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Competition, Reform and Efficiency in Banking: Evidence From 15 Transition Economies

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Competition, reform and efficiency in banking: Evidence from 15 transition economies

by

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Abstract

This paper examines the relative cost efficiency of sample of 289 banks in 15 transition economies for the years 1994 to 2002. This issue is of considerable interest because of the greater competitive pressures faced banking systems in region as they become more open to cross border capital flows and, for some countries, as they accede to the European Union. We find evidence that cost efficiency improves with the entry of newly established private banks, particularly where reforms in the banking sector are more advanced, and with the entry of majority foreign-owned banks through a spill-over effect on competition. The effects of market selection and competition are therefore a significant determinant of cost performance and that the former effect is reinforced by more effective banking regulation and supervision. Banking systems with higher ratios of capital to total asset also tend to have lower costs. This may be associated with greater risk aversion. However, there is no significant evidence that better corporate governance through privatisation or majority foreign ownership has a direct effect in boosting cost efficiency.

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1. Introduction

This paper analyses for of a sample of banks in transition economies their relative cost efficiency, which is a fundamental aspect of banking development. The development of a financially sound and competitive banking system and the abandonment of socialist banking are often regarded as central to a successful transition. Arguably, it is vital both to macroeconomic stability and to favourable long-term growth prospects in transition economies. However, as argued in Berglöf and Bolton (2002) and Fries and Taci (2002), bank intermediation in many transition economies remains stunted after a decade or more of reform, particularly where progress in macroeconomic stabilisation, hardening of enterprise budget constraints and reform of legal and banking systems remains limited. It also appears that the cost performance of banks in transition economies as measured by their cost efficiency is unimpressive. The ratio of operating costs to total assets has averaged about 5.1 per cent in a large sample of banks in transition economies, which is the focus of this paper. This figure compares unfavourably with the typical performance of banks in the OECD where the ratio of operating costs to total assets averaged about 2.4 per cent of total assets in the period 1994 to 2002.

The apparently weak performance of banks in transition economies is in some respects not surprising. Like many industrial enterprises in transition, socialist banks were themselves enterprises that were in need of restructuring at the outset of transition. Until then, banks had been used by the state mainly to channel funds, providing credits to state enterprises for investment projects approved under central planning and employment to large numbers or employees. The allocation of finance was not determined by the opportunity cost of funds and the expected ability to repay; or at least, if such considerations influenced investment and lending decisions, it was at the planning level and not at the level of the banking system. Similarly, the factors of production used by banks (labour and physical capital) were not necessarily of the scale and mix that minimised costs. As a consequence, banks have had to restructure their own activities and learn from scratch the skills of their counterparts in market economies. Moreover, they have had to do so as the banking systems were opened to entry of new private banks and foreign banks, albeit through processes that were not always adequately regulated through adequate minimum capital requirements and so-called fit and proper tests for the granting of banking licenses.

In this paper, we estimate for sample of 289 banks from 15 countries over the years 1994–2002 the cost efficiency frontier and calculate measures of their cost efficiency relative to this frontier. The aim is to identify factors both at the country level and bank level that are associated with greater cost efficiency in banking in transition economies. The paper therefore builds on an existing literature that examines variation across countries in banking efficiency by estimating a common frontier against which banking efficiency can be evaluated. These studies cover the Nordic countries (Berg et al., 1993), 11 OECD countries (Fecher and Pestieau, 1993), groups of developed countries (Pastor et al., 1997, and Ruthenberg and Elias, 1996). A strength of these cross-country studies is that they can provide useful information on the competitiveness of banks in different countries, a concern of particular importance in transition economies as cross-border competition in the provision of financial services intensifies with increased international capital flows and, for some countries, accession to the European Union. A weakness of these studies, however, arises from specifying a common cost frontier across countries even though there can be significant differences in legal, regulatory and economic environments and in the quality of services associated with loans and deposits across countries. These strengths and weaknesses apply our analysis as well, although we do take into account to the extent possible country environmental factors determining the position of the cost efficiency frontier.

The paper also adds to the existing literature on cost efficiency in banking in transition economies, which focuses primarily on variations in bank efficiency within a few of the countries. These studies cover Croatia (Kraft and Tirtiroglu, 1998), Czech Republic (Taci and Zampieri, 2000) and Poland (Opiela, 2000), while Wiell (2003) covers both the Czech Republic and Poland. The findings from these studies are mixed. Kraft and Tirtiroglu find that state-owned banks in Croatia have higher efficiency levels and than private banks, while Taci and Zampieri find greater efficiency for private banks in the Czech Republic. There is no evidence of greater efficiency of foreign-owned banks in either study. However, both Opiela for Poland and Weill for the Czech Republic and Poland find that foreign owned banks are more efficient than domestically owned banks. Moreover, Weill finds that the greater efficiency of foreign banks is unrelated to the scale and mix of their operations and attributes this superior performance of foreign banks to advantages in terms of better skills and corporate governance.

With our panel dataset for banks in transition economies, we estimate a stochastic cost frontier by imposing specific functional form for the cost function, a standard second-order translog approximation to a multi-product cost function. The benefits of this approach are the flexibility of the functional form and the allowance for random errors that can arise from measurement problems or luck that temporarily gives banks better or worse measured performance from one year to the next. The main drawback from this approach is the restriction imposed by the assumed functional form of the cost function. Alternative approaches, such data envelop analysis, have the advantage of not imposing a specific functional form on costs, but at the expense of assuming that there are no random errors. In transition economies, where measurement problems loom large and decision makers face considerable uncertainty in the economic environment, we regard the advantages of allowing for random errors in specifying a specific functional form for costs as out-weighing the disadvantages imposed by the restrictions of an assumed functional form for costs.

After estimating the efficient cost frontier, we then use the distribution free approach (DFA) to estimate the relative level of efficiency of each bank relative to the "best" bank in the sample (Berger, 1993, and Berger and Mester, 1997). The DFA makes no strong assumptions about the distributions of the inefficiencies or random errors. Rather, it makes use of the panel structure of our dataset and assumes that the efficiency of each bank is stable over time and the random error terms tend to average to zero over time. The estimate of efficiency level for each bank in the dataset is then determined by the average fixed effect for a particular bank relative to the average fixed effect for the bank on the efficient frontier. To reduce the effect of extreme points in the data, we also truncate the extreme average fixed effect at both the one per cent and five per cent levels. However, a limitation of the DFA is the assumption that the efficiency of banks is persistent over time. If efficiency is changing over time due to technological change or regulatory reform or other influences, the DFA describes the average efficiency of each bank relative to the average efficiency of the bank on the efficient frontier, rather than the efficiency at any one point in time.

The main findings of the estimations are that banks in transition economies have operated at an inefficient scale and that there are significant unrealised economies of scale. This is due in part to the very low inelasticity of total costs with respect to deposits, which suggests that depositors in transition economies are not being well remunerated either in

the form of interest payments or transactions services. While recognising our limited ability to control for variation in quality of banking services among countries, several country-level factors also appear to be significant in explaining variation in banking efficiency. Greater per capita income levels and nominal interest rates are associated with higher total costs in banking, while a higher ratio of deposits per square kilometre of territory are associated with lower costs. Banking systems with higher ratios of capital to total asset and of foreign bank assets to total assets tend to have lower costs. The former may be associated with greater risk aversion and the latter with more competition.

At the bank level, we investigate the influence of two factors that are expected to influence the incentives for efficiency and managerial selection, the origin and ownership structure of banks and the extent of banking reform and quality of prudential regulation and supervision. We find that newly established private banks are somewhat more efficient than privatised or state-owned banks. They are also more efficient than foreign owned banks. The strength of this market selection effect, moreover, increases with progress in banking reform, as measured by the EBRD transition indicator for the banking sector. Sound prudential regulation and supervision may therefore be complements in promoting greater efficiency in transition banking.

2. Methodology

2.1. Common cost efficiency frontier

Cost efficiency is determined by how close a bank's costs lie to the efficient cost frontier for a given technology. The efficient frontier is determined by two conditions, technical efficiency (minimum use of inputs) and allocative efficiency (optimal mix of inputs given relative factor prices). The absence of either technical or allocative efficiency (or both) necessarily leads to a departure from cost minimization and creates inefficiency. But since cost functions are not know or directly observable, inefficiencies must be measured relative an efficient cost frontier that is estimated from data. Therefore, the measurement of inefficiency is based on deviations from the minimal costs observed in the data rather than from a technologically feasible efficient frontier. Bank cost inefficiency is defined as the difference between observed costs and predicted minimum costs for a given scale and mix of outputs, factor prices and other environmental variables. In other words, each bank in the sample is benchmarked against the "best" bank in the sample.

Cross-country comparisons of banking efficiency require estimation of a common frontier for all banks in the countries under consideration. However, in cross-country comparisons it is important to allow for not only for variation in relative factor prices but also for environmental variables that could influence the level of efficiency for all banks in the country and the quality of services provided with loans and deposits. Simply pooling all banks across countries and ignoring factors in the economic environment that could influence the technology efficiency and quality variations would assume that efficiency differences across countries can be attributed entirely to managerial decisions within banks regarding the scale and mix of inputs. Country-specific features, such as the macroeconomic performance, legal and regulatory frameworks, household wealth and incomes, population densities and market structures in banking, can have significant effects on the level of technological efficiency and service quality as well as on the scale and mix of inputs. For example, differences in economic development measured by per capita income or in density of deposits across countries could generate significant differences in the demand for banking products and services by firms and households. By allowing for country factors to influence the position of the efficient cost frontier, we recognise that technology efficiency and service qualities can vary systematically across countries.

These differences are potentially important in countries in transition. The large differences in economic and regulatory environments across countries can have significant effects on both the demand for and supply of banking services. Therefore, while feasible banking technologies may be similar across countries, there may nevertheless be differences in bank efficiency that would reflect primarily the differences in country-specific factors and the efficiency with which technologies can be employed rather than the choice of scale and mix of inputs at the bank level. For example, a dysfunctional legal system can raise the cost of making and collecting a loan even if the credit skills and procedures of all banks in each of the countries is the same. If country-specific characteristics are important in explaining the efficiency differences across countries, the estimation of the common frontier without taking into account such factors would produce biased estimates of efficiency and may overestimate the inefficiency of banks in some countries and underestimate that in others.

In constructing a common efficient cost frontier for the 289 banks in 15 transition countries in our data set, we use a set of country characteristics to account for the possible differences they may produce in the efficiency measure. In order to investigate the differences in efficiency explained by these country-specific environmental variables, we also estimate measures of bank efficiency determining a common frontier without taking them into account.

2.2.Cost specification and the Distribution Free Approach to measuring efficiency

We estimate the relative efficiency of banks in 15 transition countries by using the Distribution Free Approach (DFA) for a panel dataset. The estimation of banks relative efficiency using panel data (Schmidt and Sickles, 1984) is performed by estimating a stochastic frontier cost function using a function that involves a bank fixed effect as follows

$$y_{ijt} = \alpha + X'_{ijt}\beta + Z'_{jt}\gamma + \nu_{ijt} - u_{ij}, \qquad (1)$$

where y_{ijt} is total cost in logarithm form of bank *i* in country *j* in period *t*, X'_{ijt} is a matrix of outputs and of input prices in logarithm form, Z'_{jt} is the matrix of country-specific environmental variables for country *j* in period *t*, ν_{ijt} is a random error term and u_{ij}>0 is the bank effect representing technical inefficiency. The bank effect term can be included in the constant term as in the usual fixed effect model

$$y_{ijt} = \alpha_{ij} + X'_{ijt}\beta + Z'_{jt}\gamma + \nu_{ijt}, \qquad (2)$$

where

$$\alpha_{ij} = \alpha - u_{ij}.$$

Assuming time-invariant bank technical efficiency, we can calculate the efficiency measures as follows. Using the "Within" estimator of cost equation (1), the residuals $\left(y_{ijt} - X'_{ijt}\hat{\beta} - Z'_{jt}\hat{\gamma}\right)$ are an estimate of $\left(\nu_{ijt} - u_{ij}\right)$ and the bank effect is estimated by averaging the residuals from the estimation over time

$$\hat{\alpha}_{ij} = \bar{y}_{ij} - \bar{x}_{ij}\hat{\beta} - \bar{z}_j\hat{\gamma} \,. \tag{3}$$

The most efficient bank in the sample is the bank that has the minimum bank–specific effect (technical efficiency). Therefore, the frontier intercept is calculated as

$$\hat{\alpha} = \min_k\left(\hat{\alpha}_{kj}\right) \quad . \tag{4}$$

To satisfy the non-negativity constraint the efficiency indicator must be normalised. Therefore, to calculate the level of technical efficiency for a given bank we calculate

$$EFF_{ij} = \exp\left(\hat{\alpha} - \hat{\alpha}_{ij}\right) . \tag{5}$$

Because of the effect of extreme randomness in some banks as reflected in the tails of the distribution of the fixed effects, we calculate an additional measure for efficiency from truncated distributions of α_j (Hunter and Timme, 1995). In this case banks that lie above the *(1-qth)* quartile of the efficiency measure take an efficiency value of 1 and those below take the same efficiency measure as the bank representing the *qth* quartile. The efficiency measure for the *qth* quartile then becomes

$$EFF_i = \exp\left(\hat{\alpha}_{1-q} - \hat{\alpha}_q\right) , \tag{6}$$

where $\hat{\alpha}_{1-q}$ and $\hat{\alpha}_q$ are the estimates of α_k for the banks in the *(1-qth)* and *qth* quartile, respectively.

2.3 Cost Function

The DFA allows for any particular functional form for costs. In the estimation we therefore employ a standard second order, non-homothetic translog approximation to the multi-product total cost function. This specification allows for a more flexible specification and imposes fewer restrictions than, for example, the Cobb-Douglas functional form.

That is, the cost function can be written as

$$\ln TC_{ijt} = \alpha_0 + \sum_m^n \alpha_m \ln P_{m,ijt} + \sum_s^t \beta_s \ln Q_{s,ijt} + 1/2 \sum_m^n \sum_n^m \alpha_{m,n} \ln P_{m,ijt} \ln P_{n,ijt}$$

$$1/2 \sum_s^t \sum_t^s \beta_{s,t} \ln Q_{s,ijt} \ln Q_{t,ijt} + \sum_m^n \sum_s^t \phi_{m,s} \ln P_m \ln Q_{s,ijt} \qquad (7)$$

where P_m and P_n are input prices and Q_s and Q_t are outputs quantities. In estimating equation (7), we impose constraints on symmetry, $\alpha_{m,n} = \alpha_{n,m}$, and $\beta_{s,t} = \beta_{t,s}$, homogeneity in prices, $\sum_m^n \alpha_m = 1$, and adding-up, $\sum_m^n \alpha_{m,n} = \sum_n^m \alpha_{n,m} = \sum_m^n \phi_{m,s} = 0$. We then test against a Cobb-Douglas functional form, where the coefficients of the cross-production terms are all restricted to zero, $\alpha_{m,n} = \beta_{s,t} = \phi_{m,s} = 0$.

2.4. Factors explaining differences in bank efficiency

After determining a common cost efficiency frontier and bank efficiency levels, including an allowance for country environmental variables, we examine the factors that may be associated with efficiency differences across banks and countries. These factors may be bank characteristics or country characteristics. To identify these factors, we regress bank efficiency levels against a set of factors that that may be associated with managerial decisions or the efficiency of banks. These factors include the origin and ownership structure of banks, their market shares and a measure of the quality of legal and regulatory environment in which banks operate. Both factors can be expected to influence the incentive structure of banks. Therefore, we estimate the following

$$EFF_{ij} = \alpha + \bar{y}_{ij} \chi + \bar{z}_j \delta + \mu_i , \qquad (8)$$

where EFF is given by equation (7), $\bar{y}_{ij}$ is the vector of average value over 1994-2002 of bank specific characteristics that may effect efficiency, $\bar{z}_j$ is the vector of average values over the period under consideration of the country-specific variables, and u_i is a random error term.

3. Data sources and variable descriptions

3.1 Data Sources

The primary source of data on the banks' balance sheets, income statements and ownership is the *BankScope* database produced by the Bureau van Dijk, which includes data on 10,227 banks world-wide. The database is updated monthly and latest issue of the *BankScope* database used in this study was May 2003. The *BankScope* data are supplemented with the data and information from annual reports of the banks and from EBRD staff research on bank ownership. The central banks of the countries provided aggregate data on their banking systems for use in calculating market concentration, ratio of total deposits to total loans (intermediation ratio), ratio of equity to total assets and share of foreign bank assets in total bank assets. The sources of macroeconomic data and measures of banking reforms for the countries are the EBRD's *Transition Reports* and the IMF's *International Financial Statistics*.

In our sample, we include all banks in the Bankscope database for which at least five years of data are available for the years 1994 to 2002. This minimum of five years is required for the Distribution Free Approach to distinguish between random noise and bank inefficiency in the errors of estimated cost functions. In addition, where banks report according to both local accounting standards and international accounting standards for at least five years, we select data in international accounting standard rather than national accounting standards for banks. This account for 57 per cent of the banks in the sample. The sample includes 289 banks from 15 transition countries, 19 banks in Bulgaria, 35 in Croatia, 23 in the Czech Republic, four in Estonia, eight in FYR Macedonia, 24 in Hungary, 10 in Kazakhstan, 19 in Latvia, 10 in Lithuania, 36 in Poland, 7 in Romania, 48 in Russia, 15 in the Slovak Republic, 17 in Slovenia and 14 in Ukraine. All bank accounting data are in nominal terms in US dollars converted at current exchange rates.

The composition of banks in our sample varies over the entire sample period of 1994 to 2001. Only a few banks have data available for 2002. There are 107 banks for which data are available for the entire sample, while there are 153 banks which enter the sample after 1994 and 70 banks which exit from the sample before 2001. The additions to the sample are not necessarily new market entrants, but rather successful banks that are added to the *Bankscope* scope database over time. Exists from the sample are due to either bank failures or mergers with other banks. This method of selecting banks from the Bankscope database introduces selection bias in data, as does the selection by *Bankscope* of banks to include in

the data set, which are primarily the larger and financially sounder banks in the region. The estimation results are therefore representative not of the entire population of banks in transition economies, but rather of the relatively successful top tier of banks in the region.

3.1 Variable definitions for estimation of stochastic cost efficiency frontier

Total cost and outputs

We use the intermediation approach to measure the cost of a bank because a competitive and efficient institution would minimise the total operating and interest costs for any given output. Total cost is therefore the sum of interest expenses and general operating expenses. To determine which bank products to include as outputs, we use the criterion of value added. Banking functions that produce a flow of banking services associated with a substantial labour or physical capital expenditure are identified as outputs. We therefore use two banks outputs. One output is loans to clients, which includes the all loans to non-bank entities and loans to other banks. The second output is deposits. One characteristic of deposits is that they are paid for in part by the provision of liquidity, transactions and payment services to depositors.

Input prices

We consider two inputs, labour and capital, and use two input prices. As a proxy for the price of labour we use the ratio of operating costs to total assets, since data on the number of employees is not available and average wages cannot be calculated. The price of physical capital is also measured using a proxy variable. Here we use the ratio of fixed assets to total assets as a proxy for the price of physical capital.

Country environmental and control variables

To control for the effect of country-specific factors on banking efficiency estimated using a common frontier, we include several such variables in the estimation of the cost function. They include macroeconomic variables and measures of structural and institutional reforms in the banking industry. The macroeconomic variables include per capita GDP measured in US dollars, the level of nominal interest rates and the density of deposits (deposits in millions of US dollars per square kilometre). Per capita GDP influences both the demand

and supply of banking services embodied in deposits and loans. Banks operating in a country with higher GDP per capita may face both a demand for higher quality banking services and higher labour costs. High nominal interests can raise the interest costs of banks and reduce bank's efficiency in activities such as risk management and evaluation of credit information through greater uncertainty and risk. Banking efficiency may be affected also by the density of demand. Banks operating in an environment with a lower level of deposits per square kilometre of land area may incur higher costs in mobilising deposits through their branches.[3]

Another set of variables that can affect banking efficiency and service quality are those that characterise the structure of banking industry and the quality of legal and regulatory institutions. This includes the degree of asset market concentration (measured as the ratio of assets of five largest banks in the total assets of the sector), the intermediation ratio of the banking industry (measured as the ratio of loans to deposits) and the average capital ratio (measured as average ratio of equity to assets for the banking sector). Asset market concentration can lead to either higher or lower costs for the banks. If market concentration reflects market power for some banks, it may increase the costs for the sector in general through slack and inefficiency. However, if the concentration of market reflects market selection and consolidation through survival of the more efficient banks, market concentration would be associated with lower costs provided that the markets remain contestable. The intermediation ratio reflects differences among the banking sectors in terms of the extent to which they convert deposits into customer (household and enterprise) loans, which can be associated with bank holdings of government securities and the crowding out of private borrowing by the public sector and higher nominal interest rates. The average capital ratio is used as a proxy for differences in the regulatory requirements among countries. A higher average capital ratio is usually associated with lower costs banks because they can borrow at lower interest rates since they are perceived as less risky.[4] In addition, bank dividend payments are excluded from the measure of total cost, therefore the return to bank equity is not included in the measure of total cost. The share of foreign bank assets to total bank assets provides a proxy measure for the intensity of competition associated with foreign entry in the banking markets of the region.

[3] We also considered the real GDP growth as a possible factor that affects the operating costs of banks due to its effect on the demand and supply of both loans and deposits. However, it turned out to be not significant.
[4] To control for the differences in the operating environment for banks in different countries we also included the EBRD banking sector reform indicator. However, since that indicator is highly correlated with other macroeconomic and regulatory variables, it was not significant in the first stage estimations.

We also include two bank-level variables to control for non-traditional bank activities and their risk difference. The measured efficiency may reflect some changes in the product quality between banks. The data show that lower cost banks have a smaller proportion of non-interest income to interest income, suggesting that they may offer less fee-type services that are relatively costly to provide. As a proxy for product differences we also use the ratio of non-loan assets to total assets. In addition, to control for variation in risk taking strategies among banks (some banks may choose high risk-high return-high cost strategy), we include the ratio of non-performing loans to loan balance.

3.2 Second stage estimation variables

Factors that may affect the efficiency level of a particular bank are its ownership structure, major operational changes within the bank itself (in particular if a bank merged with other banks during the time period) and market power of a bank in the deposit market. Bank capitalisation also may affect the bank efficiency. In addition, we include a dummy for banks that report in international accounting standards. Further, we test whether banks operating in a country where banking and related enterprise reforms are more advanced are more efficient than banks operating in a less advanced reform environment. Prudential regulation and supervision may also provide incentives for greater efficiency through the requirement of maintaining bank capital adequacy.

Bank ownership dummy variables represent majority state-ownership, privatised and *ab initio* private banks, as well as private banks with a foreign bank ownership stake above 50 percent. We take the average value the ownership dummy variable over the time period for which data on the bank are available. The merger dummy is constructed by averaging over the time period the annual merger dummies which take value one if a merger has happened in that year. Bank capitalisation is measured by the average over time of the ratio of equity to total assets of a particular bank. The average deposit market share of a bank measures its market power. We use the time average of the EBRD transition indicators of banking and enterprise reforms to check if they could explain the differences in bank efficiency across countries.

4. Empirical results

4.1 Estimation of the stochastic cost efficiency frontier

Table 1 reports two regressions used to estimate the translog cost function, one specification allows for country-specific factors and the other does not. These regressions reveal a number of important characteristics of the cost function of banks in transition economies:

- The estimated elasticity of total costs with respects to customer loans is 0.13 when evaluated at the sample mean for amount customer loans outstanding.

- The estimated elasticity of cost with respect to customer deposits is significantly lower at.0.03 when evaluated at the sample mean for amount of customer deposits on the balance sheet. The very low elasticity of cost with respect to deposits suggests that interest saved through funding with deposits outweighs at the margin much of the cost of mobilising funds through branch networks and providing transactions and other services to depositors.

- The multi-product economies of scale measure with respect to loans and deposits is 6.3, when evaluated at the sample mean for both the amount of customer loans and deposits outstanding. This suggests that there are significant unrealised economies of scale with respect to deposit taking and lending to customers for the averaged size bank in the sample. In fact, the scale economies are not exhausted even for the largest bank in the sample.

- The estimated elasticity of total cost with respect to the proxy for wages (the ratio of operating expenses to total assets) is about 0.xx when evaluated at the sample mean, which suggests that banks seek to substitute out of labour as the wage rate increases. However, the estimated elasticity of total cost with respect to the proxy for real capital costs (the ratio of fixed assets to total assets) is insignificantly different from zero. This may reflect in part a poor proxy measure rather than a lack of sensitivity of banks to input prices.

- Only the coefficient on the cross-product terms between deposit and customer loans is statistically significant. This coefficient is negatively signed.

- Costs increase with the per capita GDP of country. An increase in per capita GDP of US$ 1,000 is associated with an increase in total costs of 0.1 per cent. This may reflect

quality differences in banking services among countries at different stages of development as well as higher wage costs in countries with higher per capita incomes.

- The density of deposits per square kilometre significantly and negatively associated with costs. An increase in the density of deposits by US$ 10,000 is associated with a decrease in total cost of 1.1 per cent. This may reflect economies in mobilising deposits in countries with less land area (fewer branches needed) and higher savings.

- The nominal interest rate is positively associated with costs, reflecting the fact that interest costs a significant share of total costs. An increase in the nominal interest rate of 10 percentage points increases total costs by 3 per cent.

- Banking systems with a higher ratio of equity to total assets have significantly lower costs. A five percentage point increase in the equity to total asset ratio is associated with a reduction in total costs equivalent to 2 per cent. This is consistent with lower risk premium on deposits and other liabilities used to fund banks. Equity reduces risks both directly by absorbing losses ahead of creditors and indirectly through a stronger incentive for prudent management of bank assets.

- Banking system with a higher share of foreign-owned banks, measured by their share of total banking system assets, have lower costs. An increase in the share of foreign bank assets in total bank assets of 10 per cent is associated with a reduction in total costs of 1 per cent. This is consistent with foreign banks exerting greater competitive pressures on banks than their domestic counterparts, at least in this dimension.

- The ratio of non-performing loans to total loans of a bank is significantly and positively related to its total costs. An increase in the ratio of non-performing loans to total loans of 1 per cent is associated with an increase in total costs of 1 per cent. This is consistent with higher ex-post or observed risks being positively associated with higher banking costs, including interest costs.

- A higher share of non-loan assets in total assets of a bank is positively associated with higher costs. This variable may serve as a proxy for variations in banking service qualities that are not captured by the loan and deposit variables which are traditional banking services.

- There is significant consistency in the parameter estimates even when the country-level variables are omitted from the regression.

4.2 Correlates with bank efficiency measures

Table 2 reports the bank efficiency averaged for each of the 15 countries in the sample. When we allow for country environmental factors in determining the cost efficiency frontier, the country with the highest average level of bank efficiency is Slovenia (0.93 out of possible maximum of 1.00 at a five per cent truncation level), followed by Latvia (0.90), Croatia (0.86), Bulgaria (0.86) and Lithuania (0.85). The country with least efficient banks on average is Romania (0.67), followed by the Czech Republic (0.71) and FYR Macedonia (0.72). The other countries in the sample have average levels of bank efficiency in the range 0.75 to 0.81. However, the differences in the average efficiency levels between most countries are not statistically significant. When there is no allowance for country environmental factors in determining the cost efficiency frontier, the country with the highest average level of bank efficiency is Latvia (0.84), followed by Lithuania (0.78), Bulgaria (0.76), Croatia (0.75), Kazakhstan (0.74) and Estonia (0.73). The country with the least efficient banks remains Romania (0.50), followed by Ukraine (0.54), Hungary (0.54), FYR Macedonia (0.56) and Russia (0.56). For the two types of estimations, the correlation coefficient between the country average bank efficiency levels 0.76. There is therefore a significant correlation between the two types of estimates, although the average level of efficiency is significant lower when the country-level variables are omitted (0.65 versus 0.80).

Table 3 reports the mean efficiency scores for banks averaged according to their origin and ownership, in particular for newly established private banks, privatised banks and state owned banks as well as for majority foreign owned banks. Again, the averages are calculated for when the estimated cost efficiency frontier allows for both country environmental variables and no such variables. When there is such an allowance, newly established private banks have a higher average cost efficiency level (0.83 at the five per cent truncation level) than do other types of banks (in the range 0.78 to 0.80). However, the differences in the average efficiency levels between most countries are not statistically

significant. When there is no such allowance, the average efficiency level of banks according to bank origin and ownership shows virtually no variation.

Table 4 reports the correlates with banking efficiency for the dependent variable measured at various truncation degrees for outlying observations (no truncation, 1 per cent and 5 per cent). These regressions show that newly established private banks have on average a bank efficiency level about 0.04 to 0.05 above that of privatised banks and state-owned banks. Surprisingly, majority foreign-owned banks have an average efficiency level that is on average the same as that if privatised. This finding suggests that any cost advantages of foreign banks are not sustained and are matched by the domestic competitors that remain in the market. There is in addition weak evidence that banks which report according to international accounting standards have higher efficiency levels (by about 0.01) than banks which report according to national accounting standards. There may therefore be a positive selection effect associated with the choice of banks to report according to IAS, with the better banks taking this decision. There are no effects on costs associated with the banks that had merged and were included in the sample, with the deposit market power of some banks, and with the level of banking reform at the country level.

Table 5 reports correlates with banking efficiency that allow for an interaction effect between the origin and ownership of banks and a measure of progress in banking reform. This interaction form shows that the cost advantages of new private banks increase with progress in banking reform. One interpretation of this finding is that the strength of the market selection effect XXX that is, to enter and remain in the banking market XXX Strengthens along with progress in banking reform. There is a similar, albeit statistically weak interaction effect between bank equity to total asset ratios and measure of banking reform.

5. Conclusions

This examines the relative cost efficiency of sample of 289 banks in 15 transition economies. This issue is of considerable interest because of the greater competitive pressures faced banking systems in region as they become more open to cross border capital flows and, for some countries, as they become part of the single European market by acceding to the European Union.

We find evidence that cost efficiency improves with the entry of newly established private banks and of majority foreign-owned banks through a spill-over effect on competition. The effects of market selection and competition are therefore a significant determinant of cost performance, while there is no significant evidence that better corporate governance through privatisation or majority foreign ownership has a direct effect in boosting cost efficiency. Banking systems with higher ratios of capital to total asset also tend to have lower costs. This may be associated with greater risk aversion. There is in addition an interaction effect between progress in banking reform and the strength of the market selection effect on the efficiency of levels of banks. The processes of competition in banking and of legal and regulatory reform in banking therefore appear to be complements in strengthening the cost efficiency of banks in transition economies.

The policy implications of the analysis appear clear. To prepare the banking systems in the region for greater competitive pressures associated with cross-border capital flows and, for some countries, accession to the European Union, policy makers should sustain progress in legal and regulatory reforms that are central to the provision of banking services, while allowing greater consolidation of banks to achieve unrealised economies of scale. At the same time, banking markets should remain open and contestable, including through entry of foreign banks.

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Table 1. Estimation of the stochastic cost efficiency frontier

Ln (Total cost)	With environmental variables	Without environmental variables
Ln (Loans)	0.59***	0.51***
	(8.82)	(7.63)
(Ln (Loans))^2	0.06***	0.05***
	(8.64)	(6.84)
Ln (Deposits)	0.14**	0.14**
	(1.98)	(1.91)
(Ln (Deposits))^2	0.10***	0.10***
	(9.89)	(9.64)
Ln (Loans x deposits)	-0.14***	-0.13***
	(-9.29)	(8.17)
Ln (Loans x cost of labour)	-0.04	-0.02
	(-1.47)	(-.73)
Ln (Loans x cost of capital)	0.01	-0.02
	(0.76)	(-1.15)
Ln (Deposits x cost of labour)	0.01	0.001
	(0.15)	(-0.02)
Ln (Deposits x cost of capital)	-0.01	0.03
	(-0.48)	(1.41)
Ln (Overhead costs to total assets)	0.49***	0.29***
	(5.32)	(3.26)
(Ln (Overhead costs to total assets))^2	0.08***	0.09***
	(4.30)	(7.61)
Ln (Fixed assets to total assets)	-0.05	-0.05
	(-0.74)	(-.79)
(Ln (Fixed assets to total assets))^2	-0.02*	-0.01
	(-1.79)	(-1.57)
Ln (Cost of labour x cost of capital)	0.02	0.02
	(0.99)	(1.25)
Macro Environment variables		
Per capita GDP	0.0001***	
	(3.60)	
Nominal interest rate	0.003***	
	(5.85)	
Density of demand (Deposits per square kilometre)	-1.15***	
	(-3.22)	
Sector Structure and Regulation		
Asset market concentration (the share of assets of 5 largest banks)	-0.003	
	(-1.35)	
Intermediation ratio (loans to deposits)	-0.19*	
	(-2.02)	
Equity to total assets of the banking sector	-0.004***	
	(-4.04)	
Asset share of foreign banks	-0.001***	
	(-2.64)	
Non-traditional banking activities and riskiness		
Share of non-performing loans to total loans for individual banks	0.01***	
	(6.45)	
Other non-loan assets to total assets	0.003**	
	(2.44)	
Constant	-1.57***	
	(-4.72)	
Number of Observations	1550	1822
R-Squared	0.71	0.66

Note: The numbers in parantheses are t-statistics from 'Within' estimations. A *** denotes statistical significance at 1 per cent confidence level, ** at 5 per cent and * at 10 per cent level.

Table 2. Average bank efficiency levels by country

Bank efficiency levels	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Kazakhstan	Latvia	Lithuania	Macedonia	Poland	Romania	Russia	Slovakia	Slovenia	Ukraine
With country-specific characteristics															
EFF	0.56	0.60	0.37	0.51	0.43	0.50	0.66	0.58	0.39	0.51	0.30	0.54	0.50	0.71	0.48
	(0.12)	(0.14)	(0.11)	(0.06)	(0.10)	(0.10)	(0.13)	(0.09)	(0.14)	(0.13)	(0.09)	(0.16)	(0.08)	(0.16)	(0.19)
EFF (truncation at 1%)	0.80	0.80	0.65	0.76	0.69	0.74	0.85	0.79	0.65	0.75	0.61	0.75	0.74	0.88	0.72
	(0.08)	(0.09)	(0.08)	(0.05)	(0.08)	(0.07)	(0.08)	(0.06)	(0.12)	(0.08)	(0.07)	(0.08)	(0.06)	(0.09)	(0.11)
EFF (truncation at 5%)	0.86	0.86	0.71	0.81	0.75	0.80	0.90	0.85	0.72	0.81	0.67	0.80	0.79	0.93	0.77
	(0.08)	(0.08)	(0.06)	(0.05)	(0.08)	(0.07)	(0.07)	(0.07)	(0.11)	(0.08)	(0.04)	(0.08)	(0.06)	(0.08)	(0.11)
Without country-specific characteristics															
EFF	0.45	0.44	0.34	0.41	0.30	0.43	0.49	0.46	0.32	0.36	0.27	0.32	0.35	0.38	0.31
	(0.13)	(0.11)	(0.08)	(0.03)	(0.09)	(0.10)	(0.08)	(0.12)	(0.12)	(0.15)	(0.11)	(0.10)	(0.10)	(0.08)	(0.14)
EFF (truncation at 1%)	0.64	0.62	0.49	0.59	0.44	0.61	0.70	0.65	0.46	0.51	0.39	0.46	0.51	0.54	0.44
	(0.19)	(0.15)	(0.11)	(0.04)	(0.12)	(0.14)	(0.11)	(0.16)	(0.17)	(0.16)	(0.15)	(0.15)	(0.14)	(0.11)	(0.20)
EFF (truncation at 5%)	0.76	0.75	0.60	0.73	0.54	0.74	0.84	0.78	0.56	0.62	0.50	0.56	0.62	0.66	0.54
	(0.20)	(0.16)	(0.14)	(0.05)	(0.15)	(0.17)	(0.11)	(0.14)	(0.21)	(0.17)	(0.16)	(0.17)	(0.17)	(0.14)	(0.24)

Table 3. Average bank efficiency levels by bank ownership

Bank efficiency levels	Foreign banks	Privatised banks	Denovo banks	State-owned banks
With country-specific characteristics				
EFF	0.507	0.49	0.56	0.502
	(0.16)	(0.14)	(0.17)	(0.16)
EFF (truncation at 1%)	0.74	0.73	0.77	0.74
	(0.12)	(0.11)	(0.12)	(0.11)
EFF (truncation at 5%)	0.796	0.78	0.83	0.797
	(0.12)	(0.11)	(0.12)	(0.10)
Without country-specific characteristics				
EFF	0.384	0.382	0.381	0.383
	(0.11)	(0.10)	(0.13)	(0.13)
EFF (truncation at 1%)	0.547	0.544	0.546	0.546
	(0.16)	(0.14)	(0.18)	(0.17)
EFF (truncation at 5%)	0.664	0.661	0.665	0.663
	(0.18)	(0.17)	(0.21)	(0.19)

Table 4. Correlates with bank efficiency levels

Bank efficiency level (EFF)	EFF (no truncation)	EFF (1% truncation)	EFF (5% truncation)
State-owned banks	-0.001	0.001	0.01
	(-0.03)	(0.04)	(0.41)
Foreign-owned banks	0.008	0.0005	0.003
	(0.26)	(0.02)	(0.16)
New privatise banks	0.05*	0.04**	0.04**
	(1.80)	(2.48)	(2.56)
Equity to total assets of bank	0.001*	0.0003	0.0004
	(1.59)	(0.63)	(0.91)
IAS (dummy variable)	0.02	0.009	0.01
	(0.92)	(0.70)	(1.10)
Merger occurrence (dummy variable)	0.02	0.03	0.02
	(0.13)	(0.26)	(0.18)
EBRD banking reform indicator	0.002	0.007	0.009
	(0.07)	(0.54)	(0.76)
Deposit market share (in per cent)	0.00009	0.0003	0.0002
	(0.10)	(0.46)	(0.30)
Constant	0.47***	0.71***	0.75***
	(7.58)	(19.30)	(21.61)
Number of observations	286	286	286
R-Squared	0.05	0.05	0.06

Note: The numbers in parantheses are t-statistics calculated on the bases of robust standards errors. A *** denotes statistical significance at 1 per cent confidence level, ** at 5 per cent and * at 10 per cent level.

Table 5. Correlates with bank efficiency levels

Bank efficiency level (EFF)	EFF (no truncation)	EFF (1% truncation)	EFF (5% truncation)
IAS (dummy variable)	0.01 (0.64)	0.005 (0.38)	0.010 (0.76)
Merger occurrence (dummy variable)	0.02 (0.14)	0.03 (0.25)	0.02 (0.18)
EBRD banking reform indicator	-0.01 (-0.43)	0.003 (0.18)	0.003 (0.25)
Deposit market share (in per cent)	0.0003 (0.31)	0.0004 (0.69)	0.0003 (0.54)
New private bank x EBRD banking reform indicator	0.02* (1.88)	0.01** (0.016)	0.01** (2.52)
Majority foreign bank ownership x EBRD banking reform indicator	-0.001 (-0.12)	-0.003 (-0.41)	-0.002 (-0.31)
State ownership x EBRD banking reform indicator	-0.003 (-0.20)	-0.002 (-0.18)	0.001 (0.15)
Equity to total assets of bank x EBRD banking reform indicator	0.0006** (1.96)	0.0002 (0.97)	0.0002 (1.34)
Constant	0.50*** (8.44)	0.72*** (20.93)	0.77*** (23.29)
Number of observations	286	286	286
R-Squared	0.06	0.05	0.06

Note: The numbers in parantheses are t-statistics calculated on the bases of robust standards errors. A *** denotes statistical significance at 1 per cent confidence level, ** at 5 per cent and * at 10 per cent level.