International Journal of Economics and Financial Issues
Vol. 3, No. 2, 2013, pp.355-369
ISSN: 2146-4138
www.econjournals.com

Efficiency and Stock Performance of Banks in Transition Countries: Is There A Relationship?

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ABSTRACT: The study investigates the link between the cost and profit efficiency scores of the banks in the Central and Eastern European Countries as well as Turkey along with their stock price performance to determine whether the efficiency scores are priced accordingly in bank stocks. Changes in efficiency scores of banks, obtained from Stochastic Frontier Analysis (SFA) model, are regressed against their stock price performance by applying fixed effects panel regression technique. Empirical results indicate that changes in profit efficiency estimates have a positive and significant impact on stock returns; however, a significant but negative relationship is found between changes in cost efficiency and stock returns.

Keywords: Central and Eastern European Banking; SFA; Efficiency; Stock returns
JEL Classifications: G21

1. Introduction

Considering the importance of the financial system in attaining the overall economic performance with changes in the regulatory environment and the globalization of financial markets, a great deal of effort has been made to investigate the efficiency of banking firms by using parametric or non-parametric frontier techniques. A large body of literature on banking efficiency spanning a half-century has concentrated on the United States (Berger and Humphrey, 1991; Berger, 1993; Jagtiani and Khanthavit, 1996; Miller and Noulas, 1996 and Berger et al., 1999). Taking the structural changes in European banking industry into account, there is relatively more and a growing literature on European banking efficiency (Altunbas, et al., 1995; Favero and Pari, 1995; Girardone et al., 2004; Mendes and Rebelo, 1999 ; Lozano-Vivas, 1997).

While more recent studies have expanded this analysis to several emerging countries (Leightner and Lovell, 1998; Hao et al. ,2001; Hardy and Patti, 2001; Sufian, 2009; Thagunna and Poudel, 2013), a major part of the literature is dedicated in examining the banking efficieny using cross country sample (Berger and Humphrey, 1997; Maudos et al., 2002). Moreover, irrespective of the geographical position, some studies explore various issues of banking efficieny such as the estimates from different approaches (Berger and Mester, 1997; Bauer et al., 1998), the impact of risk (Mester, 1996; Kwan and Eisenbeis, 1997; Altunbas et al., 2000, Pasiouras, 2007), off-balance sheet activities (Tortosa and Ausina, 2003 and Pasiouras, 2007) and the role of environmental factors (Dietsch and Lozano-Vivas, 2000; Berger and DeYoung, 2001; Chaffai et al., 2001; Cavallo and Rossi, 2002).

Despite a very large amount of literature on banking efficiency, only a few studies have attempted to investigate the relationship between bank efficiency and stock performance. Over the past decades, studies on the stock market focus on the earnings information and its components as the explanatory variables for the bank stock price changes. However, since earnings can only explain a small proportion of stock price movements (Kothari, 2001; Chen and Zhang, 2007), other kinds of information sources are needed to explain the changes in stock prices of banks (Abuzayed and Molyneux, 2009). It is observed that the recent studies have concentrated more on the impact of additional possible information sources such as accruals (Sloan, 1996; DeFond and Park, 2001), revenues (Jegadees and Linvat, 2006) and economic value added (Biddle et al., 1997) as well as efficiency on stock prices and returns. Since efficiency estimates are more likely to be informative, it is argued that efficiency estimates derived from several frontier techniques have several advantages

over traditional ratios in explaining bank stock performance (Thanassoulis, 1996; Bauer et al., 1998; Becalli et al., 2006).

Stock return is the best measure to estimate the creation of value for shareholder wealth (Brealey and Myers, 1991). All things being equal, cost and/or profit efficient banks may be expected to generate greater shareholder returns and, therefore, will be reflected in greater better stock performance. In terms of efficiency estimations, a decline in the cost or an increase in the profitability of a bank is expected to create better financial performance as well as greater stock returns. Just like the traditional accounting measures, this is not surprising to examine whether cost or profit efficiency estimates are taken into consideration in the stock price formation process.

Despite a very large literature on bank efficiency, this specific strand of literature remains rather limited with only a handful of country-specific studies covering Singapore (Chu and Lim, 1998), Spain (Adenso-Diaz and Gascon, 1997), Australia (Kirkwood and Nahm, 2006), Greece (Pasiouras et al., 2008), Malaysia (Sufian and Majid, 2006), Turkey (Erdem and Erdem, 2008), China (Abdul Majid et al., 2008) and the US (Eisenbeis et al., 1999) as well as cross-country studies.

In cross-country setting, the first study conducted by Becalli et al. (2006) found a positive relationship between cost efficieny and bank stock performance using the sample of the five principal EU banking sectors (i.e. France, Italy, Germany, Spain and UK). Liadaki and Gaganis (2010) extended the study by investigating whether the performance of 15 EU listed banks is related to their efficiency. They found a significant positive relationship between change in profit efficieny and bank stock performance but no relationship between change in cost efficiency and stock returns. In a similar study, Ioannidis et al. (2008) provide evidence from a sample across developing and developed Asian and Latin American countries. They found a positive and robust relationship between profit and cost efficiency changes and stock performance.

Despite a vast amount of literature on the banks of developed and emerging countries , the literature still suffers from a scarcity of studies on Central and Eastern European (CEE hereafter) countries including the new members of the EU as well as candidate countries. Specifically, for the transition countries, much emphasis has been given to the efficiency of the financial institutions and the impact of the ownership on the performance of financial institutions with regard to the foreign investors' participation in the financial systems of the CEE countries (Grigoran and Manole, 2002; Green et al., 2004; Fries and Taci, 2005; Carvallo and Kasman, 2005 and Yildirim and Philippatos, 2007). However, the current literature continues to suffer from the scarcity of comprehensive and sufficient empirical studies that concentrate on the relationship between efficiency and bank stock performance in transition countries.

The main objective of this study is to investigate the relationship between bank efficiency estimates and stock performance of a sample of seven transition countries over the period 1995-2006. Instead of focusing only on the earnings information and its components as possible explanatory variables for the bank stock price changes, this analysis aims to determine whether cost efficiency or profit efficiency estimate is a primary determinant of the bank stock return. The selection of aforementioned countries is based on the data availability. The contribution of this study to the literature is three-fold: First, despite a large amount of literature in the banking sector of transition countries, to the author's best best knowledge, this is the first study that examine such relationship for these countries, which have shown an increasing effort to adopt the EU regulations. Second, it utilizes both cost and profit efficiency to investigate whether such information has an explanatory power on the bank stock price performance even though most of the previous studies concentrate on the relationship between cost efficiency, technical and/or scale efficiency[1] . Profit efficiency is assumed to be more superior to cost efficiency in terms of combining both costs and revenues in the measurement of efficiency. Furthermore, it is considered as one of the most important key factors that attempt to

[1] The studies that actullay include profit efficieny estimate as well as cost efficiency estimate in the analysis are Kirkwood and Nahm (2006) in Australia, Liadaki and Gaganis (2010) in 15 EU banks, and Ioannidis et al. (2008) in Asia and Latin American countries. In the studies conducted by Chu and Lim (1998) in Singapore, Sufian and Majid (2006) in Malaysia and Pasiouras et al. (2008) in Greece, the authors select the inputs and outputs on the basis of profit-oriented approach, which defines revenue components as outputs and cost components as inputs (Pasiouras et al.,2008). It can be stated that these studies generally examine technical efficiency from a different perspective rather than profit efficiency (Ioannidis et al., 2008).

explain stock performance since stockholders would be much more interested in the profits of a bank rather than its costs, as the dividends they get specifically depend upon the bank's earnings. Therefore, this is not surprising that profit efficiency estimates are expected to explain stock performance better (Ioannidis et al., 2008). Third, the time period examined covers a unique and large data set, which is characterized by the inclusion of major reforms made in the transition process to establish a more efficient and less fragile banking system.

The remainder of the paper is organized as follows. Section 2 discusses the data and methodology. Empirical results are presented in Section 3. Finally, section 4 provides a brief summary and conclusion.

2. Data and Methodology

2.1. Methodology

The efficiency estimates, which can be measured by applying frontier analysis, reflects the degree of proximity of the firms/banks to a best-practice frontier. Frontier analysis provides an overall and objective numerical efficiency values and ranking of the firms (Berger and Humphrey, 1997). Among different type of estimation methodologies – non parametric or parametric techniques[2], the efficiency measures in this study have been estimated by using Stochastic Frontier Approach (SFA hereafter), one of the most widely applied parametric technique. Even if Data Envelopment Analysis (DEA) as one of the non-parametric approaches , requires fewer assumptions, less data and less sample, it does not allow for a random error and measurement error in the construction of the frontier, which may lead to severe problems in shaping and positioning the frontier. Furthermore, conventional test of hypothesis associated with the existence of inefficiency and the structure of the production technology can not be conducted with DEA (Coelli et al., 2005). Therefore, due to the drawbacks associated with DEA, this study employs the parametric stochastic frontier approach (SFA) to establish the cost and profit efficiency frontiers of the banks.

SFA was independently developed by Aigner et al. (1977), and Meeusen and van den Broeck (1977). Based on this approach, the specification of the functional form of the frontier concerns the introduction of an error term with two components; two-sided standard statistical noise component and one sided, non-negative random variable representing inefficiencies. Specifically, the Battese and Coelli (1995) model of a stochastic frontier function for panel data, which allows the estimation of efficiency in a one-step pocedure, is employed as well as taking into account the environmental factors during the estimation of efficiency. Using the model with environmental variables[3] is much more appropriate in the estimation of efficiencies in cross-country settings to avoid bias. The model proposed by Battese and Coelli (1995) also eliminates some of the anomalies arised from the two-step procedure[4]. The proposed stochastic frontier production model of the form is specified as follows:

$$\ln TC_{i,t} = \ln f(w_{i,t}, y_{i,t}, z_{i,t}; \beta) + (v_{i,t} + u_{i,t}) \qquad for \;\; i = 1,.....,N \qquad (1)$$

where $TC_{i,t}$ denotes the observed total cost of the i^{th} firm in the t^{th} period, $w_{i,t}$, $y_{i,t}$ and $z_{i,t}$ represent the vectors of input prices, output and country-specific environmental variables. β represents a vector of unknown parameters; $v_{i,t}$ are random errors which are assumed to follow a symmetrical normal distribution ($v_{i,t} \sim N(0, \sigma_v^2)$ and are independently distributed of $u_{i,t}$; and $u_{i,t}$, which are independently distributed inefficiency effects, are obtained by truncated distribution at zero of the normal distribution $N(m_{i,t}, \sigma_u^2)$, with the mean, $m_{i,t} = z_{i,t}\delta$, and variance σ_u^2; $z_{i,t}$ is a vector of

[2] Non-parametric approaches, which require the non-probabilistic assumption and behave as if noise and inefficiencies are combined, concentrate on technological optimization, discard economic optimization since they ignore the price information. These approaches also assume a deterministic process rather than stochastic process (Berger and Mester, 1997; Coelli et al., 2003). However, parametric approaches are probabilistic and attempt to separate noise from inefficiencies (Lee, 2002).

[3] In the banking literature, some studies (Dietsch and Lozano-Vivas, 2000; Lozano-Vivas et.al, 2001; and Lozano-Vivas et.al., 2002) have recognized the importance of accounting for environmental variables in the efficiency model specification.

[4] See Wang and Schmidt (2002) for a more detail discussion of one-step and two-step methods.

environmental variables and δ is a vector of unknown coefficients of the environmental variables. The coefficients of the composed error term $(v_{i,t} + u_{i,t})$ are estimated by using maximum likelihood function.

Additionally, profit functions are estimated similarly as cost functions in equation (1) except that total costs are replaced with total profit on the left-hand side of the equation. In this study, alternative profit function (Pulley and Humphrey, 1993; Berger et al. 1996) is used in contrast to standard profit function, which assumes the perfect competition in the input and output markets. Alternative profit function is more likely to be employed because of accounting for substantial unmeasured differences in the quality/specialization among the individual banks in the sample and also diverse group of countries with different levels of competition (Berger and Mester, 1997). For the profit function, total profit is specified as the net profit before tax. Besides, in measuring the efficiency under the profit function, the composite error term is considered as $\varepsilon_i = v_i - u_i$.

Bank stock performance is represented by cumulative annual stock returns (CASR), calculated on the basis of monthly returns[5] using the following equation:

$$CASR \text{ in year } t = ((1 + month\ 1\ return) * (1 + month\ 2\ return) * (1 + month\ 3\ return) * \ldots * (1 + month\ 12\ return)) - 1 \quad (2)$$

To investigate the relationship between bank efficiency and stock performance, bank stock returns are regressed against the corresponding annual change in efficiency while controlling for size and risk using the annual percentage change in total assets and the annual percentage change in equity to assets[6]. Instead of efficiency score in year t, efficiency change is preferred because the change between year *t* and year *t-1* is perceived as a specific publicly available information by the investors who aim to make investments on bank stocks. More importantly, it does not make sense to use the efficiency score at time *t* to analyze its impact on the bank stock performance at time t, due to the inability of investors to access information concurrently. The efficiency change is measured as percentage change in efficiency scores at year-end over the period of our analysis. The efficiency change in year t can be represented as follows

$$Efficiency\ change\ in\ year\ t = \frac{Efficiency\ score_t - Efficiency\ score_{t-1}}{Efficiency\ score_{t-1}} \quad (3)$$

In the analysis, panel data analysis is employed in order to analyze the association between the efficiency of transition countries ' banks and their stock price performance. Since our sample includes 39 banks belonging to seven transition countries over the period 1995-2006, the use of panel data makes more sense compared with either purely cross-sectional or purely time-series data[7]. The model takes the following form;

$$y_{i,t} = \alpha + X_{i,t}\beta + \varepsilon_{i,t} \quad (4)$$

where dependent variable $y_{i,t}$ denotes the annual stock return of i^{th} bank in the t^{th} period; $X_{i,t}$, which is a k-vector of regressors, denotes efficiency change, size (annual change in total asset) and risk (annual change in total equity to total assets ratio) for i^{th} bank in the t^{th} period; β represents the slope parameters and $u_{i,t}$ are the error terms for *i=1,2, ...N* cross-sectional units (banks) observed for dates

[5] The empirical studies in the literature to estimate the annual stock return either employ point increase or add daily return. Whereas Chu and Lim (1998) used end of the year stock prices, Becalli et al. (2006) calculated the annual returns by adding daily returns. Becalli et al. (2006) stated that adding daily returns is a better measure than calculating a point increase- difference between the return from the first day and last day of the period under investigation. However, in this study, we relied on monthly stock prices and calculated cumulative annual stock returns due to the data availability.

[6] To account for the impact of efficiency change on the stock performance, some other explanatory variables associated with each bank are also added to the model.

[7] In the study of Becalli et al. (2006), OLS estimation method was employed because of including one-year analysis. However, if the dataset includes more than one year, observations within firms (banks) tend to be correlated, therefore, the independence assumption of OLS will be violated as the standard errors will be biased downwards.

periods $t=1,2,....T$; whereas the parameter α represents the overall constant in the model, and the remaining disturbance, $\varepsilon_{i,t}$, stochastic.

2.2. Parameter and Model Determination

Translog specification is used to estimate the cost frontier and profit frontier model since it has well-known advantages of including a Flexible form and as a particular case, Cobb-Douglas specification[8]. Total cost is defined as the sum of total operating expense and interest expense. Three outputs are used: y_1 =total loans, y_2 =other earning assets (investment securities) and y_3 =total deposits. Three input prices are defined: the price of labor, price of physical capital and price of purchased funds. Because data on number of employees are not available, the price of labor is computed by dividing total personnel expenses by total assets[9]. The price of physical capital is computed by dividing the total operating costs net of personnel expenses by total fixed assets. The price of purchased funds is computed by dividing total interest expenses by their corresponding liabilities (deposits, total money market funding and total other funding). Thus, both financial and operating costs are included in the estimation of the cost function. The value added approach (Berger and Humphrey, 1992) is adopted in this study to define inputs and outputs[10]. The translog cost function (including three inputs- three outputs), originally developed by Diewert (1974), can be expressed as follows:

$$\ln TC_{s,t} = \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_{i,s,t} + \tfrac{1}{2} \sum_{i=1}^{3}\sum_{k=1}^{3} \alpha_{i,k} \ln y_{k,s,t} + \sum_{j=1}^{3} \beta_j \ln w_{j,s,t} + \tfrac{1}{2} \sum_{j=1}^{3}\sum_{m=1}^{3} \beta_{j,m} \ln w_{j,s,t} \ln w_{m,s,t}$$
$$+ \sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{i,j} \ln y_{i,s,t} \ln w_{j,s,t} + \sum_{l=1}^{10} z_{l,s,t} + v_{s,t} + u_{s,t} \qquad (5)$$

where TC is the total cost of a given bank s at time t, y_i is the i^{th} output, w_j is the price of the j^{th} input and z_l is the l^{th} environmental variable. Based on the standard properties of the cost functions, standard homogeneity and symmetry in all quadratic terms are imposed via parameter restrictions. In order to impose linear homogeneity, total costs (TC), the price of labor (w_1), price of physical capital (w_2), price of purchased funds (w_3) are normalized. The symmetry condition requires $\alpha_{ik} = \alpha_{ki} \forall i, k$ and $\beta_{jm} = \beta_{mj} \forall j, m$.

In the case of profit function, total profit is specified as the net profit before tax. The dependent variable in the model is determined as $\ln(\prod + \theta)$. As a number of banks in the sample has losses rather than profits, a constant , such as θ, is added to the profits of all firms to eliminate the negative values[11].

Environmental Variables

To allow for the effect of country specific banking technology features, some country-specific variables -several geographic, market structure as well as financial depth variables- are included into the cost and profit estimation functions since they are assumed to be the major factors in explaining

[8] Some empirical studies (Mitchell and Onvural, 1996; Berger et al., 1997; DeYoung and Hasan, 1998) have suggested that using Fourier-Flexible form, which combines a standard translog functional form with the non-parametric Fourier functional form would provide a better fit because it approximated the underlying cost function across a broad range of outputs. On the other hand, Berger and Mester (1997) found that mean efficiency estimates between the two procedures were very small. More specifically, as Fourier form requires additional truncations of data, employing translog specification is much more appropriate (Hasan and Marton, 2003).

[9] This approximation is common in all studies using BankScope dataset. See Altunbas et al., (2000) and Maudos et al., (2002).

[10] All items on both sides of balance sheet may be identified as inputs or outputs depending on their contribution to the generation of value-added.

[11] θ indicates the absolute value of the minimum profits plus one, therefore, the natural log of profits can be taken of a positive number.

the differences in the cost and profit functions of the banks across countries[12] (Dietsch and Lozano-Vivas, 2000). Several empirical studies have emphasized the importance of environmental variables in the efficiency estimates in banking literature (Allen and Rai, 1996[13]; Dietsch and Lozano-Vivas, 2000; Lozano-Vivas et al., 2001; Lozano-Vivas et al., 2002).

As in Dietsch and Lozano-Vivas (2000), the environmental variables can be categorized into three different groups: The first group is called as "main conditions", including a measure of population density, per capita income and density of demand for each country. Population density is measured by the ratio of the inhabitants living per square kilometer. Per capita income, which serves as a proxy for the general economic development, is measured by ratio of gross domestic product (GDP) per square kilometer. The density of demand is measured by the ratio of total deposits per square kilometer.

The second group, which includes average capital ratio, degree of concentration and intermediation ratio of the banking industry, characterize the structure of the banking industry in each country. Average capital ratio, which is measured by the total equity over total assets, is included as a control variable for reflecting the differences in the regulatory requirements among countries. Concentration of the banking industry is measured by the Herfindahl-Hirschman index, measured by summing the squared asset markets shares of all banks in each country. The intermediation ratio, which is measured by the ratio of total loans to total deposits, is included into the estimation equations as a proxy to recognize the differences among domestic banking industries in terms of their ability to convert deposits into loans.

The final category , which is related with banking efficiency, includes macroeconomic variables; annual rate of inflation, GDP growth to take into account the macroeconomic conditions, M2 to GDP as a proxy for the overall size of the financial intermediary sector, and market capitalization to capture the financial market development.

2.3 Data

The data set of this study is comprised of commercial banks listed on the stock exchanges of CEE countries , which already joined the EU or are candidates, over the period 1995-2006. The annual balance sheets, income statements of publicly traded banks and environmental variables were obtained from Bankscope database of Bureau van Dijk's company. Monthly stock prices of all listed banks were obtained from the stock exchanges of each country in the sample. After reviewing the data for reporting errors and other inconsistencies, this study inludes an unbalanced panel data of 39 listed banks consisting 236 bank-level observations over the period[14]. Table 1 presents summary statistics of bank-level variables. The list and averages of several geographic, market structure and financial depth variables by countries are reported in Table 2. By taking into account different environments where the banks operate, there exist large differences across countries. Especially, density of population, income per capita and density of demand vary greatly.

[12] Even though the regulatory conditions, banking structures and the accessibility of services are quite similar across transition countries, the sample countries may exhibit significant variations. Therefore, the inclusion of these variables into the estimated functions allows for the cost and profit efficiency levels to vary systematically across countries.

[13] Allen and Rai (1996) included the regulatory environments of each country. However, they specified these determinants at bank level, not at country level. More importantly, they employed ex-post analysis in order to explore the differences in efficiency estimates.

[14] The total of 39 banks is divided into seven countries, with the number of banks in parentheses; Croatia (14), Estonia (2), Hungary (2), Latvia (2), Poland (9), Slovenia (1) and Turkey (9).

Table 1. Descriptive statistics of bank level variables over the 1995-2006 period

Variables	Mean	Median	Maximum	Minimum	Standard Deviation	Coefficient of variation
y_1 = Total loans	2,423,764	877,856	21,162,740	5,340	3,723,204	1.536
y_2 = Other earning assets	2,731,953	709,445	28,063,367	3,619	4,729,832	1.731
y_3 = Total deposits	4,216,855	1,559,014	36,737,899	10,923	6,420,475	1.523
p_1 = Price of labor	0.018	0.017	0.047	0.005	0.007	0.403
p_2 = Price of physical capital	1.165	0.917	9.043	0.187	1.082	0.929
p_3 = Price of purchased funds	0.064	0.044	0.274	0.015	0.046	0.724
tc = Total costs (interest expenses + noninterest expenses)	678,359	152,259	8,268,838	1,880	1,215,929	1.792
ta = Total assets	5,842,067	2,021,709	53,374,590	15,093	9,369,051	1.604
tc / ta	0.103	0.087	0.289	0.035	0.049	0.476
Equity / ta	0.114	0.104	0.435	0.028	0.053	0.464
Net income / ta	0.013	0.013	0.060	-0.092	0.017	0.013

Note: Assets, costs, earnings, deposits and loans are in US dollars.

Table 2. Average values of environmental variables over the period 1995-2006

	Density of population	Income per capita ($)	Density of Demand ($)	Average Capital Ratio	Degree of Concentration	Intermediation ratio	Inflation (%)	Money	GDP growth (%)	Capitalization (%)
Croatia	79.156	5,565.001	9.255	0.174	0.159	0.514	4.637	0.531	4.257	21.498
Estonia	30.491	5,646.631	12.263	0.141	0.406	0.506	10.729	0.347	7.322	29.214
Hungary	108.297	7,658.880	14.703	0.113	0.181	0.487	10.325	0.493	4.036	25.847
Latvia	36.625	4,333.621	5.907	0.122	0.159	0.390	7.424	0.322	7.071	8.376
Poland	122.790	5,449.067	4.269	0.123	0.123	0.481	8.798	0.402	4.672	18.364
Slovenia	97.891	12,609.609	53.917	0.119	0.224	0.537	7.532	0.469	4.126	16.731
Turkey	84.269	3,452.791	6.932	0.122	0.173	0.373	46.731	0.218	4.704	30.164

Sources: Bankscope IBCA. World Development Indicators. Transition Report 2008. own calculations. Notes: Degree of concentration = Herfindahl-Hirschman Index (according to total assets); Money = M2 / GDP; Capitalization= Market capitalization (% of GDP).

3. Empirical Results

3.1. Cost and Profit Efficiency Estimates

The estimates of cost efficiency scores, based on common frontier with country specific environmental variables[15], have been obtained from stochastic translog cost function defined as the Equation 5, which includes output levels, input prices and country-specific environmental variables (Table 3). The measure of efficiency takes a maximum value of 1, which corresponds to the most efficient bank in the sample. The average estimated cost efficiency scores for the whole sample is 81.2% , or cost inefficiency level of 18.8% , suggesting that an average bank produces with a 0.812 of cost efficiency in the sample or an average bank in the sample could have saved about 18.8% of total cost if it had used the best practice technology , thereby, matching its performance with the best performance banks.

Table 3. Average cost efficiency scores over the period 1995-2006

Year	*Mean*	*Standard Deviation*	*Coefficient of Variation*
1995	0.788	0.103	0.131
1996	0.832	0.108	0.130
1997	0.770	0.181	0.236
1998	0.850	0.052	0.061
1999	0.805	0.092	0.115
2000	0.740	0.141	0.191
2001	0.843	0.115	0.136
2002	0.846	0.059	0.070
2003	0.821	0.109	0.133
2004	0.806	0.068	0.085
2005	0.816	0.133	0.163
2006	0.829	0.082	0.099
Overall	0.812	0.104	0.129

Notes: Cost efficiency scores are estimated by using a stochastic frontier. Estimations are based on a common cost frontier with country-specific environmental variables (Equation 5). Pooled sample data includes seven commercial banks over the period 1995–2006 consisting of 236 observations.

The average estimated cost efficiency scores fluctuate importantly during the sample period, reaching the minimum in 2000 (74%) and the maximum in 2002 (84.6%). There is not a specific trend for the cost efficiency between 1995 and 2001 despite the fact there is a downward trend over the period 2002 and 2004 and a slight upward trend after 2004. This result suggests that the decline may be due to the financial crisis in Turkey in 2000 and 2001 and the improvement may be indicative of the slight adaptation of the transition countries to EU through financial and economic systems.

[15] The coefficients of the environmental variables in the estimation of cost function are statistically significant at least 10% level. The signs of the coefficient of the density of population and density of demand are negative, as expected, which implies that higher population and deposit demand densities result in lower banking costs. The sign of the coefficient of income per capita is also negative, which indicates that higher general development of the economy contribute to lower costs of banking services. As expected, the sign of the coefficient of the average capital ratio is negative, suggesting that higher capital (equity) leads to lower risk taking which makes the funds borrow more expensive. The coefficient of the Herfindahl-Hirschman index is positive, which shows that the all the operating and financial costs of the banks are higher in the highly concentrated market. The coefficient of the intermediation ratio (ratio of total loans to total deposits) is negative, indicating that the developments in the financial and regulatory system support the financial intermediation process and thereby, lowering the costs of the banks. The sign of the inflation coefficient is positive, implying that the higher the inflation, the higher the banking costs are. All the coefficienct on the M2 to GDP, market capitalization and GDP growth are negative, which suggest that financial improvement results in lower costs and thereby, higher efficiency.

Estimates of alternative profit efficiency are presented in Table 4[16]. Average profit efficiency score of all banks in the sample is 0.586, which indicates that during the period, the earnings of banks would have needed 58.6% of their potential profits on average. In other words, a profit inefficiency of 0.414 suggests that an average bank could increase its profits by 41.4% if it was to meet the performance of the best-practice bank. As seen in Table 3 and Table 4, profit efficiency estimates are lower than cost efficiency estimates. This outcome is consistent with the results of earlier studies such as the ones of Berger and Mester, 1997; Rogers, 1998; Maudos et al., 2002; Lozano-Vivas and Pasiouras, 2008 and Mamatzakis, et al., 2008. The above efficiency results can be justified from the fact that the high demand for financial services and also observed low financial intermediation penetration over the sample period left the banks in transition countries in a dominant position as a provider of these services. Therefore, since banks have specifically concentrated on increasing their investment activities, profit efficiencies stayed behind cost efficiencies (Mamatzakis et al., 2008). Additionally, regarding the potential reward of expanding market shares in a rapidly growing market, banks do not have much incentive to maximize their profits by means of full utilization of their discretionary pricing power (Rossi et al., 2004). Furthermore, banks face less pressure to increase their profitability as interest margins in these banking systems are so high, thereby, making much more effort to restructure their activities to manage costs.

Table 4 . Average profit efficiency scores over the period 1995-2006

Year	*Mean*	*Standard Deviation*	*Coefficient of Variation*
1995	0.603	0.084	0.140
1996	0.582	0.129	0.221
1997	0.602	0.130	0.217
1998	0.594	0.230	0.388
1999	0.564	0.244	0.432
2000	0.653	0.156	0.239
2001	0.623	0.171	0.275
2002	0.523	0.210	0.402
2003	0.556	0.211	0.379
2004	0.638	0.184	0.288
2005	0.583	0.208	0.357
2006	0.515	0.272	0.529
Overall	0.586	0.185	0.322

Notes: Profit efficiency scores are estimated by using a stochastic frontier. Estimations are based on a common cost frontier with country-specific environmental variables (Equation 5). Pooled sample data includes seven commercial banks over the period 1995–2006 consisting of 236 observations.

Even though the overall trend for the profit efficiency is not constant, there is a slight decline during the beginning of the sample period only to be followed by a strong setback in 2000. However,

[16] The coefficients of environmental variables in the estimation of alternative profit function are statistically significant at least 10% level. Among the characteristics of the markets in which the banks operate and macro economic factors, the deposit denstity and income per capita have a positive impact on profit efficiency whereas the population density has a negative influence on profit efficiency. Based on these results, the average capital ratio, as a proxy of regulatory conditions, has a negative impact on the profit efficiency levels of the banks, implying that the banks exposed to more strict regulatory environment would operate with lower efficiency levels. The sign of the concentration (Herfindahl-Hirschman) index is negative, which suggest that banks operating in less concentrated markets contributes to more profit efficiency. The coefficient of intermediation ratio is found to be positive, as expected, which shows that banks operating with a higher amount of loans per unit of deposits are more profit efficient. The sign of the coefficient of inflation is negative, implying that the higher the inflation, the lower the profit efficiency. Lastly, all the coefficienct on the M2 to GDP, market capitalization are positive, which states that banks generate higher profits in the financially developed markets. However, surprisingly, the results show a significant negative relationship between GDP growth and profit efficiency levels.

the results regarding the cost efficiency follow the opposite line, a slight improvement in cost efficiency estimates during the sample period.

3.2. Regression Results

After estimating the cost and profit efficiency scores based on stochastic frontier method, in order to investigate the relationship between stock returns and efficiency, the stock returns (CASR) are regressed against corresponding annual change in efficiency estimates while controlling for controlling for size and risk using the annual percentage change in total assets (TA) and the annual percentage change in equity to assets (EQAS). The regression results, derived from equation 4, are reported in Table 5. Since an unbalanced panel data set is used to examine this relationship in these transition countries, there are several types of panel data models including constant coefficients model[17], fixed effects model and random effects model. To determine the choice of appropriate methodology, several specification tests are empoyed such as likelihood ratio, Breusche-Pagan Lagrange Multiplier (LM) test, and Hausman's test. In both cases, the test results indicate that the fixed effects model should be preferred[18]. Year dummy variables are included into the model to take into account the potential time effects in the stock returns. The models are estimated also using White's transformation to control for cross-section heteroscedasticity with corrected degrees of freedom.

Panel A corresponds to the regression results for cost efficiency changes and Panel B for profit efficiency changes. If improvements in cost and profit efficiency are reflected in stock returns, a positive association is expected between these changes and stock returns. The results indicate that profit efficiency changes have a positive and statistically significant impact on stock returns. However, the striking result is that cost efficiency changes have a negative and statistically significant impact on stock returns. The positive impact of profit efficiency on stock return could be explained by the argument that rational shareholders and potential investors are very concerned about the profits as they provide an indication about the future dividend payments and capital gains[19] (Board and Day, 1989). Also, the profit efficiency naturally includes the revenue side of the profit function. If banks are more profitable, this will be directly reflected in the future expectations of the banks' stock returns. On the other hand, this is not the case for the cost efficiency changes. Cost efficiency scores, which offer an indication for the capability of managers, will not be reflected positively in the bank stock returns. This finding suggests that stocks of cost efficient banks do not tend to outperform their inefficient counterparts. Even though both better profit management and better cost management are directly observed by the public and reflected in the stock prices, rational shareholders or potential investors in transition countries do not perceive the cost efficiency changes positively. These results are not consistent with the results of earlier studies (Sufian and Majid, 2006; Liadaki and Gaganis, 2010).

Among the explanatory variables to account for the impact of efficiency change on the stock returns, only size of banks, which corresponds to the annual percentage change in total assets, is statistically significant at 5% for cost and profit efficiency scores. Moreover, the explanatory power of the profit changes and cost changes in the variability of stock returns is approximately 30% (Adjusted R-squared is equal to 0.300 for profit changes, 0.299 for cost changes).

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[17] The constant coefficient model with residual homogeneity and normality can be estimated by using pooled Ordinary Least Square (OLS) regression model, which refers to constant intercepts and slopes across time and regions. More specifically, there is assumed to be unobserved individual heterogeneity. Since the independence and homoscedasticity assumptions of the error terms in the pooled OLS are not usual in the panel data applications, it will not be so realistic to expect that pooled OLS be adequate for such models (Davidson and Mackinnon, 1993).

[18] A main assumption in random effects model is that the random effects and explanatory variables are not correlated with each other. For this reason, a Hausman test is employed to make a specific comparison between the fixed and random effects estimates of coefficients (Baltagi, 2001). The results of the Hausman test indicate a Chi-square statistic equal to 8.843 (with 3 degrees of freedom) for cost efficiency and 8.771 (with 3 degrees of freedom) for profit efficiency, which are both statistically significant at the 10% level.

[19] Generally, not all investors tend to keep their stocks in the long term and benefit from dividend payments. However, these groups of investors will be interested in the stream of expected future dividend payments since stock price will reflect the present value of future dividends. Therefore, positive changes in the expectations about the dividend payments will be reflected positively in the stock returns, providing the investors to earn profits on sale (Board and Day, 1989).

Table 5. Regression results

Panel A - Dependent Variable : CASR	**Coefficient**
Constant	0.359 (10.008) ***
COSTCH	-0.329 (-2.983)**
Size	0.269 (2.153)**
Risk	0.267 (1.315)
R2	0.527
Adjusted R2	0.300
Time dummies	Yes
F-statistics	2.326***
Hausman test	8.843 **
Panel B - Dependent Variable : CASR	**Coefficient**
Constant	0.336 (9.161) ***
PROFCH	0.115 (2.421)**
Size	0.251 (1.979)**
Risk	0.224 (0.952)
R2	0.526
Adjusted R2	0.299
Time dummies	Yes
F-statistics	2.319 ***
Hausman test	8.771 **

Notes: ***, ** and * Statistically significant at the 1, 5 and 10% levels, respectively; *t*-statistics are in parentheses; CASR: cumulative annual stock return calculated from monthly returns; COSTCH: percentage change in cost efficiency; PROFCH: percentage change in profit efficiency; *Size* corresponds to the annual percentage change in total assets; *Risk* corresponds to the annual percentage change in total equity to total asset ratio. The models are estimated with fixed effects panel regression (including bank and period fixed effects) with White's transformation to control for cross-section heteroscedasticity (d.f.corrected).

4. Conclusions

An investigation of the relation between stock returns and publicly available information has also attracted the attention of researchers in accounting and finance. While the majority of the existing literature focuses on earnings, some recent studies investigate the impact of other firm attributes such as accruals, revenue surprises and economic value added and efficiency. Motivated by the limited research in banking, this study investigates the link between the cost and profit efficiency scores of the banks along with their stock price performance to determine whether the efficiency scores are priced accordingly in bank stocks of transition countries. To achieve the objectives of this study, common cost and profit frontiers with country-specific variables are estimated for a panel of 39 banks operated in seven transition countries over the period 1995-2006, while taking into account specific environmental variables of countries. Then, annual efficiency changes are regressed on annual stock returns to determine whether they have an explanatory power on the stock returns. .

The average cost efficiency estimate for the whole sample is 81.2% whereas the corresponding figure for the profit efficiency is 58.6%, which shows a higher cost rather than profit efficiency for the whole period under the investigation. This outcome is consistent with the results of the previous studies in the developed and developing countries.

Turning to the relationship between efficiency changes and stock returns, the regression results indicate that profit efficiency changes have a positive and statistically significant impact on stock returns. However, the striking result is that cost efficiency changes have a negative and statistically significant impact on stock returns. The positive impact of profit efficiency on stock return could be explained by the argument that rational shareholders and potential investors are very concerned about

the profits as they provide an indication about the future dividend payments and capital gains (Board and Day, 1989). Cost efficiency scores, which offer an indication for the capability of managers, will not be reflected positively in the bank stock returns. This finding suggests that stocks of cost efficient banks do not tend to outperform their inefficient counterparts. Even though both better profit management and better cost management are directly observed by the public and reflected in the stock prices, rational shareholders or potential investors in transition countries do not perceive the cost efficiency changes positively.

There are a number of potential explanations for these findings. First of all, shareholders are interested in both profits and costs. The dividends in the former influence both the future dividend payments and subsequent movements in prices. For the latter, higher cost efficiency will not be reflected in better stock performance. Even though it is expected that cost efficient banks should be more profitable and generate greater returns for their shareholders, in this study, it is found that the cost efficient banks, despite of being more profitable, they can not provide higher shareholder returns.

Secondly, it is likely that profit efficiency estimates are indicators of the "quality of earnings" and "persistency of earnings", whereas traditional profitability ratios are not (Ioannidis et al., 2008). Additionally, cost efficiency estimates are indicators of the "cost management", which provide more advantages over accounting ratios. Finally, efficiency estimates are able to provide information which is not biased or agency problems.

The results of this study have crucial implications. The investigation of the determinants of the bank efficiency and their relationship with the stock performances is vital in terms of understanding the intrinsic valuation of the banks' stocks generally. Evaluating the performance of banks and thus, assessing their efficiency in maximizing shareholder wealth have relevance for computing the cost of capital since more efficient banks are expected to raise capital at a lower cost.

The impact of banking efficiency on the bank stock return has important implications for regulators and policy makers since it is important for regulators, especially in developing countries, to create an environment which enhances the efficiency and stability in the banking systems. Moreover, this provides new insights for policy makers due to the importance of the efficiency in affecting the shareholder wealth maximization in banking. In this sense, policy makers should not only evaluate banking policies through the financial stability but also should investigate the policies that encourage banks to operate efficiently in order to make effective capital allocation decisions (Beck et al., 2000). Using the efficiency as a primary determinant for the bank stock return can be more precise and timely than the traditional accounting ratios in assessing the risk of bank failure. As a consequence, the results of this part of the study have a number of practical implications for event studies to analyze banks, particularly to estimate of bank cost of capital and investment performance, as well as regulatory initiatives to utilize market discipline to evaluate bank efficiency.

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