Bank Performance in Central and Eastern Europe: The Role of Financial Liberalization

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Abstract

In this paper we analyze the impact of financial liberalization, reforms in the banking sector and the associated changes in the industry structure on the banking performance, measured in terms of cost efficiency and total productivity growth index in 17 countries from Central and Eastern Europe for 2004 – 2008 period. The period chosen is relevant in the context of the entrance of new ten EU members at the beginning of the year of 2004 and the beginning signs of the subprime crises in the Central and Eastern Europe in 2008. To examine the relationship between bank performance, financial liberalization and banking systems structure, we develop a two-stage empirical model that involves estimating bank performance in the first stage and assessing its determinants in the second. From our analyze result that the levels of the banking reform and interest rate liberalization indicator and financial openness index improve cost efficiency, suggesting that banks from Central and Eastern European countries with higher level of liberalization and openness are able to increase cost efficiency and finally to offer cheaper services to clients. Concerning the effect of financial reform on total productivity growth of banks from CEE countries, the results show that the level of banking reform and interest rate liberalization indicator and the score regarding soundness and safety of banks have a positive impact on total productivity growth.

Keywords: financial liberalization, efficiency, productivity, banks, CEE countries
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1. Introduction

The opening to the outside and the internal structural reforms of the financial sector are two interdependent processes, both having as purpose the development of the financially competitive and efficient system, in order to facilitate economic growth and financial/ banking system stability.

Many studies evaluate the direct impact of financial deregulation on bank performance, their empirical results are also rather controversial. Some authors, such as Berg et al. (1992), Berger and Humphrey (1997), Kumbhakar et al. (2001), Isik and Hassan (2003), Brisimis et al. (2008), show that financial deregulation has a positive impact on banking efficiency and on the productivity of banks, while other authors consider that deregulation has a negative effect on the performance of banks, determining a decrease of technical efficiency (Wheelock and Wilson, 1999) or consider that financial liberalization most often leads to financial crises (Betty and Jones, 2007).

The presence of foreign banks can be beneficial for consumers by offering superior products and services, for the financial industry by increasing the quality of services and for economy by increasing efficiency (Yildirim and Philippatos, 2007). Nevertheless, the entry of foreign banks is not without risks, especially in the case when this entry takes place without a previous consolidation of the institutional framework.

In this paper we analyze the impact of financial liberalization, reforms in the banking sector and the associated changes in the industry structure on the banking performance, measured in terms of cost efficiency and total productivity growth index in 17 countries from Central and Eastern Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia (FYROM), Republic of Moldova, Montenegro, Poland, Romania, Serbia, Slovakia and Slovenia), for 2004 – 2008 period. To examine the relationship between bank performance, financial liberalization and banking systems structure, we develop a two-stage empirical model that involves estimating bank performance in the first stage and assessing its determinants in the second.

The rest of the paper is organized as follows. Section 2 reviews the previous literature on the relationship between financial liberalization and banks performance.

In section 3 we explain the methodology we have used to measure impact of financial liberalization on bank efficiency and productivity growth and discuss the data and the variable selection. Thereafter, the results of the empirical analysis are presented and discussed in section 4. The main conclusions are presented in section 5.

2. Literature review

Levine (1996), Walter and Gray (1983), and Gelb and Sagari (1990) studied the potential benefits of foreign bank entry for the domestic economy in terms of better resource allocation and higher efficiency. In this context Levine (1996) considered that foreign banks may (a) improve the quality and availability of financial services in the domestic financial market by increasing bank competition, and enabling the application of more modern banking skills and technology, (b) serve to stimulate the development of the underlying bank supervisory and legal framework, and (c) enhance a country's access to international capital.

Claessens, Demirguc-Kunt and Huizinga (1998) showed that the presence of foreign banks can facilitate the increase of competition, the improvement of allocation of credits and access to the international capital markets. But there are, also, the costs associated to the entry of foreign banks, costs that can consists of the increase of the systemic risk caused by the increase of competition and of the inclination towards risk of the banks in order to maintain or increase their market share (Hellmann, Murdock and Stiglitz, 2000).

Berger et al (2000) has found foreign-owned financial institutions from most foreign countries to be less efficient than domestic institutions. They found also that domestic institutions may be about equally efficient with foreign banks from some foreign countries, but may be less efficient than foreign banks from one (the United States) of the foreign countries. Miller and Parkhe (2002) considered profit efficiency in fourteen different nations, and found domestic banks to be more efficient than foreign banks. Claessens, Demirgüc-Kunt and H. Huizinga (2001) found that foreign banks tend to have higher interest margins, profitability, and tax payments than domestic banks in developing countries, while the opposite is true in developed countries.

Among single country studies reporting that foreign banks generally have higher profit rates than the domestic banks in the developing countries are analyses for Chile—Fuentes and Vergara (2003); China—Berger et al. (2007); Croatia— Kraft

et al. (2002); the Czech Republic—Preteanu-Podpiera et al. (2008); Hungary—Hasan and Marton (2003); Pakistan—Qayyum and Khan (2007); Romania—Asaftei and Kumbhakar (2008); Russia—Karas et al. (2008); and Turkey—Öncel and Süer (2008) and Ege (2009). On the other hand, there is reverse evidence for selected Asian countries—Hadad et al. (2008) for Indonesia, and Chantapong (2005) for Thailand—and for Argentina—Berger et al. (2005). Among regional studies reporting that foreign banks generally have higher profit rates than the domestic banks in the developing countries are analyzed for selected European transition countries by Bonin et al. (2004), Fries and Taci (2004) and Grigorian and Manole (2006). For other regions, the better performance of foreign banks is demonstrated by Barry et al. (2008) for a sample of six East Asian countries and by Chen (2009) for eight Sub-Saharan African middle income countries. Zajc (2006) and Košak and Zajc (2006) report a lower efficiency of foreign banks for samples of six and eight European transition countries and Kablan (2007) shows this evidence for a sample of six West African countries.

Agenor (2001) underlines the fact that because foreign investors are not familiarized with the problems specific to the countries they invest in, they tend to immediately and massively withdraw when meeting with the first difficulty. This can lead to a profound crisis on the internal financial markets.

Studies of the impact of deregulation upon efficiency have found different results. Evidences from Taiwan (Shyu, 1998), Korea (Gilbert and Wilson, 1998), Norway (Berg et al, 1992), Turkey (Zaim, 1995) and Thailand (Leightner and Lovell, 1998) proved improvements in efficiency and in the case of Spain (Grifell-Tatje and Lovell, 1996), US (Berger et al, 2000, Mukherjee et al, 2001) deregulation was found to have a negative impact upon efficiency.

Pasiouras, Tanna and Zopounidis (2009) uses stochastic frontier analysis to provide international evidence on the impact of the regulatory and supervision framework on bank efficiency based on a dataset consists of 2853 observations from 615 publicly quoted commercial banks operating in 74 countries during the period 2000–2004. Their results suggest that banking regulations that enhance market discipline and empower the supervisory power of the authorities increase both cost and profit efficiency of banks. In contrast, stricter capital requirements improve cost efficiency but reduce profit efficiency, while restrictions on bank activities have the opposite effect, reducing cost efficiency but improving profit efficiency.

Brissimis et al. (2008) examine the relationship between banking sector reform and bank performance – measured in terms of efficiency, total factor productivity growth and net interest margin – accounting for the effects through competition and bank risk-taking. The model is applied to bank panel data from ten newly acceded EU countries. The results indicate that both banking sector reform and competition exert a positive impact on bank efficiency, while the effect of reform on total factor productivity growth is significant only toward the end of the reform process.

Based on evidence for 61 countries in 1980-97, Demirguc-Kunt and Detragiache (2000) find that explicit deposit insurance tends to increase the likelihood of banking crises, the more so where bank interest rates are deregulated and the institutional environment is weak. Barth, Caprio, and Levine (1999) affirm that countries with the most regulatory and restrictive systems are likely to eradicate banking crises.

Ranciere, Tornell, and Westermann (2006), Barrell, Davis, and Pomerantz (2006), Gupta and Karapatakis (2008) show the process of financial liberalization may increase, at a high level of risk, the volatility of macroeconomic indicators and may raise the probability of starting banking crises.

Kaminsky and Reinhart (1999) conducting a study of a panel of 20 countries in Latin America, Europe, and Asia over the period 1970-1995 conclude the number of banking crises strongly increased and policies of financial liberalization precede these crises. Fisher, Gueyie, and Ortiz (1997), based on a study conducted in Malaysia, Thailand, and Taiwan, conclude banks are exposed to high risks during the process of financial liberalization.

The process of financial liberalization or of integration was made at the level of the states in two ways: some states first liberalized the internal financial markets, including the banking sector and capital market, while other states first liberalized the capital account. The performed studies show that most developed countries first liberalized the capital markets, while the developing states first liberalized their bank systems (Kaminsky and Schmukler, 2003).

Essaadi, Jouini and Khallouli (2009) consider that financial liberalization facilitates economic integration markets and interdependence between economies.

In the literature in the field, there is no consensus regarding the optimum method for performing the financial liberalization. While some studies claim that the

liberalization of the financial sector should be performed first, other studies propose as a first stage the liberalization of the capital account (Johnston, 1998).

Bekaert, Harvey and Lundblad (2005), Bonghoon and Kenny (2007), Alfaro and Hammel (2007) suggest that developing countries must liberalize the banking system to ensure its proper functioning and to reinforce economic development.

Studies such as Claessens and Glaessner (1998) show that there are important connections between the internationalization of financial services and the deregulation and liberalization process of the capital account. In the case when the internal market is highly regulated, the liberalization process can create problems for the domestic banks because they are inefficient. The liberalization level of the capital account can affect the benefits and costs for internationalization. Also, they highlight the fact that a certain level of mobility of the capital is necessary for the efficiency internationalization of the banks. Johnston (1998) investigated the relationship between the reform of the financial sector and the liberalization of the capital account. The author shows that, before the liberalization of the capital account, the financial intermediaries must reach a development level that guarantees the efficient use of capital. The countries with poorly developed financial system need time to develop their financial institutions and market, especially the banking sector, before the liberalization of the capital account. Johnston, Darbar and Echeverria (1997) present three different approaches for performing the financial liberalization. A first approach claims there are certain conditions that must be fulfilled before the liberalization of the capital account, conditions such as macroeconomic stability and development of the financial institutions and markets. The second approach claims that for the incipient liberalization of the capital account the implementation of some ampler economic reforms can play an important role. The final approach is a mix between the first two and considers that the liberalization of the capital account should be part of the program of structural reforms.

In order to express the performance of banks we measure the level of bank efficiency. The efficiency of banks has been widely and extensively studied in the last few decades. For banks, efficiency implies improved profitability, greater amount of funds channeled in, better prices and services quality for consumers and greater safety in terms of improved capital buffer in absorbing risk (Berger, Hunter and Timme, 1993).

The creation of an effective and solid financial system constituted an important objective of the process of reform and passing from a centralized economy to a market economy in Central and Eastern European countries. The liberalization of prices, the liberalization of the circulation of goods, services and of capital, the deregulation of financial systems, globalization and the mutations on the level of the economic, social and political environment had a significant impact on the development of the CEE banking system. The banking systems in the developing countries suffered ample mutations with the purpose of creating some efficient banking institutions and with a high degree of soundness capable of facilitating economic growth.

On other hand, in case of developing countries the concentration has generally been on investigation of the impact of the bank reforms, of the privatizations of the state banks, of entering foreign banks and their effects on the efficiency (Asaftei and Kumbhakar, 2008; Bauer et al., 1998; Bauer, Berger and Humphrey, 1993; Beccalli, Casu and Girardone, 2006; Berger and Humphrey, 1997, Berger and Mester, 1997; Berger and Mester, 2003; Bonin, Hassan and Wachtel, 2005; Casu and Girardone, 2002; Casu, Girardone and Molyneux, 2004; Guzmán and Reverte, 2008; Koutsomanoli-Filippaki, Margaritis and Staikouras, 2009; Yildirim and Philippatos, 2007, Pasiouras, 2008; Pasiouras, Tanna and Zopounidis, 2009).

On contrary to many other regions, the examination of efficiency - banking industry in Central and Eastern Europe countries, has received little attention. Most studies focused on the banking sector in Central and Eastern Europe (CEE) are only performed at the level of one state and do not offer comparative information regarding the efficiency and productivity growth of banks in these states. However, in recent years, several papers have been published on comparative analysis highlighting the impact of banking sector reform, evolution of banking structure, competition, privatization on banks' efficiency (Fries and Taci, 2001; Grigorian and Manole, 2002; Weill, 2003, Hasan and Marton, 2003; Bonin, Hasan and Wachtel, 2005; Fries and Taci, 2005; Rossi et al., 2005; Havrylchyk, 2006; Yildirim and Philippatos, 2007; Brissimis et al, 2008; Koutsomanoli-Filippaki et al., 2009).

3. Methodology and data

In this section we discuss the empirical model used to investigate the impact of financial liberalization on bank performance. Then we explain our measures of

bank performance: cost efficiency and productivity growth. Discussion of the data and control variables then follows.

Estimable Model

The purpose of the estimable model outlined in this section is to capture the effects of financial liberalization, reforms in the banking sector and the associated changes in the industry on bank performance. We also include a range of bank-specific variables that have been used in previous empirical studies that examine the drivers of bank performance. The model is specified as:

$$P_{ijt} = \alpha_0 + \beta \times BS_{jt} + \beta_i \times B_{it} + \beta_j \times M_{jt} + \varepsilon_{ijt}$$

Where the subscripts i, j, t denotes bank i, country j, and year t.

P_{ijt} – performance indicators of the banks;

BS_{jt} – banking system specific variables;

B_{it} – bank-specific variables;

M_{jt} – macroeconomic variables;

ε_{ijt} – error term.

Measures of banks performance

Bank performance is proxied alternatively by cost efficiency (EFF) and total productivity index (TFPCH). These indicators have been used widely in previous empirical literature concerned with the measurement and determinants of the bank performance in developing countries (Yildirim and Philippatos, 2007; Brissimis et al., 2008; Koutsomanoli-Filippaki et al., 2009; Zhao, Casu and Ferrari, 2010). The analysis of the efficiency and productivity of banks can be performed with both the help of the parametrical methods and that of non-parametrical methods. For a comparison of these methods see Berger and Humphrey (1997), Berger and Mester (2003) and Casu et al. (2004). We use stochastic frontier analysis as it controls for measurement error and other random effects. More specifically, we use the Battese and Coelli (1992) SFA model. In line with Berger and Mester (1997) we measure cost efficiency as how close a bank's cost is to what best practice banks cost would be for producing the same output bundle under the same conditions. As costs functions are not directly observable, inefficiencies are measured relative to an efficient cost

frontier. Also, in assess the impact of financial liberalization on banking performance we use the total productivity index what measures the modification of total productivity of the factors between the two periods of time, by calculating the ratio between the distance from each point observed in the respective technology.

Cost efficiency

Bank performance is proxied alternatively by cost efficiency (EFF) and total productivity index (TFPCH). These indicators have been used widely in previous empirical literature concerned with the measurement and determinants of the bank performance in developing countries (Yildirim and Philippatos, 2007; Brissimis et al., 2008; Koutsomanoli-Filippaki et al., 2009; Zhao, Casu and Ferrari, 2010).

In the analysis of the efficiency of the banks in CEE countries we will use a parametric method – the SFA Method (Stochastic Frontier Analysis). The SFA Method (Stochastic Frontier Analysis) is an econometrical, deterministic method for estimating the efficiency frontier. The SFA method entails a certain functional form for the relation between inputs and outputs. The SFA method was first proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977).

The deterministic production frontier is given by the relation:

$$y_i = f(x_i;\beta)\times \exp\{-u_i\} \quad (1)$$

where: $TE_i = \exp\{-u_i\}$ si $u_i \geq 0$

Transposed into log-linear form, the deterministic production frontier becomes:

$$\ln y_i = \ln f(x_i;\beta) - u_i \quad (2)$$

or $$\ln y_i = \beta_0 + \sum_n \beta_n \ln x_{ni} - u_i \quad (3)$$

where: $u_i \geq 0 \Rightarrow y_i \leq f(x_i;\beta)$.

A major problem of the deterministic method is the fact that it does not allow for the decomposing of the error term and the separate analysis of inefficiency from the stochastic shock.

The SFA method entails as expression form of the production frontier;

$$\ln y_i = \beta_0 + \sum_n \beta_n \ln x_{ni} + v_i - \mu_i \quad (4)$$

$$\mu_i \geq 0$$

where: $f(x_i;\beta)$ – production function; μ_i – technical inefficiency component; v_i – random error component (statistical „noise"); β –input elasticity; x_i – inputs; y_i – outputs.

The v_i variable reflects the effects of the conditions independent of the analyzed decisional unit and the measuring errors and it presupposes that, in general, it follows a normal distribution. The second component of the error term μ_i is a variable manageable by the decisional unit, which represents inefficiency and presupposes that a semi-normal distribution follows.

According to Aigner, Lovell and Schmidt (1977) the production function for a panel-type set of data can be written thus:

$$\begin{aligned} &\ln y_i = \beta_0 + \sum_n \beta_n \ln x_{nit} + v_{it} - u_i \\ &v_{it} \sim N(0, \sigma_v^2) \\ &v_{it} \sim N(0, \sigma_v^2) \end{aligned} \qquad (5)$$

Kumbhakar (1987) and Battese and Coelli (1988) generalized the hypothesis concerning the semi-normal distribution of u_i and proposed for the panel-type set of data a normal truncated distribution. The general form for the production form of a series of panel-type set of data can be written as:

$$y_{it} = x_{it}\beta + v_{it} - u_i \qquad (6)$$

where: y_{it} –output vector; x_{it} –input vector; β – independent variable coefficient; v_{it} – random error $N(0, \delta_v^2)$; u_i – truncated error variable.

The production frontier (6) can be estimated through Maximum Likelihood Estimation (MLE). The resulting error component is decomposed into the „noise" component and the stochastic inefficiency component that is used in estimating the level of inefficiency for each decisional unit. For the estimation of the efficiency frontier in the case of panel-type data series aside from the Maximum Likelihood estimation (ML) the LSDV approach (least square dummy variable method) and the GLS approach (generalized least squares method) can also be used.

A disadvantage of the models presented above is the fact that they presuppose that inefficiency is stable in time, this presupposition being difficult to accept when the number of analyzed periods is high enough. In time, it is to expect that managers learn from past experience in the production process and modify their decisions so that the effects of inefficiency change their characteristics in time.

Cornwell, Schmidt and Sickles (1990) proposed a model in which the effects of technical inefficiency are specific to each company and vary in time thus:

$$u_{it} = u_i + r_i \qquad (7)$$

The obtained model can be treated either as a fixed effects model, or as one with random effects and it relaxes the invariance hypothesis of the effects of inefficiency. Kumbhakar (1990) suggested the use of a model in which the effects of technical inefficiency vary systematically in time, according to the relation:

$$u_{it} = \left[1 + \exp\left(bt + ct^2\right)\right]^{-1} u_i \qquad (8)$$

where u_{it} are distributed semi-normal, and *b* and *c* are the parameters that have to be estimated using the MLE method.

Battese and Coelli (1992) proposed an alternative model to the model developed by Kumbhakar (1990) in which the parameters of the model are estimated with the method of maximum likelihood and in which the terms vary exponentially in time according to the relation:

$$u_{it} = \{\exp[-\gamma(t - T)]\} u_i \qquad (9)$$

where: γ - unknown parameter to be estimated,

$u_i \sim N(0, \sigma_u^2)$

$v_{it} \sim N(0, \sigma_v^2)$

According to this model technical efficiency can vary in time, but the evolution is the same for all analyzed units.

The restrictions regarding the function of the stochastic frontier are more flexible when a functional form of the translog (TL) type production function is applied, than when a Cobb-Douglas type functional form is applied. The translog form does not impose the hypothesis regarding the constant elasticity of the production function or of the elasticity of the substitution between inputs. Another advantage of the translog form is that it allows data to indicate the real value of the curb of the function, rather than imposing prior hypotheses regarding its value.

The production frontier variable in time can be expressed in translog form thus:

$$\ln y_{it} = \beta_0 + \sum_n \beta_n \ln x_{nit} + \beta_t t + \frac{1}{2}\sum_n \sum_k \beta_{nk} \ln x_{nit} \ln x_{kit} + \frac{1}{2}\beta_{tt} t^2 + \sum_n \beta_{nt} \ln x_{nit} t + v_{it} - u_{it} \qquad (10)$$

where: y_{it} –output vector; x_{it} –input vector; β – independent variable coefficient; v_{it} – random error $N(0,\delta_v^2)$; u_i – error variable that follows a normal-truncated distribution; t – time component.

The translog (TL) form can be written more simply in the form:

$$\ln y_{it} = TL(x_{it}, t) + v_{it} - u_{it} \qquad (11)$$

Battese and Coelli (1995) introduced a model for the frontier of a panel-type set of data that quantifies the effect of inefficiency in μ_{it}. The authors presuppose as hypothesis that the term non-negative technical efficiency follows a truncated distribution with different environments for the analyzed units.

$$\mu_{it} = Z_{it}\delta + \omega_{it} \qquad (12)$$

where: Z_{it} – inefficiency of variable.

When the prices of inputs are available and an objective of the company is constituted by minimization of costs the cost efficiency can be estimated by using a cost frontier. The cost frontier indicates the minimum cost, ci, which a decisional unit can register in order to produce a quantity of outputs, yi, considering the prices of inputs, pi. the cost frontier can be expressed thus:

$$\ln c_i = \beta_0 + \sum_{n=1}^{N} \beta_n \ln p_{ni} + \sum_{m=1}^{M} \phi_m \ln y_{mi} + v_i + u_i \qquad (13)$$

where u_i represents inefficiency and is non-negative. This function is non-decreasing, linearly homogeneous and concave in inputs if β_n is non-negative and satisfies the condition $\sum_{n=1}^{N} \beta_n = 1$ (18)

By introducing condition (18) in model (17) we obtain:

$$\ln\left(\frac{c_i}{p_{Ni}}\right) = \beta_0 + \sum_{n=1}^{N-1} \beta_n \ln\left(\frac{p_{ni}}{p_{Ni}}\right) + \sum_{m=1}^{M} \phi_m \ln y_{mi} + v_i + u_i \qquad (14)$$

The cost efficiency level is given by the ratio between the minimum cost and the cost registered by the decisional unit and is calculated as: $EC = \exp(-u_i)$ (15)

The SFA method assumes that the inefficiency component of the error term is positive and thus the high costs are associated with a high level of inefficiency. In the estimation of the cost efficiency level we used the model developed by Battese and Coelli (1992). The estimation of the cost efficiency through the SFA method will be made using the Frontier Version 4.1.

Total productivity growth

The total productivity index of the Malmquist factors measures the modification of total productivity of the factors between the two periods of time, by calculating the ratio between the distance from each point observed in the respective technology. Färe et al. (1992) proposed the following form for the Malmquist index (output oriented), between two periods of time t (basic period) and (t+1) (current period):

$$M_O\left(y^t,x^t,y^{t+1},x^{t+1}\right)=\left[M_O^t\left(y^t,x^t,y^{t+1},x^{t+1}\right)\times M_O^{t+1}\left(y^t,x^t,y^{t+1},x^{t+1}\right)\right]^{\frac{1}{2}}=$$
$$=\left[\frac{D_O^t\left(x^{t+1},y^{t+1}\right)}{D_O^t\left(x^t,y^t\right)}\times\frac{D_O^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_O^{t+1}\left(x^t,y^t\right)}\right]^{\frac{1}{2}} \qquad (16)$$

where we noted with $D_O^t\left(x^{t+1},y^{t+1}\right)$ the distance from the point observed in the period t+1 to the frontier of the technology of period t. A value of M_O proper will indicate an increase of the total productivity of factors from one period to another, while an improper value corresponds to a decline of total productivity of factors.

We must note that relation (16) is actually a geometric mean of two indexes of total productivity of factors: the first one evaluated in relation to the technology of period t, and the second one relative to the technology of period t+1. Relation (16) can be re-written in the form:

$$M_O\left(y^t,y^{t+1},x^t,x^{t+1}\right)=\frac{D_O^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_O^t\left(x^t,y^t\right)}\left[\frac{D_O^t\left(x^{t+1},y^{t+1}\right)}{D_O^{t+1}\left(x^{t+1},y^{t+1}\right)}\times\frac{D_O^t\left(x^t,y^t\right)}{D_O^{t+1}\left(x^t,y^t\right)}\right]^{\frac{1}{2}} \qquad (17)$$

in which the ratio outside the square brackets measures the modification of the Farrell measure of the output oriented technical efficiency between the periods t and t+1. In other words, the modification of efficiency is equivalent to the ratio of the two Farrell measures:

$$\text{Efficiency modification}=TE\Delta_O\left(y^t,x^t,y^{t+1},x^{t+1}\right)=\frac{D_O^{t+1}\left(x^{t+1},y^{t+1}\right)}{D_O^t\left(x^t,y^t\right)} \qquad (18)$$

The remaining part is a measure of the technological modification – the geometrical mean of the modifications in technology between the two periods, evaluated in x^{t+1} and x^t; that is:

$$\text{Tehnological modification } = T\Delta_O\left(y^t, x^t, y^{t+1}, x^{t+1}\right) = \left[\frac{D_O^t\left(x^{t+1}, y^{t+1}\right)}{D_O^{t+1}\left(x^{t+1}, y^{t+1}\right)} \times \frac{D_O^t\left(x^t, y^t\right)}{D_O^{t+1}\left(x^t, y^t\right)}\right]^{\frac{1}{2}}$$

(19)

The Malmquist productivity index is a theoretical index, and the empirical application needs its estimation. The estimation of the distance function involved in the analysis of productivity is performed by using linear programming methods or econometrical methods. See Balk (2001), and Diewert and Nakamura (2003, 2005) for a synthesis of the performed researches. In the performed analysis we will estimate the Malmquist index with the help of the DEA-type linear programming method, a method that was introduced by Färe et al. (1992) and developed by many other authors (Fried, Lovell and Schmidt, 2008).

In the empirical analysis of the mutations on the level of the productivity of banks we have to calculate four distance measures that occur in equation (16) for each pair of adjacent periods of time. Having at disposal panel sets of data, we can calculate the distance functions with the help of the DEA method. For the bank „i", i =1, 2, ..., N the four DEA linear programming problems, in the hypothesis that the technologies have constant returns to scale, can be written:

$$\begin{aligned}
&\left[D_O^s(y_s, x_s)\right]^{-1} = \max_{\phi,\lambda} \phi, s = t, t+1 \\
&-\phi y_{is} + Y_s\lambda \geq 0 \\
&x_{is} - X_s\lambda \geq 0 \\
&\lambda \geq 0
\end{aligned} \qquad (20)$$

$$\begin{aligned}
&\left[D_O^s(y_r, x_r)\right]^{-1} = \max_{\phi,\lambda} \phi, s = t, t+1; r = t, t+1; s \neq r \\
&-\phi y_{is} + Y_r\lambda \geq 0 \\
&x_{is} - X_r\lambda \geq 0 \\
&\lambda \geq 0
\end{aligned} \qquad (21)$$

The four linear programming problems must be solved N times, once for each company in the ensemble. The introduction of solutions to the 4 problems in relation (16) allows for the estimation of the Malmquist index of productivity.

In the literature in the field there is no consensus regarding the inputs and outputs that must be used in the analysis of the efficiency and productivity growth of commercial banks (Berger and Humphrey, 1997). In the studies in the field five

approaches for the definition of inputs and outputs in the analysis of the efficiency of a bank were developed, these are: Intermediation approach; Production approach; Assets approach; User costs approach; Value added approach.

In our paper, bank inputs and outputs are defined according to the value-added approach, originally proposed by Berger and Humphrey (1992), which suggests using deposits as outputs since they imply the creation of value added. Following Dietsch and Lozano-Vivas (2000), Maudos et al. (2002), and others, we used the following set of inputs and outputs in order to quantify the efficiency and mutations on the level of the productivity of banks: loans, other earning assets and demand deposits – outputs, personnel expenses, fixed assets and financial capital (sum of total deposits, total money market funding, total other funding and equity) – as inputs. Input prices are obtained as total personnel expenses over total assets, other operating expenses over fixed assets and interest expenses over financial capital.

The data used in the analysis are taken from the annual reports of the banks and from the Fitch IBCA`s BankScope database.

Banking system characteristics

Because the purpose of this analysis is to analyze the connection between the performance of banks and the degree of financial liberalization of the banking system, first set of banking system characteristics considered in the model include the following variable: the banking reform and interest rate liberalization indicator (BREF), Financial Openness Index (KOPEN), asset share of state-owned banks (ASSB) and asset share of foreign-owned banks (ASFB).

Banking reform and interest rate liberalization indicator is compiled by the EBRD with the primary purpose of assessing the progress of the banking systems of formerly communistic countries and quantifies and qualifies the degree of liberalization of the banking industry (Brissimis, Delis and Papanikolaou, 2008). This indicator provides a ranking of progress in liberalization and institutional reform of the banking sector, on a scale of 1 indicating little progress in reform to 4 representing a level that approximates the institutional standards and norms of an industrialized market economy (Koutsomanoli-Filippaki, Margaritis and Staikouras, 2009).

In order to assess the level of financial openness we use the Chinn-Ito index what are measuring a country’s degree of capital account openness. The index is

based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (Chinn and Ito, 2008).

Following previous studies that focus on banks' performance (Barth et al., 2004; Fries and Taci, 2005; Pasiouras, 2008), we control for cross-country differences in the national structure and competitive conditions of the banking sector, using the following measures: i) Asset share of state-owned banks (ASSB) are quantified as percentage of asset share of state-owned banks in total assets of banking system, the state includes the federal, regional and municipal levels, as well as the state property fund and the state pension fund (state-owned banks are defined as banks with state ownership exceeding 50 per cent, end-of-year). ii) Asset share of foreign-owned banks (ASFB) show the share of total bank sector assets in banks with foreign ownership exceeding 50 per cent. We use these indicators to assess the impact of state and foreign ownership on performance differences in national banking systems. iii) Number of banks (NB). iv) The percentage share of the three largest banks (CR3), ranked according to assets, in the sum of the assets of all the banks in that banking system. v) Herfindahl-Hirschmann index (HHI) what is calculated as the sum of the squares of all the banks' market shares in terms of total assets.

We measure bank stability using Z-score, what is very popular indicator in recent literature concerned with the measurement and determinants of soundness and safety of banks (Merciera, Schaeck and Wolfe, 2007, Demirguc-Kunt, Detragiache and Tressel, 2006, Scheck and Cihak, 2008, Beck et al., 2009, Liu, Molyneux and Wilson, 2010).

The Z-score is calculated as:

$$Z = \frac{ROA + E/A}{\sigma(ROA)}$$

ROA is the bank's return on assets, E/A represents the equity to total assets ratio and s (ROA) is the standard deviation of return on assets. A higher Z-score implies a lower probability of insolvency, providing a direct measure of soundness that is superior to analyzing leverage.

The data used to quantify this indicator has been taken from EBRD and ECB reports.

Bank-specific variables

The economic literature pays a great deal of attention to the performance of banks, expressed in terms of efficiency, productivity, competition, concentration, soundness and profitability.

The use of risk indicators in the analysis of bank performance has gained in the past decades a special attention because the control on bank risks is one of the most important factors the profitability of the bank depends on (Fiordelisi, F., Marques-Ibanez, D., Molyneux, P. (2010).

Following the empirical literature, we use the Return on Assets (ROA) to reflect the bank's management ability to use the resources the bank disposes of for the purpose of optimizing profit. Bank capital adequacy is measured as the equity to assets ratio, quantified as the value of total equity divided by the value of total assets.

To express the risk profile of the banks we use two different types of risk: credit risk measured as ratio of loan-loss provisions to total loans (LLR_GL) and liquidity risk measured as ratio of liquid assets to total deposits and borrowing funds (LA_TD). Another variable used in analyze is bank's size measured as logarithm of total assets (TAL).

The data used in the analysis are taken from the annual reports of the banks and from the Fitch IBCA`s BankScope database.

Macroeconomic variables

In line with the previous literature (Dietsch and Lozano- Vivas, 2000; Maudos et al., 2002; Kasman and Yildirim, 2006; and Pasiouras, Tanna and Zopounidis, 2009), we include a variety of macroeconomic variables in our model. The macroeconomic variables used in analyze are: GDP growth rate – Growth in real GDP in per cent (GDP_G), Inflation rate - change in annual average retail/consumer price level in per cent (IR), Level of financial intermediation – domestic credit provided by banking sector percentage of GDP (FIN_INT), and Interest rate spread – lending rate minus deposit rate percentage (IRS).

Also to quantify the effects of structural reforms, we use 2 governance indicators developed by Kaufmann et al. (2006) to proxy institutional differences: rule of law (ROL) and regulatory quality (RQ). Rule of law is an indicator of the extent to which agents have confidence in and abide by the rules of society and regulatory

quality is an indicator of the ability of the government to formulate and implement sound policies. These indicators are assessed on a scale of about -2.5 to 2.5 with higher values corresponding to a 'better' regulatory environment.

Improvements in the regulatory quality help banks if it is accompanied by more adequate banking supervision. The quality of the rule of law affects cost efficiency through the effectiveness and predictability of the judiciary. There is a growing literature that points to the importance of institutions for an efficient operation of the financial system. This literature argues that better institutions positively affect bank efficiency (see also Demirgüc-Kunt, Laven, and Levine, 2004). The data used to quantify this indicator has been taken from EBRD, World Bank and ECB reports.

Data

The model is estimated on a panel of 236 commercial banks Commercial banks, Savings banks, Cooperative banks, Real Estate & Mortgage banks, Investment banks, Bank holdings & Holding companies, from 17 countries from Central and Eastern Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia (FYROM), Republic of Moldova, Montenegro, Poland, Romania, Serbia, Slovakia and Slovenia), for 2004 – 2008 period. Table 1 and 2 presents the mean values for banking system characteristics, bank-specific variables and macroeconomic variables. All bank-level data used are obtained from the BankScope database and are reported in euros and data regarding banking systems characteristics and macroeconomic variables has been taken from EBRD, World Bank and ECB reports.

Table 1 Means of banking system characteristics, bank-specific variables and macroeconomic variables by year

YEAR	BREF	KOPEN	ASSB	ASFB	CR3	NB	HHI	Z_SCORE
2004	3.31	1.05	8.52	66.29	0.62	32.61	1136.37	8.76
2005	3.42	1.14	8.24	72.42	0.61	33.60	1097.16	9.63
2006	3.43	1.36	7.04	77.43	0.59	32.52	1142.94	9.38
2007	3.49	1.43	6.45	77.18	0.65	32.59	1122.89	9.71
2008	3.56	1.49	7.33	80.07	0.72	33.23	1088.31	10.59
Average	3.44	1.30	7.51	74.68	0.64	32.91	1116.78	9.61

YEAR	ROA	LA_TD	LLR_GL	TA	GDP_G	IR	FIN_INT	IRS	ROL	RQ
2004	1.44	42.00	5.95	1583.52	6.08	5.88	33.52	6.24	0.21	0.50
2005	1.77	39.70	5.46	1938.34	5.57	5.39	39.82	5.96	0.15	0.48
2006	1.48	36.84	4.35	2374.87	6.54	5.26	46.35	5.00	0.17	0.51

2007	1.31	34.20	3.48	2948.24	6.39	5.21	54.35	4.53	0.21	0.55
2008	0.71	28.52	4.00	3233.63	3.92	8.36	59.02	4.24	0.25	0.60
Average	1.34	36.24	4.63	2415.72	5.70	6.03	46.62	5.19	0.20	0.53

Table 2 Means of banking system characteristics, bank-specific variables and macroeconomic variables by country

COUNTRY_CODE	KOPEN	BREF	ASSB	ASFB	CR3	NB	HHI	Z_SCORE
ALBANIA	-0.72	2.76	2.88	92.78	0.82	16.40	192.00	9.58
BOSNIA-HERZEGOVINA	1.50	2.76	2.72	90.92	0.59	32.00	919.00	13.13
BULGARIA	1.26	3.70	1.98	80.48	0.51	32.00	758.60	7.28
CROATIA	1.17	4.00	3.96	90.92	0.61	36.20	1322.20	14.36
CZECH REPUBLIC	2.50	3.94	2.58	84.70	0.64	36.40	1095.20	10.33
ESTONIA	2.50	4.00	0.00	98.70	0.95	13.60	3609.80	9.49
HUNGARY	2.45	4.00	5.64	75.34	0.71	41.00	814.80	6.05
LATVIA	2.50	3.82	7.28	59.86	0.55	24.40	1166.20	8.04
LITHUANIA	2.45	3.62	0.00	91.62	0.79	13.20	1829.20	11.46
MACEDONIA (FYROM)	0.12	2.76	1.54	66.16	0.76	19.20	1618.20	13.40
MOLDOVA REP. OF	-1.14	2.82	14.16	26.50	0.55	15.80	1167.20	10.04
MONTENEGRO	0.12	2.60	4.30	74.78	-	10.40	-	-
POLAND	0.12	3.62	20.42	74.36	0.60	63.00	628.60	7.05
ROMANIA	2.18	3.12	6.24	76.12	0.66	31.80	1070.80	3.74
SERBIA	0.12	2.68	18.78	66.64	-	37.80	650.00	-
SLOVAKIA	1.13	3.70	1.06	97.84	0.77	24.00	1128.00	11.50
SLOVENIA	2.13	3.30	13.38	26.38	0.59	24.60	1334.20	14.49
Average	1.30	3.44	7.51	74.68	0.64	32.91	1116.78	9.61

COUNTRY_CODE	ROA	LA_TD	LLR_GL	TA	GDP_G	IR	FIN_INT	IRS	ROL	RQ
ALBANIA	0.84	50.61	2.22	304.26	5.78	2.66	21.96	7.10	-0.74	-0.05
BOSNIA-HERZEGOVINA	0.95	52.10	5.53	267.14	5.91	5.02	44.04	4.81	-0.51	-0.28
BULGARIA	1.77	37.12	3.17	918.67	6.36	7.88	53.30	5.97	-0.09	0.65
CROATIA	1.00	36.15	6.43	1448.90	4.21	3.50	61.48	8.36	0.11	0.47
CZECH REPUBLIC	1.00	31.95	2.90	5851.63	5.24	3.30	40.90	4.57	0.86	1.09
ESTONIA	1.58	54.35	1.57	4580.57	6.32	5.71	70.56	2.68	1.05	1.37
HUNGARY	1.37	28.19	1.97	4404.06	2.84	5.64	55.04	2.06	0.89	1.20
LATVIA	1.31	39.16	1.56	1242.22	7.39	8.99	76.60	4.33	0.69	1.00
LITHUANIA	1.22	26.25	1.51	2411.93	7.12	4.85	47.96	2.35	0.65	1.08
MACEDONIA (FYROM)	2.05	40.91	6.81	249.92	4.57	3.04	31.62	5.72	-0.36	0.05
MOLDOVA REP. OF	3.46	35.45	4.38	101.36	6.10	12.48	29.12	5.01	-0.48	-0.35
MONTENEGRO	1.31	36.66	2.85	226.94	6.96		49.42	5.21	-0.34	-0.36
POLAND	1.59	26.91	6.29	5975.97	5.40	2.71	40.50	3.54	0.47	0.79
ROMANIA	1.04	41.33	2.08	2123.97	7.18	8.03	27.18	9.72	-0.06	0.38
SERBIA	1.00	47.90	11.47	478.34	6.30	11.63	32.26	-	-0.61	-0.38
SLOVAKIA	1.03	34.27	3.84	3341.37	7.39	4.42	38.24	4.36	0.56	1.12
SLOVENIA	1.08	20.43	5.08	3120.77	4.98	3.56	66.92	3.80	0.93	0.80
Average	1.34	36.24	4.63	2415.72	5.70	6.03	46.62	5.19	0.20	0.53

Estimation approach

The empirical models used in the literature in the field use a two stage procedure: in the first stage the level of cost efficiency and total productivity growth is estimated and in the second stage the regression analysis is applied in which the levels of cost efficiency and total productivity index are dependent variables.

The empirical model specified in equation is estimated using the panel least square fixed effects methodology. We use the fixed effects model, since we focus on a limited of number of countries, for which we want to assess country-specific differences with respect to the relationship between financial liberalization and bank performance. For this purpose, performance scores are regressed on a set of common explanatory variables; a positive coefficient implies efficiency increase whereas a negative coefficient means an association with an efficiency decreases. The empirical model is tested for each of the two measures of banking performance, i.e. cost efficiency and total productivity growth.

The research strategy follows the specific-to-general approach. We start by investigating the relationship between the cost efficiency and banking reform and interest rate liberalization indicator (BREF) and Financial Openness Index (KOPEN). Next, we include all other banking system characteristics, bank-specific variables and macroeconomic variables one by one category to test the stability of the main independent variables BREF and KOPEN. A second set of models is estimated using total productivity index as dependent variable. GMM data models are also estimated, to allow comparison of results, and as a robustness check.

4. Empirical results

Efficiency and productivity level

Table 3 presents the estimates of the cost efficiency level and total productivity growth index, showing the results by country and year.

Table 3 Means of cost efficiency level and total productivity growth index by country and year

COUNTRY_CODE	EFF	TFPCH	YEAR	EFF	TFPCH
ALBANIA	.9330446	.9047500	**2004**	.8866425	
BOSNIA-HERZEGOVINA	.8480512	1.9773438	**2005**	.8924896	1.3511102
BULGARIA	.9111905	1.0845972	**2006**	.8983264	1.3626441
CROATIA	.9439455	1.3550217	**2007**	.9041426	1.2441144

CZECH REPUBLIC	.9688820	1.0250263
ESTONIA	.8788302	1.3021500
HUNGARY	.9439129	1.2320263
LATVIA	.8948106	1.3645313
LITHUANIA	.8861573	1.2571071
MACEDONIA (FYROM)	.8584147	1.1361250
MOLDOVA REP. OF	.9020564	1.5848250
MONTENEGRO	.8389457	1.9448500
POLAND	.9385431	1.0464130
ROMANIA	.8426061	1.2679079
SERBIA	.8300287	1.7130833
SLOVAKIA	.8691180	1.1644500
SLOVENIA	.8920361	1.2795000
Average	.8983056	1.3252415

2008	.9099270	1.3430975
Average	.8983056	1.3252415

From empirical results we see that the average cost efficiency of banks in Central and Eastern European countries grew in the period analyzed, from an average value of 0.8866 in 2004 to 0.9099 in 2008. Looking at the average efficiency scores for each country, we observe significant variation across the banking systems of the Central and East European country, we see that the highest level of technical efficiency are recorded in banking systems from Czech Republic and the lowest are recorded in Serbia. The full sample overall mean cost efficiency is 0.8983, while that of total productivity growth index equals 1.3252.

Total productivity growth index values estimates for banks from Central and Eastern European during 2005-2008 period range from 0.9047 in Albania to 1.9448 in Montenegro.

Table no. 4 also shows the average cost efficiency and productivity growth results for banks of different size. We classified banks into 3 different categories considering the size of banks: small if it has total assets < 1 000 mil EUR; medium if it has total assets >1000 mil EUR and <10 000 mil EUR; and large if it has total assets > 10 000 mil EUR. Also, we classified banking systems into 2 different categories considering the status of the country: member or non-member of European Union.

Table 4 Means of cost efficiency level and total productivity growth index by size of banks and status of country

Size of banks	EFF	TFPCH	Status of country	EFF	TFPCH
Small	0.8968371	1.4637117	**Non-member of European Union**	0.8791212	1.5655112
Medium	0.8943662	1.1389842	**Member of European Union**	0.9099207	1.1797721
Large	0.9339452	1.0363692	**Total**	0.8983056	1.3252415

Thus the results show that, on average, banks from non-member country are less cost efficient but experienced much higher total productivity growth level during 2004-2008 period.

Large sized banks are the much more cost efficient than medium and small banks, but small sized banks show the highest growth in terms of productivity.

Determinants of efficiency

Table 5 and 6 reports the key empirical results of the second stage analyze based on the estimation of Panel OLS and GMM models, using cost efficiency and total productivity growth index as the dependent variable.

Tabel 5 Determinants of cost efficiency

Dependend variable: Cost efficiency					
Model	**1**	**2**	**3**	**4**	**5**
BREF	0.039741***	0.030006***	0.015697***	0.00542**	0.00542**
	(0.001787)	(0.002636)	(0.003028)	(0.002374)	(0.002374)
KOPEN	0.007113***	0.005852***	0.003952***	0.001734***	0.001734***
	(0.000522)	(0.000558)	(0.000598)	(0.000516)	(0.000516)
ASSB		2.38E-07	0.000238*	-0.000353**	-0.000353**
		(0.000115)	(0.000124)	(0.000146)	(0.000146)
ASFB		0.000337***	0.00019***	1.74E-06	1.74E-06
		(3.60E-05)	(4.66E-05)	(5.11E-05)	(5.11E-05)
NB		-8.01E-05	3.45E-05	0.000173	0.000173
		(0.000117)	(0.000129)	(0.000111)	(0.000111)
CR3		0.013322***	0.002114	-0.020292***	-0.020292***
		(0.0037)	(0.003993)	(0.003629)	(0.003629)
HHI		-0.0000141***	-0.0000141***	0.00000846***	0.00000846***
		(3.18E-06)	(3.33E-06)	(2.90E-06)	(2.90E-06)
Z_SCORE		0.000274***	0.000253**	-5.40E-05	-5.40E-05
		(9.80E-05)	(0.000102)	(8.34E-05)	(8.34E-05)
ROA			-0.000775**	-0.000518**	-0.000518**
			(0.000331)	(0.000257)	(0.000257)
LLR_GL			-0.000276**	-0.000201**	-0.000201**
			(0.000132)	(0.000101)	(0.000101)
LA_TD			-0.00012***	-2.16E-05	-2.16E-05
			(2.69E-05)	(2.09E-05)	(2.09E-05)
TAL			0.007326***	0.000869	0.000869
			(0.000694)	(0.000618)	(0.000618)
GDP_G				-0.000379***	-0.000379***
				(0.000124)	(0.000124)
IR				0.000786***	0.000786***
				(0.00016)	(0.00016)
FIN_INT				0.000501***	0.000501***
				(3.65E-05)	(3.65E-05)
IRS				-0.001449***	-0.001449***
				(0.000259)	(0.000259)
ROL				-0.008359*	0.008359*
				(0.004266)	(0.004266)
RQ				0.008363	0.008363
				(0.005092)	(0.005092)
Method	OLS	OLS	OLS	OLS	GMM

Note: Standard deviations are presented between brackets.
*, **, *** indicates significance levels at 10%, 5% and 1%

Concerning the effect of banking system characteristics, we find that higher level of the Banking reform and interest rate liberalization indicator (BREF) and Financial Openness Index (KOPEN) improves cost efficiency, suggesting that banks in country with higher level of liberalization and openness are able to increase cost efficiency and finally to offer cheaper services to clients. A higher share of state-owned banks (ASSB) has a negative impact on the level of banks cost efficiency. The level of asset share of foreign-owned banks (ASFB) has no statistically significant impact on level of bank cost efficiency. With regard to the impact of structure of banking systems, results show that higher concentration quantified with Herfindahl-Hirschmann index (HIH) improves cost efficiency, but percentage share of the three largest banks (CR3) has a negative impact on cost efficiency level.

Tabel 6 Determinants of total productivity growth

Dependend variable: Total productivity growth index					
Model	**1**	**2**	**3**	**4**	**5**
BREF	0.400634***	0.327468***	0.259045***	0.395788***	0.395788***
	(0.024241)	(0.087397)	(2.58439)	(0.14925)	(0.14925)
KOPEN	0.083508*	0.026943*	0.026183*	0.12306*	0.12306*
	(0.047573)	(0.040201)	(0.545913)	(0.064195)	(0.064195)
ASSB		0.014873	0.019555*	0.016693	0.016693
		(0.010082)	(1.818648)	(0.012175)	(0.012175)
ASFB		-0.000205	0.002522	0.000212	0.000212
		(0.002812)	(0.791936)	(0.004411)	(0.004411)
NB		-0.008881*	-0.006295	-0.002406*	-0.002406*
		(0.005139)	(-1.154973)	(0.006392)	(0.006392)
CR3		0.202387	0.062689	-0.023763*	-0.023763*
		(0.313091)	(0.174837)	(0.374783)	(0.374783)
HHI		6.50E-05	3.45E-05	0.000125	0.000125
		(0.000102)	(0.324424)	(0.000119)	(0.000119)
Z_SCORE		0.008228	0.012189*	0.010519*	0.010519*
		(0.009468)	(1.226219)	(0.012144)	(0.012144)
ROA			0.004147	-0.037154*	-0.037154*
			(0.135944)	(0.033597)	(0.033597)
LLR_GL			-0.002466	-0.001239	-0.001239
			(-0.19703)	(0.013331)	(0.013331)
LA_TD			0.002543	0.000947	0.000947
			(1.271163)	(0.002095)	(0.002095)
TAL			-0.027018	-0.026066	-0.026066
			(-0.98238)	(0.028349)	(0.028349)
GDP_G				0.03044**	0.03044**
				(0.014903)	(0.014903)
IR				0.003246	0.003246
				(0.01937)	(0.01937)
FIN_INT				-0.002651	-0.002651
				(0.003325)	(0.003325)
IRS				-0.035951	-0.035951
				(0.026044)	(0.026044)
ROL				-0.152544	-0.152544
				(0.387756)	(0.387756)
RQ				-0.438561	-0.438561

				(0.455659)	(0.455659)
Method	OLS	OLS	OLS	OLS	GMM

Note: Standard deviations are presented between brackets.
*, **, *** indicates significance levels at 10%, 5% and 1%

The results show that the level of Banking reform and interest rate liberalization indicator (BREF), Financial Openness Index (KOPEN) and the score regarding soundness and safety of banks (Z_score) have a positive impact on total productivity growth. The number of banks (NB) and the concentration of banking system (CR3) have a negative impact on the total productivity growth index decrease, that it mean if the number of banks and concentration increase then the level of productivity growth decrease.

Regarding the impact of bank-specific variables, the results show that level of Return on Assets (ROA) has a statistically significant and negative impact on both cost efficiency and total productivity growth. Level of credit risk measured as ratio of loan-loss provisions to total loans (LLR_GL) influences negatively cost efficiency.

Turning to the effect of macroeconomic variables, we observe that GDP growth rate had a negative impact on cost efficiency, maybe because under expansive demand conditions, manager are less focused to control expenditure and therefore become less cost efficient. Another explanation it could be that the increase of credit markets involve higher capital cost, an increase of operating expenses and cost with fixed assets.

Also, we find a negative and significant relationship between Inflation rate (IR), Interest rate spread (IRS) and level of Rule of law (ROL) and bank cost efficiency.

Our results show that level of financial intermediation has a positive effect on bank performance, means that a low level of financial intermediation hampers banking performance.

Concerning the link between macroeconomic variables and productivity growth, we observed that only GDP growth rate had a negative impact. This result suggests that the important factors shaping the total productivity are merely banking system characteristics and bank-specific variables.

5. Conclusions

In this paper we analyze the impact of financial liberalization, reforms in the banking sector and the associated changes in the industry structure on the banking performance, measured in terms of cost efficiency and total productivity growth index in 17 countries from Central and Eastern Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia (FYROM), Republic of Moldova, Montenegro, Poland, Romania, Serbia, Slovakia and Slovenia), for 2004 – 2008 period. The period chosen is relevant in the context of the entrance of new ten EU members at the beginning of the year of 2004 and the beginning signs of the subprime crises in the Central and Eastern Europe in 2008. In this period, tow other countries have adhered to EU in 2007 (Romania and Bulgaria).

To examine the relationship between bank performance, financial liberalization and banking systems structure, we develop a two-stage empirical model that involves estimating bank performance in the first stage and assessing its determinants in the second.

Analyzing the means of determinants of efficiency value we can observe that the degree of financial liberalization of banking system has continuously increased in the period assessed. Thus the level of the banking reform and interest rate liberalization indicator (BREF), Financial Openness Index (KOPEN) and asset share of foreign-owned banks (ASFB) increased and the level of asset share of state-owned banks (ASSB) due to the privatization process and the increasing of foreign capital (the last two determinants are correlated). The number of banks was relatively stable, the concentration ratio of the first 3 banks continuously grew, but the evolutions HHI denote a moderate competition towards high competition, being relatively stable. The bank stability for the entire banking systems, in the perspective of insolvency probability, has increased continuously as Z-score relieves. The explanations could be the process of harmonization with the European acquis, which implies a batter banking regulation framework. We consider that these evolutions of these determinants were influenced by the process of European integrations, because some of the countries assessed are EU members, some of them are EU candidates and others potential EU candidates.

The bank-specific variables had different evolutions. Thus we can observe a degreasing of ROA in the context of a fat grow of total bank assets. The risk profile of

the banks evaluated as followings: the ratio of loan-loss provisions to total loans (LLR_GL) and liquidity risk measured as ratio of liquid assets to total deposits and borrowing funds (LA_TD) have decreased, indicating a lost in bank liquidity, but a better credit risk situation.

From empirical results we see that the average cost efficiency of banks in Central and Eastern European countries grew in the period analyzed. The higher increase of total productivity growth index during 2004-2008 had recorded in Bosnia and Herzegovina, Montenegro, Serbia and Republic of Moldova. Only Albania recorded a decrease of total productivity growth index during analyzed period.

Also, on average, banks from non-member country are less cost efficient but experienced much higher total productivity growth level during 2004-2008 period. Large sized banks are the much more cost efficient than medium and small banks, but small sized banks show the highest growth in terms of productivity.

From our analyze result that the levels of the Banking reform and interest rate liberalization indicator (BREF) and Financial Openness Index (KOPEN) improve cost efficiency, suggesting that banks from Central and Eastern European countries with higher level of liberalization and openness are able to increase cost efficiency and finally to offer cheaper services to clients.

Concerning the effect of financial reform on total productivity growth of banks from CEE countries, the results show that the level of Banking reform and interest rate liberalization indicator (BREF) and the score regarding soundness and safety of banks (Z_score) have a positive impact on total productivity growth. The number of banks (NB) and the concentration of banking system (CR3) have a negative impact on the total productivity growth index decrease, that it mean if the number of banks and concentration increase then the level of productivity growth decrease.

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