrylchyk and Jurzyk (2008). The data set covers the period 1995-2004 and categorizes foreign-owned banks into two groups: greenfield establishments and banks taken over as a result of a cross-border acquisition. Next, for the remaining two years, we obtain a list of cross-border bank takeovers from the Securities Data Company (SDC) mergers and acquisitions database produced by Thompson Financial. We identify 8 cross-border bank acquisition events that led to a transfer of bank control from domestic to foreign ownership (at least 50

[8] We obtain qualitatively similar results with respect to the impact of foreign bank participation on interest margins when the current values of the theoretically-motivated and environmental variables are used in the estimations. Using the lagged variables only influences coefficient estimates of theoretically motivated and environmental variables, while the impact of foreign bank participation remains unaffected.

[9] Our sample comprises Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

percent of capital) during 2005-2006. Finally, the aforementioned bank-level information is complemented by country level information on the share of foreign-owned banks in total banking assets from the EBRD Transition Report (EBRD, 2007). Our macroeconomic variables - per capita GDP, GDP growth rates and consumer prices - are taken from the World Development Indicators database (see Table 6.1).

Table 6.2 shows descriptive statistics of the net interest margin and its determinants for the total sample, as well as for subsamples of domestic and foreign banks. The average margin is about 4.2% but it has a large variation as shown by its wide range. The magnitude of the margin is on average lower for the sample of domestic banks, compared to foreign banks. This indicates that foreign banks are charging a lower margin than domestic banks, suggesting a negative direct effect of foreign bank participation on the margin. However, summary statistics of both theoretically-motivated and environmental determinants of the margin suggest that this variation can be explained by differences in variables influencing the margin. For instance, foreign banks incur lower operating costs than domestic banks and the credit portfolio of foreign banks is characterized by lower risks in comparison to the credit portfolio of domestic banks.

6.3 Estimation Results

Table 6.3 presents estimation results for the reference and augmented *dealership* models. All estimations are performed using the fixed effects estimator, which is superior to the random effects estimator according to the Hausman test. We do not present the coefficient estimates for time dummies to save space and keep the discussion focused.

6.3.1 The reference model

We start by fitting the model of Maudos and Fernandez de Guevara (2004) as reference specification. In this model, some of the theoretically-motivated variables determining the margin have a significant impact and the expected sign. Interest margins are higher for banks incurring greater operational expenses and more risk, as well as for banks characterized by greater risk aversion. Similar to the finding of Maudos and Fernandez de Guevara (2004) for selected EU countries, we find that interest margins increase with the size of operations, presumably reflecting compensation for a possibility of larger losses per operation due to greater stakes. However, contrary to Maudos and Fernandez de Guevara (2004), we do not find a significant impact for market concentration. This result might imply that in CEECs, the impact of bank-specific characteristics outweighs the importance of the market structure. Although the individual impact of market and credit risks come out insignificant, their interaction term has a negative significant impact on the margin. This suggests that the impact of the credit risk on the margins is amplified by the level of the market risk, and vice versa. The negative sign is in contrast to the theoretical expectation and suggests that CEECs banks are unable to value their risks properly.

For the environmental variables, we find a negative association between implicit interest payments and margins. Banks holding greater liquid reserves compensate their alternative costs by setting higher margins. Likewise, the cost-to-income ratio has a significantly positive impact, reflecting that more cost inefficient banks charge higher margins.

6.3.2 The impact of foreign bank participation

In order to evaluate the indirect impact of foreign bank participation on interest margins, in specification (II) we include the market share of foreign banks as additional

explanatory variable.[10] Our estimations do not support the hypothesis that foreign bank participation has significant spill-over effects, when theoretically-motivated and environmental variables are controlled for.

Specification (III) tests for the direct impact of foreign bank participation on interest margins. The dummy variable for foreign-owned banks is not significant, implying no significant own effect above the theoretically-motivated and environmental determinants. Since theoretical models of foreign bank entry underscore the importance of the mode of entry, in specifications (IV) and (V) we split the foreign ownership dummy variable into two components: a dummy variable for greenfield foreign banks and a dummy variable for acquired foreign banks. Our estimations suggest that different modes of entry do not significantly influence interest margins, after controlling for the impact of the theoretically-motivated and environmental determinants. The impact remains insignificant when both dummy variables enter the specification simultaneously (column VI) and together with the measure of indirect impact of foreign bank participation (column VII).

Finally, in specification (VIII) we control for the impact of macroeconomic variables as additional explanatory variables influencing the margin. This does not change our conclusion regarding the insignificant direct and indirect impact of foreign bank participation on the interest margin. We find that the margin is lower in relatively more developed countries (negative and significant coefficient of per capita GDP), while the impact of economic growth is insignificant. The margins increase with the level of inflation, probably reflecting additional price uncertainty risk. It is also important to note that introducing the macroeconomic variables wipes out the impact of the market and credit risks interaction dummy, while the direct impact of the market risk variable becomes significant.

[10] This variable was also used as a measure of spill-over effects from foreign bank participation to margins in Latin American economies by Martinez Peria and Mody (2004).

6.3.3 Economic significance

So far, we have focused on statistical significance only. In this section, we analyze the economic relevance of the determinants of interest margins. Table 6.4 presents the economic impact of interest margin determinants, measured as a response of the interest margin in percentages to a one percentage change in its determinants based on specification (VIII). The results suggest that among the theoretically-motivated determinants, the most substantive impact comes from the size of banking operations (1.25 percentage points) and the size of operating costs (0.25 percentage points). Among the environmental variables, the economic impact of implicit interest payments (0.11 percentage points) and cost inefficiency (0.09 percentage points) are comparable in size. Finally, among the macroeconomic variables, the strongest impact comes from the level of economic development of the country measured by the per capita GDP (-9.6 percentage points).

The analysis of the relative impact of these variables suggests that the insignificant impact of the foreign participation may be explained by the fact that all the channels through which foreign participation may affect margins are already accounted for in the *dealership* model. The insignificant own impact of foreign bank participation calls for reassessment of previous findings on the impact of foreign bank participation on interest margins.

6.4 Conclusions

This chapter has re-examined the impact of foreign bank participation on interest margins using the recent sharp increase of foreign bank presence in CEECs as a laboratory experiment. We start by observing that the *dealership* model widely used in empirical work to provide a quantitative assessment of factors driving the margin

does not allow for the impact of foreign bank participation to be explicitly tested. The mechanisms through which foreign bank participation may influence bank behavior and ultimately the margin are analyzed by other models in a framework different from the *dealership* model. However, the majority of these mechanisms, like market concentration, riskiness of bank portfolio, and operational costs, are already taken into account by the margin determinants inspired by the *dealership* model. This raises the question of whether the foreign bank participation has its own direct and/or indirect impact on interest margins.

Previous empirical studies that addressed this question have produced mixed results. Most of the studies report a negative effect, suggesting that foreign participation helps to decrease the margin due to spillover effects and portfolio mix of foreign banks (see, for example, Martinez Peria and Mody, 2004), while others did not find any significant impact, or even reported a positive impact (see, for example, Schwaiger and Liebeg, 2008). The mixed results in these studies can be explained by differences in the coverage of theoretical determinants inspired by the *dealership* model.

Using data on domestic and foreign-owned banks in 11 CEECs, we show that after fully accounting for all interest margin determinants inspired by the *dealership* model, foreign bank participation does not have any significant impact on interest margins in CEECs. The impact remains insignificant when we differentiate between proxies for indirect (foreign bank market share) and direct (dummy variables for greenfield and acquired foreign banks) effects of foreign bank presence. We explain this finding by the fact that the variables inspired by the *dealership* model already account for the main mechanisms through which the impact of foreign bank participation on the margins may be materialized. Our results call for a reassessment of results reported in some of the previous studies, which suggest a direct impact of foreign bank participation.

Table 6.1. Variable definition and sources

Variable	**Measure**	**Source**
Net interest margin	Ratio of total interest revenues net of total interest expenses to total assets	BankScope
Market concentration	Herfindahl index (total assets)	BankScope
Operating costs	Ratio of total operating expenses to total assets	BankScope
Risk aversion	Ratio of total equity to total assets	BankScope
Market risk	Standard deviation of monthly money market rates	International Financial Statistics (IMF)
Credit risk	Ratio of loan loss provisions to total loans	BankScope
Size of operations	Logarithm of total loans	BankScope
Implicit interest payments	Ratio of operating expenses net of non-interest revenues to total assets	BankScope
Opportunity costs of bank reserves	Ratio of liquid reserves to total assets	BankScope
Cost inefficiency	Ratio of total costs to total income	BankScope
Market share of foreign banks	Ratio of total assets controlled by foreign-owned banks to total banking system assets	EBRD Transition Report
Foreign bank dummy	Dummy variable that takes value of 1 for foreign banks (both greenfield and acquired)	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzuk (2008)
Foreign greenfield bank dummy	Dummy variable that takes value of 1 for greenfield establishments of foreign banks	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzuk (2008)
Foreign acquired bank dummy	Dummy variable that takes value of 1 for domestic banks acquired by a foreign bank	De Haas and Van Lelyveld (2006), Havrylchyk and Jurzuk (2008) and Thomson's SDC Platinum Database
Economic development	Logarithm of GDP per capita (US dollars)	World Development Indicators (World Bank)
Economic growth	Real GDP growth rate	World Development Indicators (World Bank)
Inflation	Percentage change in consumer price index	World Development Indicators (World Bank)

Table 6.2. Descriptive statistics

	Mean	**Median**	**Standard deviation**	**Maximum**	**Minimum**
Domestic banks					
Net interest margin	0.045	0.040	0.024	0.002	0.196
Market concentration	0.158	0.129	0.070	0.084	0.473
Operating costs	0.062	0.054	0.034	0.007	0.272
Risk aversion	0.133	0.111	0.088	0.012	0.658
Market risk	0.024	0.013	0.038	0.001	0.296
Credit risk	0.036	0.019	0.052	0.000	0.574
Size of operations	11.739	11.653	1.639	7.436	15.565
Implicit interest payments	-0.014	-0.013	0.026	-0.125	0.123
Opportunity costs of bank reserves	0.052	0.034	0.050	0.000	0.280
Cost inefficiency	0.851	0.804	0.372	0.160	3.999
Foreign banks					
Net interest margin	0.037	0.031	0.026	0.003	0.185
Market concentration	0.146	0.123	0.069	0.084	0.473
Operating costs	0.048	0.039	0.031	0.010	0.237
Risk aversion	0.123	0.101	0.082	0.021	0.612
Market risk	0.016	0.009	0.028	0.001	0.296
Credit risk	0.018	0.010	0.030	0.000	0.278
Size of operations	12.439	12.500	1.557	7.787	15.560
Implicit interest payments	-0.011	-0.012	0.020	-0.112	0.100
Opportunity costs of bank reserves	0.040	0.025	0.045	0.000	0.264
Cost inefficiency	0.823	0.773	0.297	0.156	2.954
Total sample					
Net interest margin	0.042	0.036	0.025	0.002	0.196
Market concentration	0.154	0.128	0.070	0.084	0.473
Operating costs	0.057	0.049	0.034	0.007	0.272
Risk aversion	0.130	0.106	0.086	0.012	0.658
Market risk	0.021	0.011	0.035	0.001	0.296
Credit risk	0.030	0.015	0.046	0.000	0.574
Size of operations	11.987	11.968	1.644	7.436	15.565
Implicit interest payments	-0.013	-0.012	0.024	-0.125	0.123
Opportunity costs of bank reserves	0.048	0.031	0.049	0.000	0.280
Cost inefficiency	0.841	0.793	0.347	0.156	3.999

Notes: all variables are measured in thousands of US dollars and deflated by the consumer price index, using 1995 as a reference year. Each variable is winsorized at the 1^{st} and 99^{th} percentiles, to confront the influence of outliers and reporting mistakes.

Table 6.3. Estimation results: Does foreign bank participation affect interest margins?

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Theoretically-motivated determinants								
Market concentration	-0.0142**	-0.0132**	-0.0143**	-0.0142**	-0.0144**	-0.0144**	-0.0134**	-0.0097*
Operating costs	0.3582***	0.3578***	0.3577***	0.3582***	0.3573***	0.3573***	0.3571***	0.3397***
Risk aversion	0.0465***	0.0466***	0.0463***	0.0465***	0.0463***	0.0463***	0.0464***	0.0426***
Market risk	0.0223	0.0217	0.0222	0.0223	0.0221	0.0221	0.0215	0.0271*
Credit risk	0.0130	0.0132	0.0133	0.0130	0.0136	0.0136	0.0138	0.0036
Interaction term (Market risk*Credit risk)	-0.2868**	-0.2888**	-0.2882**	-0.2868**	-0.2888**	-0.2888**	-0.2905**	0.0681
Size of operations	0.0024***	0.0024***	0.0024***	0.0024***	0.0024***	0.0024***	0.0024***	0.0034***
Environmental factors								
Implicit interest payments	-0.4910***	-0.4904***	-0.4920***	-0.4910***	-0.4924***	-0.4924***	-0.4918***	-0.4720***
Liquidity	0.0109	0.0101	0.0111	0.0109	0.0112	0.0112	0.0104	0.0121
Cost inefficiency	0.0037**	0.0037**	0.0038**	0.0037**	0.0038**	0.0038**	0.0037**	0.0034**
Foreign ownership in banking								
Market share of foreign banks		0.0025					0.0024	-0.0025
Foreign bank dummy			0.0010					
Foreign greenfield bank dummy				0.0000		0.0000	0.0000	0.0000
Foreign acquired bank dummy					0.0013	0.0013	0.0011	0.0015
Macroeconomic variables								
GDP per capita (US dollars)								-0.0456***
Real GDP growth rate								-0.0001
Inflation (consumer prices)								-0.0000***
Intercept	-0.0152*	-0.0289**	-0.0273**	-0.0152*	-0.0156**	-0.0156**	-0.0296**	0.3550***
Statistics								
Number of observations	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039
Log-likelihood	6381.0	6382.0	6381.3	6381.0	6381.6	6381.6	6382.5	6439.7
R^2	0.5764	0.5760	0.5751	0.5764	0.5743	0.5743	0.5741	0.3607

Notes: the dependent variable is the net interest margin. Estimations are performed using the ficed-effects OLS estimator. Each specification also contains a set of dummy variables to control for time fixed effects (not shown in the table to conserve the space). *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 6.4. Economic significance of interest margin determinants

	Coefficient	**P-value**
Market concentration	0.0309	0.1800
Operating costs	0.2537	0.0000
Risk aversion	0.0751	0.0030
Market risk	-0.0351	0.0020
Credit risk	-0.0032	0.6740
Interaction term (Market risk*Credit risk)	-0.0042	0.1220
Size of operations	1.2490	0.0000
Implicit interest payments	0.1061	0.0000
Liquidity	0.0176	0.1740
Cost inefficiency	0.0931	0.0140
Market share of foreign banks	-0.0001	0.9990
Foreign greenfield bank dummy	0.0000	0.9190
Foreign acquired bank dummy	0.0090	0.2260
GDP per capita (US dollars)	-9.5853	0.0000
Real GDP growth rate	0.0049	0.8480
Inflation (consumer prices)	0.1090	0.0000

Notes: reported are economic significance results from specification (VII) in Table 6.3. The coefficients reflect percentage point changes in the interest margin in response to a 1 percent change in corresponding determinants.

Chapter 7

Concluding Remarks

7.1 Main Findings

During the last two decades, the financial landscape around the world has undergone dramatic changes following a wave of financial liberalization, globalization, and removal of restrictions on cross-border banking activities. Motivated by these developments in international banking, this thesis analyzes the impact of foreign bank participation on banking systems in host countries. In particular, the thesis addresses the following research questions:

- What motivates banks to expand their activities internationally?
- What is the impact of foreign bank participation on the performance and competition of banking systems in host countries?
- Does the mode of foreign entry matter for the post-entry performance of banks?
- How does increased foreign bank participation affect the costs of financial intermediation?

The key challenge in analyzing these research questions is that the theoretical studies provide contrasting predictions regarding the ultimate impact of foreign bank par-

ticipation on banking systems in host countries. Empirical investigations are also plagued with a number of difficulties, such as scarcity of adequate data, different macroeconomic and institutional characteristics of host countries, sample-selection issues related to the decision of banks to go abroad. This thesis tries to tackle these empirical challenges by: (i) using bank-level data on FSEs that have experienced a substantial increase of foreign bank participation during the last two decades, (ii) applying innovative empirical methodologies to confront difficulties associated with the empirical assessment of the impact of foreign bank participation.

Chapter 2 analyzes the impact of foreign bank participation on bank performance, focusing on the impact of sample-selection on the decision of foreign banks to go abroad. In particular, the chapter examines whether the positive impact of foreign ownership on the efficiency of banks in FSEs documented in previous studies (Bonin et al., 2005, Fries and Taci, 2005, Yildirim and Philippatos, 2007) may be biased due to the *cream-skimming* effect.[1] Using a two-step approach (Heckman, 1979), we come up with new evidence suggesting that foreign banks tend to acquire good performing banks when expanding abroad. We further show that after controlling for the sample selection, the positive impact of foreign ownership on bank performance documented in previous studies vanishes. In addition, our results suggest that those FSEs that have attracted more foreign direct investment into their banking sectors are characterized by a lower level of bank efficiency. These findings underscore the importance of exercising care in drawing conclusions regarding the impact of foreign ownership on bank performance in the presence of sample selection problems.

Chapter 3 provides further evidence on the motives driving banks to expand their activities internationally. We build on the previous literature that distinguishes be-

[1] The *cream-skimming* effect suggests that foreign banks select best performing banks for acquisition, which complicates the empirical analysis of the impact of foreign ownership on bank performance due to the sample selection problem.

tween the *efficiency* versus *market power* hypotheses[2] as motives for foreign expansion (Lanine and Vander Vennet, 2007) and hypothesize that the relative strength of these hypotheses may vary depending on the institutional environment in host countries (EBRD, 2006; Lensink et al., 2008). Using a novel multilevel mixed-effect logistic regression framework, we find support for the *market power* hypothesis in relatively less advanced FSEs in terms of their economic development and institutional background. This finding is in line with previous evidence of Lanine and Vander Vennet (2007). However, we also show support for the *efficiency* hypothesis, which holds for relatively more advanced FSEs. Our findings highlight the importance of macroeconomic heterogeneity in FSEs and its relevance for the decision of foreign banks to go abroad.

The discussion of the implications of heterogeneous economic environments in which banks operate for the assessment of their performance is continued in *Chapter 4*. We start our analysis by noticing that previous studies analyzing performance of banks in FSEs based on the efficiency frontier framework impose a single technology regime in banking. One of the consequences of this restrictive assumption is that in the presence of multiple technology regimes, the obtained inefficiency estimates will be biased (Orea and Kumbhakar, 2004). Moreover, the technology regimes in transition banking are very likely to be affected by notable differences in macroeconomic environments of these countries. Using a novel latent class stochastic frontier methodology, we relax the single-frontier assumption of previous studies and allow for multiple technology regimes in transition banking. Our estimations suggest that transition banking is characterized by three distinct technology regimes. These technology regimes differ not only in terms of relative performance, technological

[2] The *efficiency* hypothesis suggests that foreign banks enter host countries with the aim of extracting revenues as a result of upgrading performance of target banks. In contrast, the *market power* hypothesis suggests that the main motivation for foreign entry is acquisition of large local banks that would allow to exercise market power and extract monopolistic rents.

progress, and returns to scale, but also in terms of the impact of foreign ownership on bank efficiency. More specifically, we find that foreign entry improves efficiency of banks located in FSEs characterized by better economic development prospects and institutional background, while the impact of foreign ownership on the efficiency of banks in less developed FSEs is ambiguous. This result confirms our previous finding on the importance of accounting for the macroeconomic environment in evaluating the impact of foreign bank participation.

Chapter 5 deals with another important aspect of opening the borders for foreign entry: its implications for the competitiveness in the domestic banking industry. The novelty of our approach is that we take into account the impact of foreign entry on bank efficiency when assessing its implications for market competition. In addition, we differentiate between two modes of foreign entry, foreign acquisitions and greenfield establishments, when analyzing the impact of foreign entry on banking competition. This differentiation is important given different motives behind these modes of entry: while greenfield investments are motivated by the follow the client abroad considerations, cross-border acquisitions aim at establishing full scale operations in FSEs. Our results suggest that foreign entry contributes to the competitiveness in the banking industry only for the case of cross-border acquisitions, while the impact of greenfield investments is insignificant. The latter finding can be explained by the special relationships between foreign banks and their customers in FSEs, which adds to the market power of greenfield foreign banks.

In *Chapter 6* we investigate the impact of foreign bank participation on the costs of financial intermediation in FSEs, proxied by net interest margins. Theoretical studies on determinants of interest margins (the *dealership* model) do not consider the role of bank ownership among the determinants (Ho and Saunders, 1981; Maudos and Fernandez de Guevara, 2004), while other theoretical studies outline

various direct and indirect channels through which foreign ownership may matter (Claeys and Hainz, 2007; Dell'Ariccia and Marquez, 2004; Lehner and Schnitzer, 2008). Comparative analysis of both types of theoretical studies reveals that the main channels through which foreign ownership may matter for the cost of financing are taken into account by the *dealership* model. Our empirical analysis supports this hypothesis and suggests that after taking into account the theoretically motivated determinants of interest margins discussed in the *dealership* model, the own impact of foreign ownership is insignificant. This finding is in contrast to previous studies, which did not take into account all theoretically motivated determinants and found significant impact of foreign ownership dummies, interpreting those as own effects of foreign ownership on the cost of financing.

7.2 Policy Implications

The analysis conducted in this thesis confirms the general expectations of policymakers that increased foreign bank participation will have a positive impact on FSEs, but with some caveats. First of all, the analysis shows that the impact of foreign bank entry is not uniform across FSEs. On average, more developed FSEs with a better record for policy reforms seem to have gained more from foreign bank participation than the others. Related to this, the causal relationship between foreign bank participation and performance may have gone also in the opposite direction, namely improvement of overall economic performance and positive prospects of EU membership have attracted foreign banks to the advanced FSEs. Next, the mode of foreign entry needs to be taken into account by the policymakers when formulating policies encouraging the foreign bank entry. Different motivations behind these modes result in different post-entry performance of foreign banks and should be weighed by policymakers with care. Finally, further efforts need to be undertaken to improve

the competitive stance of transition banking systems. Although foreign entry improves competition on the margin, it should not be treated as panacea of solving all problems in the domestic banking markets. A substantial degree of market power is still present in most FSEs' banking sectors.

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Samenvatting

Gedurende de laatste twee decennia is de financiële wereld drastisch veranderd als gevolg van een golf van financiële liberalisaties en globalisatie in de banksector. Tegen deze achtergrond wordt in dit proefschrift de invloed van de toetreding van buitenlandse bank op het bancaire stelsel van gastlanden geanalyseerd. In dit proefschrift worden in het bijzonder de volgende onderzoeksvragen behandeld:

- Wat brengt een bank ertoe om activiteiten in het buitenland op te zetten?
- Wat is de invloed van participatie van buitenlandse banken op de prestaties van en de concurrentie binnen het bancaire systeem van het gastland?
- Is de wijze van toetreding van invloed op de prestaties na toetreding?
- Hoe beïnvloedt toetreding van buitenlandse banken de kosten van financiële bemiddeling?

Theoretische studies leveren tegenstrijdige voorspellingen over de invloed van toetreding van buitenlandse banken op het bancaire systeem van de gastlanden. Empirisch onderzoek wordt bemoeilijkt door schaarsheid van data en verschillen in macro-economische en institutionele karakteristieken van de gastlanden waarmee rekening dient te worden gehouden. Bovendien kunnen selectie invloeden die gerelateerd zijn aan de keuze van een bank om internationaal te gaan opereren de resultaten beïnvloeden. In dit proefschrift worden deze problemen aangepakt door: (i) Data te gebruiken op bank niveau van banken uit voormalige socialistische economieën (former socialists economies FSEs). Er is voor FSEs gekozen omdat deze groep van landen te maken heeft gehad met een grote toename van buitenlandse bank participatie gedurende de laatste twee decennia. (ii) Toepassing van innovatieve empirische methoden die kunnen omgaan met de moeilijkheden die het analyseren van buitenlandse bank participatie met zich mee brengt.

In Hoofdstuk 2 wordt onderzocht wat de invloed van toetreding van buitenlandse banken is op de prestaties van banken. Dit hoofdstuk richt zich voornamelijk op de invloed van sampleselectie die ontstaat door de keuze van banken om naar het buitenland te gaan. Specifiek wordt gekeken of de positieve invloed van buitenlands eigendom op de efficiency, zoals beschreven in eerdere studies (Bonin et al., 2005, Fries and Taci, 2005, Yildirim and Philippatos, 2007), verklaard kan worden door het zogenoemde *cream-skimming* effect. Hiermee wordt bedoeld dat buitenlandse banken alleen de best presterende binnenlandse banken overnemen.

In dit hoofdstuk maken we gebruik van een twee-staps procedure (Heckman, 1979) waarmee we laten zien dat buitenlandse banken voornamelijk goed presterende banken overnemen wanneer ze naar het buitenland gaan. Wanneer er gecontroleerd wordt voor deze sampleselectie, is niet langer sprake van een positieve invloed van buitenlandse banken op de prestaties van de bancaire sector zoals die in eerdere studies werd gerapporteerd. Bovendien wijzen de resultaten erop dat FSEs die meer buitenlandse directe investeringen hebben aangetrokken een minder efficiënte bank sector hebben.

In Hoofdstuk 3 wordt nieuw bewijs geleverd voor de motieven die een bank heeft om zijn activiteiten naar het buitenland uit te breiden. Wij bouwen op voorgaande literatuur die onderscheid maakt tussen de *efficiency* en de *market power* hypothesen als motieven om buitenlandse banken over te nemen (Lanine and Vander Vennet, 2007) en veronderstellen dat de relatieve kracht van deze motieven afhankelijk kan zijn van de institutionele omgeving in het gastland (EBRD, 2006; Lensink et al., 2008). De *efficiency* hypothese veronderstelt dat buitenlandse banken die banken kopen waarvan ze verwachten dat ze de efficiëntie kunnen verbeteren. De *market power* hypothese veronderstelt dat banken juist banken kopen met veel marktmacht. Met gebruikmaking van een recent ontwikkeld latente klasse logistische regressie raamwerk, laten we zien dat de *market power* hypothese opgaat voor FSEs die relatief minder ontwikkeld zijn in termen van inkomen en kwaliteit van hun instituties. Voor de meer ontwikkelde FSEs vinden we echter bewijs voor de *efficiency* hypothese. Onze bevindingen benadrukken dat het belangrijk is om rekening te houden met heterogeniteit binnen FSEs bij het testen van de invloed toetreding van buitenlandse banken.

De discussie over de invloed van heterogene economische omgevingen waarbinnen banken opereren op het analyseren van hun prestaties, wordt voortgezet in Hoofdstuk 4. Eerdere studies die bankprestaties meten met behulp van een *efficient frontier*

raamwerk veronderstellen dat de te bestuderen landen beschikken over dezelfde technologie. Een gevolg van deze nogal restrictieve veronderstelling is dat wanneer blijkt dat er verschillende technologieën zijn, de verkregen efficiëntie scores gekleurd kunnen zijn (Orea and Kumbhakar, 2004). Bovendien is het waarschijnlijk dat bank technologieën worden beïnvloed door de verschillen in de macro economische omgeving van FSEs. Met behulp van een recent ontwikkeld latente klasse *stochastic frontier* methodologie kan de assumptie dat alle landen beschikken over dezelfde technologie worden versoepeld. Onze schattingen duiden erop dat bankieren in transitie landen wordt gekarakteriseerd door drie verschillende technologieën. De technologieën verschillen niet alleen in termen van relatieve prestaties, technologische vooruitgang en schaalvoordelen, maar ook met betrekking tot de invloed van buitenlands eigendom op de efficiëntie van een bank. Meer specifiek vinden we dat toetreding van buitenlandse banken de efficiëntie van banken verbetert in landen die sinds kort lid zijn van de EU. Deze landen hebben betere economische vooruitzichten en een sterkere institutionele achtergrond. De invloed van buitenlands eigendom op minder ontwikkelde landen is ambigu. Deze resultaten onderbouwen de eerdere bevindingen van het belang van de macro economische en institutionele omgeving als het gaat om het evalueren van buitenlandse bank participatie.

In Hoofdstuk 5 wordt gekeken wat de invloed van het openstellen van grenzen is op de concurrentie binnen het binnenlandse bancaire systeem. Het vernieuwende van onze aanpak is dat we rekening houden met de invloed van het toetreden van buitenlandse banken bij het analyseren van de concurrentie binnen het bancaire systeem. Bovendien maken we onderscheid tussen overnames en *greenfield investments*. Dit onderscheid is belangrijk omdat er voor de verschillende manieren van toetreding mogelijk verschillende motieven zijn. Bij een *greenfield* is het waarschijnlijk dat de bank zijn klanten achterna gaat en slechts beperkte diensten aanbiedt, terwijl bij een overname het waarschijnlijk is dat de bank een breeds scala van diensten wil gaan aanbieden. Onze resultaten duiden erop dat toetreding van buitenlandse banken alleen bijdraagt aan meer concurrentie in de bank sector wanneer er sprake is van een overname. De invloed van *greenfields* op de concurrentie is niet significant.

In Hoofdstuk 6 onderzoeken we de invloed van buitenlandse banken op de kosten voor financiële bemiddeling in FSEs, door te kijken naar netto interest marges. Theoretische studies over de determinanten van interest marges ('het *dealership* model') gaan ervan uit dat karakteristieken van de eigenaar van een bank hierin geen rol spelen (Ho and Saunders, 1981; Maudos and Fernandez de Guevara, 2004). Andere stud-

ies geven echter aan dat buitenlands eigendom via verschillende directe en indirecte kanalen wel degelijk van invloed kan zijn op interest marges (Claeys and Hainz, 2007; Dell'Ariccia and Marquez, 2004; Lehner and Schnitzer, 2008). Vergelijkende analyses van beide typen theoretische studies laten zien dat de hoofd kanalen waarmee buitenlands eigendom van invloed is op de kosten van financiering meegenomen worden in het *dealership* model. Onze empirische analyse ondersteunt deze hypothese en laat zien dat wanneer rekening wordt gehouden met theoretisch gemotiveerde determinanten, eigendom niet van invloed is op de interest marge. Deze bevinding wijkt af van eerdere studies die geen rekening houden met theoretisch gefundeerde determinanten en alleen eigendom opnemen als determinant van interest marges. In deze studies komt naar voren dat eigendom significant is.

Onze analyses bevestigen de verwachting van beleidsmakers dat een toename van buitenlandse banken een positieve invloed heeft op FSEs, maar leiden ook tot enige nuanceringen. Allereerst is de invloed van buitenlandse banken niet overal hetzelfde. Gemiddeld genomen profiteren FSEs waar hervormingen zijn doorgevoerd meer van toetreding van buitenlandse banken dan FSEs waar deze hervormingen nog onvoldoende zijn doorgevoerd. Het is echter ook mogelijk dat de causaliteit omgekeerd is en dat banken voornamelijk naar die landen zijn gegaan die al meer economisch ontwikkeld waren en zich richtten op toetreding tot de EU.

Vervolgens blijkt dat beleidsmakers rekening moeten houden met de wijze waarop buitenlandse banken toetreden. De motieven die schuilgaan achter de manier van toetreding resulteren in verschillende in prestaties na toetreding. Ten slotte moet er extra inspanning geleverd worden om de concurrentie binnen het bancaire systeem in de transitie landen te verbeteren. Hoewel toetreding van buitenlandse banken leidt tot meer concurrentie, blijkt in de meeste FSEs sprake te zijn van marktmacht.