RISK MEASURES AND EFFICIENCY SCORES OF PUBLICLY TRADED BANKS IN NEW AND CANDIDATE EUROPEAN UNION COUNTRIES' STOCK MARKETS

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RISK MEASURES AND EFFICIENCY SCORES OF PUBLICLY TRADED BANKS IN NEW AND CANDIDATE EUROPEAN UNION COUNTRIES' STOCK MARKETS

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ABSTRACT

RISK MEASURES AND EFFICIENCY SCORES OF PUBLICLY TRADED BANKS IN NEW AND CANDIDATE EUROPEAN UNION COUNTRIES' STOCK MARKETS

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The risk measures and efficiency scores of the publicly traded banks in Central and Eastern European Stock Exchanges are analyzed in this research. The first study investigates the link between the cost and profit efficiency scores of the 39 listed 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.

In the second study, the relation between the accounting and market-determined measures of risk for a sample of 39 listed banks in Central and Eastern European Countries and Turkey are examined over a specified period by applying panel data analysis. Empirical results show that when total return risk is used as the dependent variable, the equity to total assets ratio, gross loans to total assets ratio and liquid assets to total assets ratio are found to be statistically significant. Only the coefficients associated with gross loans to total assets ratio and liquid assets to total assets ratio are statistically significant in explaining systematic risk. Surprisingly, none of the coefficients are statistically significant in explaining the variability in unsystematic risk.

Keywords: *Efficiency, SFA, Stock returns; Accounting measures of risk, Total return risk, Systematic risk, Non-systematic risk*

ÖZET

AVRUPA BİRLİĞİ'NE YENİ ÜYE ve ADAY ÜLKELERİN HİSSE SENEDİ PİYASALARINDA İŞLEM GÖREN HALKA AÇIK BANKALARIN RİSK ÖLÇÜTLERİ VE ETKİNLİK ANALİZLERİ

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Bu çalışmada, Orta ve Doğu Avrupa ülkeleri ve Türkiye hisse senedi piyasalarında işlem gören halka açık bankaların risk ölçütleri ve etkinlikleri analiz edilmektedir. İlk bölümde, Orta ve Doğu Avrupa ülkeleri ve Türkiye'deki hisse senedi piyasalarında işlem gören 39 bankanın maliyet ve karlılık etkinlikleri ile bankaların hisse senetlerinin performansları arasındaki ilişki incelenerek etkinlik değerlerinin banka hisse senetlerinin fiyatlanmasında etkisinin olup olmadığı tartışılmaktadır. Stokastik Sınır Analizi (SFA) kullanılarak elde edilen bankaların etkinlik değerlerindeki yıllık değişimler bankaların hisse senetlerinin getirileri üzerine sabit etkiler panel veri modeli kullanılarak regress edilmiştir. Panel analiz bulguları, karlılık etkinlik değerlerindeki değişimler ile hisse senetlerinin getirileri arasında istatiksel olarak anlamlı ve pozitif bir ilişki olduğunu göstermesine rağmen maliyet etkinlik değerlerindeki değişimlerin banka hisse senetlerinin getirileri üzerinde istatiksel olarak anlamlı fakat negatif bir ilişki olduğunu ortaya çıkarmıştır.

İkinci bölümde, Orta ve Doğu Avrupa ülkeleri ve Türkiye'deki hisse senedi piyasalarında işlem gören 39 bankanın muhasebe ve piyasa bazlı ölçütleri arasındaki ilişki panel veri yöntemi kullanılarak test

edilmektedir. Panel analiz bulguları, toplam getiri riski bağımlı değişken olarak kullanıldığında, özkaynakların toplam aktiflere oranı, brüt kredilerin toplam aktiflere oranı ve likit varlıkların toplam aktiflere oranı rasyolarının toplam getiri riskini açıklamada istatiksel olarak anlamlı olduğunu tespit etmiştir. Fakat sadece brüt kredilerin toplam aktiflere oranı ve likit varlıkların toplam aktiflere oranı rasyoları, bankaların sahip olduğu sistematik riskleri açıklamada istatiksel olarak anlamlı bulunmuştur. Şaşırtıcı bir biçimde, sistematik olmayan riski açıklayan hiçbir değişken istatiksel olarak anlamlı sonuçlar vermemiştir.

Anahtar Kelimeler: *Etkinlik, SFA, Hisse denedi getirileri, Riskin muhasebe bazlı ölçütleri, Toplam getiri riski, Sistematik risk, Sistematik olmayan risk*

To My Husband

&

My Parents

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Gülin Vardar

Izmir, June 2010

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CHAPTER 1

INTRODUCTION

1.1. Overview

Financial markets and institutions contribute to the prosperity and economic growth by alleviating market frictions that prevent the direct pooling of society's savings into profitable projects. Well developed financial systems also contribute to higher production and efficiency in the overall economy by facilitating the exchange of goods and services with the payment services, pooling savings from a large number of investors, acquiring and processing information about enterprises and possible investment projects, and hence allocating savings of the society to their most productive and profitable use, monitoring investments and implementing corporate governance, and aids at diversifying and reducing liquidity and intertemporal risk (Levine, 1997 and 2005). Such an efficient financial system not only reduces the cost and information asymmetries, but also accomplishes the goal of financial liberalization, by eliminating institutional and legal restrictions that deteriorate the financial system's role as a financial intermediary between savers and borrowers. Therefore, as the analysis of financial system and its role has long been a favorite topic of economic and finance research, it is likewise essential to investigate in detail the characteristics of the financial system in Central and Eastern European (CEE hereafter) transition economies because of their unique characteristics. In contrast to

a well-developed financial system in western countries, until the social and economic transformations reforms, a huge inventory of non-performing loans allocated to state enterprises, inexperienced staff and management, illiquid stock market were the characteristics of CEE countries' financial systems.

The path these countries follow, from state control to a relatively free market system, is very challenging. After the fall of Berlin Wall in 1989, signaling the collapse of communism, a number of new countries emerged in Central and Eastern Europe due to the disintegration of Soviet Union. These countries are called "transition economies" since they have begun a transition from a centrally planned economy towards a market-based economy. As part of this process, the accession of some countries into European Union (EU hereafter) has worked as an important trigger for a rapid adjustment to the market economy. The transition process from a centrally planned towards a free market economy involved adopting some political and economic reforms to create a regulatory framework. Considering the complexity and gravity of the transition to a market economy, the development of financial system has been the major issue because of its essential significance on the economic infrastructure.

Ten years after the collapse of communism, financial systems including banking systems in transition countries have undergone fundamental changes. The financial system inherited from the central planning system in CEE countries was extremely inadequate before the transformation process. A huge inventory of non-performing loans allocated to state enterprises, the capital inadequacy, sectorally concentrated loan portfolios, underdeveloped branch networks, asymmetric information,

insufficient supervision, illiquid stock market were the characteristics of CEE countries financial systems**.** Under central planning, the financial system was little more than "a bookkeeping mechanism for tabulating the authorities' decisions about the resources to be allocated to different enterprises and sectors" (European Bank for Reconstruction and Development 1998, Transition Report, pg. 92). Banking systems were formed entirely by monobanks[1]. Securities markets were absent because creating marketable financial instruments was not allowed by the authorities. Through the transition process from a centrally planned economy to a relatively free-market economy, the banking systems in these countries had been restructured, was recapitalized and privatized during 1990s with the aid of key reforms. Due to the enormous progress made to strengthen the banking systems of the transition countries, banking system became the dominant source of funding for industrial and commercial businesses. The restructuring and privatization of the state-owned banks, the elimination of the restrictions of the foreign entry to create a competitive structure and the establishment of a series of amendments to the development of the financial system were the key reforms implemented at the outset of the transition. The major reforms made in the transformation process led to the establishment of a more efficient and less fragile banking system. However, capital markets had less financial depth and breadth for fund-raising compared to the banking system. In addition, the development of stock markets in various CEE countries has taken quite different paths. Although transformation process from the state control to a relatively free-market system has been very rapid for some countries, the creation of a capital market infrastructure and a gradual privatization were considered as an integrated process for the other countries. Moreover, the financial systems in most of the

[1] Monobank, which has no counterpart in the market economy, was the combination of central bank and monopoly commercial bank. It had 'simultaneously the financial advisor, the treasurer, the cashier and the auditor of every enterprise' (Dembinski, 1988).

transition economies were relatively small in terms of economic activity, size and depth of their financial systems compared to developed countries. The investigation of the financial system development in these countries, however, holds considerably more importance for academic scholars.

Specifically, the swift changes made in the CEE countries' financial systems were enhanced by the goal of EU membership. The transition process, initiated in March 1998, resulted in the enlarged union in May 2004 when eight of the CEE countries joined the EU, namely; Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. Bulgaria and Romania joined in 2007, and Croatia is expected to join the EU by 2010. Turkey, which is not a transition country, has been granted the status of the candidate country and started the accession negotiations with the EU in 2005. Since the establishment of a strong financial system in CEE countries and Turkey is a major concern, as a candidate member of EU, it is essential to evaluate whether crucial improvements have been achieved in their banking system and stock markets. The scant research conducted on the transition economies is the major driving force behind this study. Turkey has been particularly included due to its ongoing efforts to join the EU in the near future.

1.2. Objectives and Contributions of the Study

The relation between capital markets and financial statements is a broad areas of research that originated with the seminal publication of Ball and Brown (1968) and Kothari (2001). The literature has grown rapidly since this subject is probably one of the most debated in the relevant literature. The primary objective of the capital

market research has been to assess whether financial statements provide value-relevant information to investors. Financial statements are widely used by shareholders to evaluate the value of the firm on the assumption that accounting data have an international content with regard to stock valuations. However, the nature of the relationship between financial statements and market values of the firms for this purpose, particularly in transition countries, has yet to be determined with any degree of certitude.

Transition economies are gaining considerable importance in accounting and finance studies for a number of reasons. First, transition countries are different from developed and developing countries in terms of transparency, liquidity, level of corruption, volatility, governance and taxes. Second, the capital markets are not well-developed and transparent in transition countries. Even though they would like to keep pace with the developments in the countries of the EU, they are still in the transition process.

Since evidence from research on these topics is likely to be helpful in capital market investment decisions, accounting standard setting, and corporate financial disclosure decisions, the main purpose of this study is to improve our understanding of the link between financial statements and stock performance measures from the two perspectives - efficiency and risk measures, by decomposing the study into two parts in the banking systems of the CEE countries. Toward this end, this study extends the literature on capital markets research in trnasition countries in terms of the impact of operating efficiency and accounting based risk characteristics of banks on stock return.. Instead of focusing on just one topic, the two interrelated studies is combined

to create a broad framework in the stock valuation and accounting information of the banking systems of the transition countries.

The first study investigates the explanatory power of operating efficiency[2] scores of the banks, which are assumed to have several advantages over traditional ratios, in explaining the bank stock performance. Although the capital market research topics of primary interest to researchers appear to be tests of market efficiency with respect to accounting information, the impact of the operating efficiency on the banks' stock returns has gained considerable attention by the academic researchers. Efficiency measures are estimated by using financial statements. Therefore, it is worthwhile to analyze that efficiency scores of the banks are taken into consideration in the price formation process. In the second study, the relationship between capital markets and financial accounting data is examined by considering the risk characteristics of the banks. Regarding stock valuation, accounting data are supposed to facilitate the prediction of the firms' future cash flows and help investors assess securities' risk and return.

The objective of the first study is to investigate the link between efficiency change and stock returns of the 39 banks in CEE countries (including Poland, Hungary, Croatia, Estonia, Latvia, Slovenia and also Turkey). Instead of focusing only on the earnings information and its components as possible explanatory variables for the bank stock price changes, the analysis aims to determine whether efficiency estimate is a primary determinant of the bank stock return. Even though the majority of the existing studies on accounting information and stock returns concentrate on earnings,

[2] Operating efficiency (Farrell, 1957) implies whether a firm is cost minimizing or profit maximizing based on published accounting numbers.

the fact that earnings are applicable only under special economic settings and fail to consider the role of balance sheet data (Patel, 1989) has shifted the recent research towards the use of additional data to understand how they affect stock returns or prices. Since efficiency measure both takes into account the balance sheet data and can be adjusted easily for the changes in economic settings, it is crucial to determine whether efficiency measure affects the stock returns. In terms of cost and profit efficiency scores of banks, consequently, it is questioned whether the choices or decisions made by bank management in the cost minimization or profit maximization process have an explanatory power on the bank stock performance.

A significant amount of recent literature has focused on the transition economies, and 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). Despite the increasing number of studies on the banking system, 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 CEE countries. Therefore, this study can be considered an important contribution to the literature on transition countries.

This study is important not only because it is one of the few studies that explicitly evaluates the relationship between bank efficiency and stock returns, but also, to the best of my knowledge, is the first cross-country study to examine such relationships

for transition countries, which have shown an increasing effort to adopt the EU regulations.

The examination of the banks' stock returns in the transition countries is crucial because banks were considered as the only viable source of financing during the transformation process. The cost and profit efficiency scores are calculated by determining the inputs and outputs to incorporate into the parametric stochastic frontier model[3], which has been extensively used in the literature. The impact of efficiency scores on the stock price returns are determined by utilizing fixed effects panel regression while controlling for macroeconomic factors and also bank specific characteristics, which has not been previously studied by utilizing a large sample and including an extensive data set.

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. 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, while inefficient banks may be prone to higher risk (Marcus, 1984; Kwan and Eisenbeis, 1996).

[3] Stochastic Frontier Analysis, proposed by Aigner et al. (1977) and Meeusen and van den Broeck (1977), uses a parametric approach to estimate the characteristics of a best-practice firm from cost or profit function. This approach involves `parameterizing` the relationship between the level of input(s) and the technically efficient level of output(s).

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 investigate the policies that encourage banks to operate efficiently in order to make effective capital allocation decisions (Beck et al. (2000). Using efficiency as a primary determinant for the bank stock return can be more precise and appropriate 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 the use of event studies in analyzing banks, particularly to estimate cost of capital and investment performance, as well as regulatory initiatives to utilize market discipline to evaluate bank efficiency.

Second study aims to extend the current literature that investigates the link between accounting and capital market risk measures by drawing on a sample of 39 banks across CEE countries and Turkey to determine how successful the accounting fundamentals were in reproducing the market-determined measures of risk. The main research questions to be answered in this section are:

a) Do the investors actually use accounting-based risk measures in their portfolio-decision process?
b) To what extent can market-determined variables be used as a “standard” against which to evaluate accounting data?

The relation between the accounting-based and market-determined measures of risk is detected over a specified period by applying panel data analysis. If a high degree of relationship exists between accounting-based and market-determined risk measures, the same information can be obtained by using either risk measure. On the other hand, if there exists a failure to establish a high degree of correlation between these two measures, further investigation is required to ascertain the superiority of one over the other. In order to investigate the relationship between these two measures, three measures of market risk, total risk proxied by the standard deviation of bank's daily stock returns, systematic risk proxied by the beta of the bank's stock returns and unsystematic risk proxied by the standard deviation of the residual errors from the market model are measured. Subsequently, each risk measure is regressed on the banks' financial ratios to determine the degree to which the relationship exists.

Despite the existence of a significant literature on this issue, particularly focusing on developed countries (Brewer and Lee, 1986; Karels et al., 1989; Mansur et al., 1993; Elyasiani and Mansur; 2005) this is the first study that examines the association between accounting-based and market-determined risk measures using bank specific data from CEE countries, as well as Turkey. Generally, empirical evidence presented in the extant literature covers primarily data from developed countries' such as US and Japan. However, this issue has not been investigated extensively in the developing countries. One exception is Agusman et al. (2008) who examine the accounting and capital market risk measures for a sample of Asian banks by employing a panel data analysis that takes into account country specific factors.

The analysis of market risk includes a set of implications for international portfolio managers and financial analysts as well as investors, who are willing to obtain and analyze the financial ratios of the firms and market risk measures, such as beta, to use in their investment decisions. Another implication is that evidence from research on this issue is useful for capital market investment decisions, accounting standard settings as well as corporate financial disclosure decisions.

More importantly, corporate executives are able to use these accounting-based and market- determined risk variables to determine their financial policies for maximizing shareholder wealth. This issue is even more important for the regulators of the financial institutions who make judgments concerning the accuracy of these institutions based on the certain key financial ratios and market based risk measures.

The layout of this study is as follows. The next chapter provides brief information about financial system development in the sample countries and also discusses some fundamental legal, institutional and economic policies initiated by the governments and authorities in these countries. Chapter III includes the theoretical background and literature review on the relation between the efficiency estimates and stock performance, as well as the methodology. This chapter also discusses empirical results and remarks on these. Chapter IV discusses the theoretical background and presents a literature review of the association between the accounting and market determined risk measures. Methodology and empirical results with the final comments are also presented throughout this chapter.

CHAPTER 2

FINANCIAL SYSTEM IN THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

This chapter provides brief information about the banking system and the stock market development in CEE countries. The chapter is divided into two sections. The first discusses the specific conditions prevailing during the transition period in late 1980s. This section is followed by a discussion of economic and political transformations required, involved in moving away from centrally planned economies to relatively free market systems.

2.1. Background On The Financial System In Cee Countries In The Transition Period

During the years of centrally planned economies in CEE countries, the structure of all of the banking systems included only a single institution, the monobank, which played the dual role of central bank and commercial bank. As the single authority, it had the responsibility of issuing currency, managing the payments system among enterprises, providing saving deposit facilities to households, making loans to enterprises and covering the deposits of the State Budget (Catte and Mastropasqua, 1993). Not being run as profit-maximizing business units, banks were considered as the vital elements of the centralized allocation system. Therefore, loans were granted

on the basis of a criteria that was not necessarily related to market performance (Schröder, 2001).

After the collapse of the communism, many attempts at reform were undertaken in the financial system of the CEE countries. One banking reform wave of the late 1980s was seen as a chance to break up the monobank into a two-tier banking system, a central bank and a number of commercial banks which specialized in different instruments and operations in each country with the regulatory frameworks. The sectoral restrictions on some specialized banks were lifted. All the commercial banks were allowed to conduct retail and corporate business and liberalize interest rates. However, as these commercial banks were all created by transferring the existing loans from the central bank portfolio to these new institutions, these artificially established banks inherited many problems from central planning. The financial system inherited from a planned economy was in a relatively weak condition, as described by Blommestein and Spencer (1994). They stated that large stocks of non-performing loans to state enterprises, the capital inadequacy, sectorally concentrated loan portfolios, underdeveloped branch networks, inexperienced staff, asymmetric information and insufficient supervision were perceived as the characteristics of the banking system in that period.

The problem in the banking system illustrated that many banks were not healthy and well-organized. Since most people did not trust the banks with their money the degree of financial intermediation was very low. Due to the relatively small degree of banking intermediation, it can be stated that the banks in the CEE countries could not have a strong impact on the economic development (Fink et al., 1998).

In the period of 1993-1996, bail-out programmes were put into practice by the government to rescue the banks by taking over a huge part of the non-performing loans, while replenishing their capital base. The main aims of these recapitalization programmes were also to improve the existing conditions of the banks for future privatizations of the banking system.

During the initial years of the transition, the establishment of new banks was encouraged by some governments to enhance the competition. Though the increase in the number of banks in the financial system created a specified degree of competition in the market, many of these new banks were declared insolvent because of the financial problems discussed above. While most of these countries put great efforts into restructuring and developing their banking systems, they suffered from banking crises due both to corporate stress and the absence of effective regulatory and legal environments. Therefore, the banking systems in these CEE countries during the transition period did not have enough flexibility to operate adequately or competitively in the market economy (Yıldırım, 2003).

Ten years after the start of transition, the development of banking sector was still in early stages when compared to developed economies. The ratio of domestic credit, defined as credit to the households and private enterprises, to GDP assesses the depth and breath of financial markets and the degree of transition to market economies. In developed economies, this ratio stands at about 120% of GDP; however, it falls far below this figure in transition economies. Table 1 illustrates credit to the private sector as percentage of GDP in transition countries as well as developed countries. Despite of the increasing or decreasing trend of this ratio for the transition countries,

in 1998, one country stands far above the others, Czech Republic with a ratio of 60.1. The next highest is Croatia, with a ratio of 40.1. In a second group of countries, this ratio stands around 20%; Estonia, Hungary, Poland and Slovenia. In the other countries, such as, Latvia, Lithuania, Bulgaria and Romania, domestic credit to private sector ratio is very low. This is partly due to the slow development of banking system or financial market (Schröder, 2001).

Table 1. Credit to private sector as a percentage of GDP

	1991	1992	1993	1994	1995	1996	1997	1998
Czech Republic			50.8	59.5	59.4	57.4	66.4	60.1
Estonia	18.0	7.5	10.9	13.8	14.8	18.0	25.5	25.3
Hungary	38.8	33.2	28.2	26.2	22.3	21.7	23.4	22.8
Latvia			17.3	16.4	7.8	7.2	10.7	14.1
Lithuania			13.8	17.6	15.2	10.7	9.6	9.5
Poland	11.1	11.4	12.2	12.0	12.8	15.9	18.1	20.6
Croatia			47.3	28.6	30.8	28.9	36.4	40.1
Slovenia			22.1	23.0	27.4	28.7	28.6	32.5
Slovakia				26.9	20.7	24.9	n.a.	n.a.
Bulgaria	7.2	5.8	3.7	3.8	21.1	35.6	12.6	14.2
Romania						11.5	8.5	12.8
Germany	132.7	130.1	134.4	131.8	136.0	141.4	152.9	136.1
France	92.8	93.1	91.3	86.2	85.1	80.8	79.9	84.4
UK	105.4	104.2	101.6	99.8	102.8	105.5	106.7	107.1
USA	127.1	123.6	122.0	121.9	124.9	126.2	127.7	133.1

Source: EBRD (1999), IMF, International Financial Statistics (1998); Central Banks. (Schröder, 2001)

Table 2 shows some data about the indicators regarding the development of the banking system in the transition period. The first column of the table illustrates that there is a higher level of concentration. In many of these CEE countries, the system was dominated by the three largest banks, which have the monopoly power in deposit and lending activities. The second column gives information about the number of banks in each country in 1999. The number of banks ranges from 30 to 77 in Poland, Hungary, Czech Republic, Slovenia and Romania, However, the number in Estonia and Lithuania is only 7 and 13, respectively. In the fourth column, the

bad-loans-to-total-loans ratio of the banks in each country is displayed. The worst performers in terms of cleaning up bank balance sheets are the Czech Republic, Slovakia and Romania, with a ratio ranging from 30 to 40 percent in 1999. The growing bad loan problem, which is a common threat in transition countries, mainly stems from the fact that inefficient state enterprises would use bank financing at the expense of more efficient private firms. Moreover, many banks have been reluctant to impose financial discipline on the borrowers.

Table 2. Indicators of the development of the banking sector

Country	*Concentration[a] (Percentage, 1997)*	*Number of banks (1999)*	*Asset share of state-owned banks (percentage, 1999)*	*Bad loans-total loans (percentage, 1999)*	*Loan-deposit rate spread[b]*
Czech Republic	74.9	42	23.2	31.4	4.2
Estonia	84.5	7	7.9	3.1	4.5
Hungary	67.4	39	9.1	2.8	3.4
Latvia	53.1	23	8.5[d]	6.3[d]	9.2
Lithuania	69.7	13	41.9	11.9	8.2
Poland	42.3	77	25.0	14.5	5.8
Slovenia	71.7	31	41.7	10.2	5.1
Slovakia	84.5	25	50.7	40.0	6.7
Bulgaria	86.7	28[c]	66[c]	12.9[c]	9.6
Romania	85.0	34	50.3	36.6	

[a] Defined as the ratio of three largest banks' assets to total banking sector assets.
[b] Loan rate is defined as the average rate charged by commercial banks on outstanding short-term credits to enterprises and individuals, weighted by loan amounts. Weighted average of credits of all maturity is used for Czech Republic, Lithuania and Ukraine. For Poland, only minimum risk loans are considered. Deposit rate is defined as the average rate offered by commercial banks on short-term deposits, weighted by deposit amounts. Weighted average of deposits of all maturity is used for Czech Republic, Estonia, Lithuania and Ukraine.
[c] Data for 1997.
[d] Data for 1998.
Sources: IMF International Financial Statistics, IMF Staff Country report Nr.00 / 59, WB Database on Financial Development and Structure, EBRD Transition Report 2000.

The last column illustrates the loan-deposit spread, which provides an indication of the serious economic consequences of the fragile state of the banking system in the transition countries: the lower the spread, the better the performance of the banking system and legal protection of creditors, other things being equal. The spread in

selected transition countries ranges from a low of 3.4 percent in Hungary to 9.6 percent in Bulgaria. The comparable spreads in United States and Sweden in 1999 were 2.7 percent and 3.9 percent, respectively. Among these countries, Latvia, Lithuania, Slovakia and Bulgaria have the higher loan-deposit rate spreads. Higher spreads lead to higher banking costs and greater monopoly power and lending risks (Berglof and Bolton, 2002). Higher spreads are also one of the causes of low financial deepening. It is evident that the high levels of bad loans in Slovakia may have enforced banks to maintain relatively wide margins between lending and deposit rates. However, the lower number of banks in Latvia, Lithuania and Bulgaria may have resulted in a greater monopoly power and therefore, a higher spread. One exception is the case of Estonia. Even though Estonia has just 7 banks and a lower bad-loan to total-loan ratio, spread is low. This may be due to the development of financial intermediation.

The fact that the banks in CEE countries have high profitability ratios and performance indicators should be considered with caution. The high profitability ratios could indicate a lack of competition in the banking system or the existence of moral hazard. High performance indicators such as return on assets could not give an indication on the soundness and stability of banking systems in those countries.

One of the cornerstones of the successful transformation from a planned economy to a market economy was the development of the stock markets. The stock markets enhance the economic growth by providing a way for the companies to raise the capital at a lower cost and in larger size.

While the banking system existed prior to the transformation process, stock exchanges were established in all CEE economies in the 1990s. Although stock markets were not new in transition economies[4], all the stock markets were closed under the regime of socialism. During the transition period, stock exchanges reemerged or were instituted for the first time in 20 of 26 transition economies. These stock exchanges have been used for the mandatory listing of shares of mass-privatized companies and for voluntary initial public offerings (IPOs). However, the development of the stock markets in CEE countries took quite different paths (Claessens, Djankov and Klingebile, 2000). The first stock market in transition economies emerged in Czech and Slovak Republics in 1992; Bulgaria, Lithuania, FYR Macedonia, Moldova, and Romania followed soon after. The use of stock markets was encouraged in these countries to transfer ownership from the state to private citizens. At first, a large number of firms were listed on the stock exchanges, many of which were illiquid, After an initial phase of high trade volumes, most of the stocks became and remained illiquid. Along the time line, given the companies' small size and their concentrated ownership structure, the companies would not have been willing to list in the stock exchanges and raise new capital from equity offerings. Starting with the Czech Republic in 1996, Bulgaria, Lithuania and Slovakia in 1999, the number of listed companies fell since illiquid stocks were de-listed. There were also several factors that affect the companies' decision to trade publicly and to de-list in the transition countries. The higher cost of equity capital relative to the cost of bank credit, the heavy taxes that listed companies were obliged to pay and the extensive disclosure requirements of listed companies discouraged the companies to be listed. Foreign acquisitions as well as domestic mergers may be the

[4] The Warsaw Stock Exchange was opened in 1817, and the Prague Stock Exchange was opened in 1871.

other reasons for the decline in the number of listed companies in these stock markets.

Other group of countries- including Estonia, Hungary, Latvia, Poland and Slovenia- expanded their stock markets through a small number of initial public offerings. Trading in most of these shares remained relatively high. In this group of countries (such as Hungary and Poland), the number of listed companies has shown an increase, starting from a low base.

Furthermore, some large, publicly listed companies in the local stock exchanges chose to be listed in more liquid international stock market in Europe and the United States. In 1999, 72 corporations in transition countries had American Depository Receipts (ADRs) listed on the New York Stock Exchange or the NASDAQ and 61 corporations were listed on the stock exchanges in London. Corporations listed abroad (in New York, London and Frankfurt) accounted for approximately an average of 18 percent of domestic stock market capitalization in transition economies (Claessens et al., 2000).

Table 3 shows the pattern of flat or declining numbers of the companies listed on stock markets in some selected CEE countries over the period 1994 through 2000 March. There was a substantial increase in the number of listed companies on stock markets of Lithuania in 1995, Slovakia in 1996 and Bulgaria and Romania in 1998. However, in Estonia, Hungary, Latvia, Poland and Slovenia, there was an increasing uniform trend. The striking result is the sharp decline in the number of listed

companies in Czech Republic in 1997 and in Lithuania in 1997. The stock exchange regulations in the transition countries were also at the minimum level.

Table 3: Number of companies listed on the Stock Market

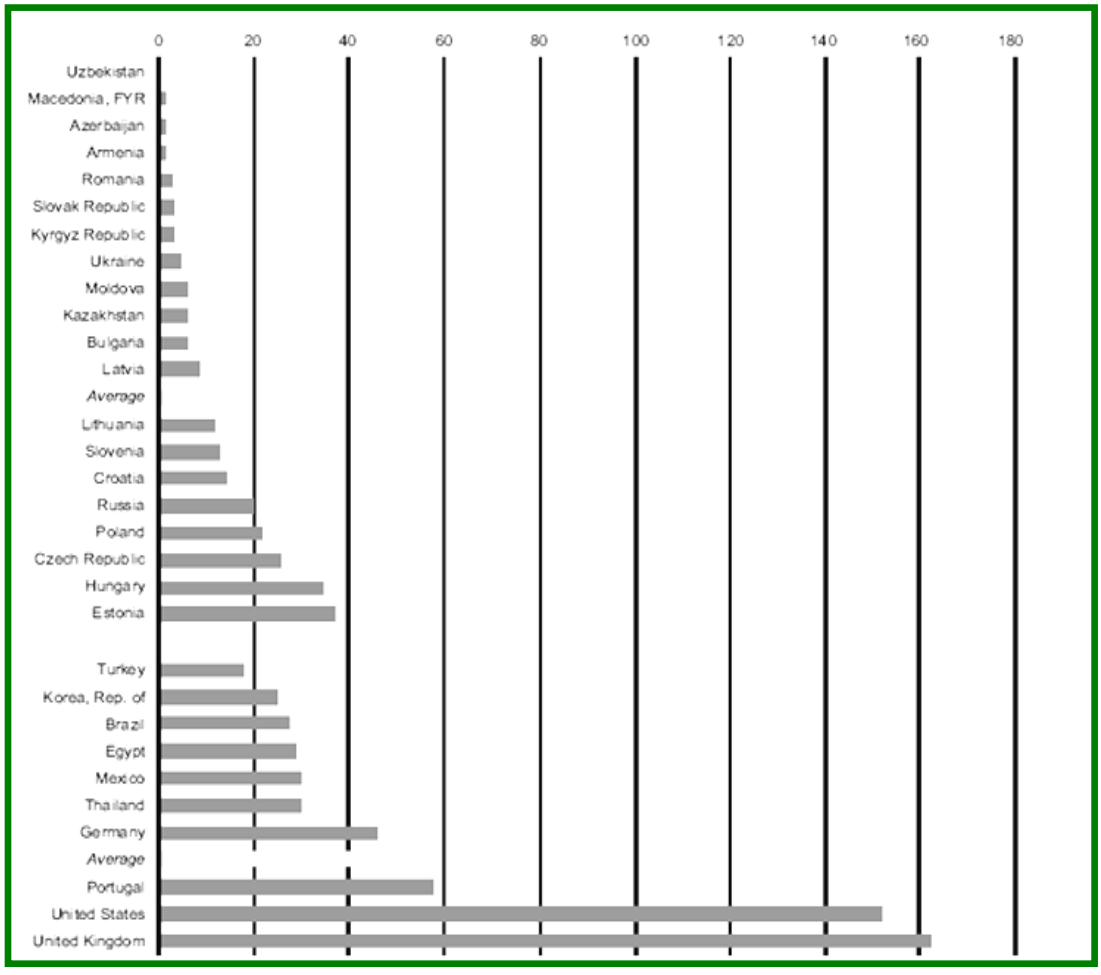
Country	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000 (March)*
Czech Republic	1024	1635	1588	276	261	164	154
Estonia	0	0	0	22	26	25	23
Hungary	40	42	45	49	55	66	65
Latvia	0	17	34	50	69	70	64
Lithuania	13	357	460	607	60	54	54
Poland	44	65	83	143	198	221	221
Slovenia	25	17	21	26	28	28	34
Slovakia	19	21	816	872	837	845	843
Bulgaria	16	26	15	15	998	828	842
Romania	4	7	17	76	5756	5825	5578

Sources: Emerging Markets Fact Book, International Finance Corporation; Claessens, Djankov and Klingebiel (2000).

Due to the illiquidity and smaller size of stock markets of CEE countries relative to mature stock markets in Europe or the USA, these countries have been expanding dramatically since these economies began their integration into the European structures. As part of the integration, the countries are required to adjust their legislative framework to the standards applicable in the EU. The conditions for the accession of the CEE countries to the EU, which were laid down by the Copenhagen European Council (1993), include the stability of institutions guaranteeing democracy, human rights, the existence of a well functioning market economy as well as the capacity to withstand competitive pressures and market forces within the Union. It also requires appropriate government policy in the fields of finance, trade and competition policy, the appropriate institutions to implement these policies (European Commission, 1997a:43). The market capitalization as a percentage of GDP ratio used as a benchmark for the degree of financial intermediation in CEE countries indicates that of the 20 stock markets in transition countries, only three -

the Czech Republic (23 percent), Hungary (30 percent) and Estonia (36 percent) have capitalization-to-GDP ratios comparable to those of other emerging markets (Figure 1). Market capitalization ratio, with an average of 11 percent of GDP, is considerably lower than in comparable emerging market economies ratios (Berglof and Bolton, 2002).

Figure 1. Market Capitalization in Transition and Comparator Economies (March 2000)
Percent of GDP



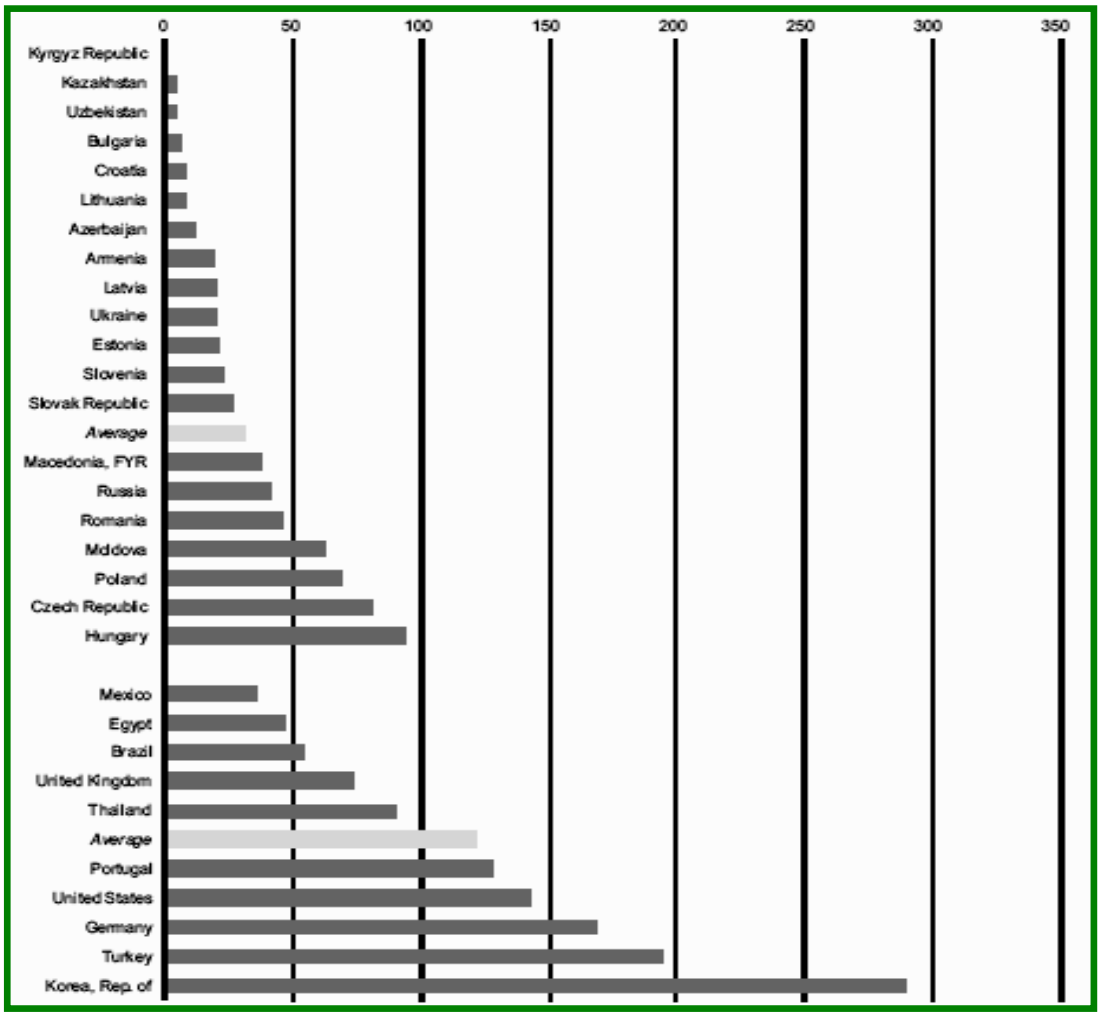
Source: Claessens et al., 2000.

The market turnover, which is defined as the value of trading over market capitalization, is used as an indicator for measuring the effect of stock markets on

growth (Levine and Zervos, 1998). Figure 2 shows the market turnover ratios of transition countries and other comparable countries. On average, the stock markets of the transition economies have a 30 percent turnover, compared with 121 percent in 10 other countries. This lower market turnover may be attributed to the ownership concentration, a relatively free float and the international migration of trading among large firms. Among these transition countries, Hungary has the highest market turnover ratio (93 percent), followed by the Czech Republic (81 percent) and Poland (69 percent) (Claessens, et al., 2000).

Figure 2. Market Turnover in Transition and Comparator Economies (March 2000)

Percentage of Market Capitalization



Source: Claessens et al., 2000)

The CEE countries stock markets have been characterized by an unstable return and high volatility. Even though the stock markets in CEE countries have shown a dramatic increase since mid-1993, they suffered from serious drawbacks due to the stock market crashes. Unsolved structural problems included the lack of market transparency, information disclosure, comparatively low trading volume and liquidity, narrow market focus, composition of market participants, insufficiency of regulations and supervisory institutions, low capitalization of many securities houses. Fortunately, during 1996 and first half of 1997, the stock markets showed a dramatic improvement due to the inflow of funds from international portfolio investors to these countries. However, the second half of 1997 was characterized by declining stock markets again in almost all CEE countries, coupled with a sharp rise in volatility. The main reason behind this decline was that the international investors lost interest from the emerging markets due to the Asian crisis, which emerged in 1997 and affected many economies. Furthermore, since the financial system of these CEE economies was strongly dominated by the banks, more emphasis was given to the creation of a reliable and secure banking system.

2.2. The Influence of Reform and Regulatory Programs on The Financial System (Economic and Political Transformations)

The financial system is considered as one of the key elements in any market economy, through the process of channeling funds from suppliers to demanders. The reform programs launched in the financial system of CEE countries in the last decades required a comprehensive change in mindsets and institutions. The financial system transition from a planned economy to a market-oriented economy involved

the development of financial institutions such as banks, stock and bond markets and insurance companies. Thus, the basic aims of the reforms made were to create a more trustworthy and prudent financial system to support economic growth. An important role in transition process was also the large capital inflows to this region from developed countries, the huge amounts of foreign direct investments (FDI), originating mainly from Western Europe, has played as significant role in the catching up process to the Western European Countries (Mora et al. 2002).

After the beginning of the transformation process, the substantial economic and political reforms programs were launched to stabilize the economies and to allow rapid adaptation to the forces of the market economies. The key reforms implemented at the transition process included restructuring, rehabilitation and privatization of the state-owned banks in order to create competitive pressure and increase the efficiency of the sector. Through the eliminations of the restrictions on foreign entry, the number of banks dramatically increased (Tang et al. 2000). Foreign banks, which dominate the banking sector in most CEE countries, were considered to produce positive externalities to the sector as a whole by providing know-how and expertise. Allowing the entry of foreign banks also enhanced the competition and efficiency of the banking sector with strong competitive pressure; however it may negatively affect market stability in the long-run. Therefore, the countries in the region may experience some bank failures in addition to mergers and acquisitions through the internalization process (Yıldırım, 2003). By the end of 1990s, the share of foreign ownership in terms of both total assets and capital reached 60 percent. According to the 2005 ECB report, foreign involvement was still greater in these countries, with an average of 77 percent of bank assets owned by foreigners in 2004.

However, the variance of foreign ownership was very large across these countries, ranging from 36 percent in Slovenia to 97 percent in Estonia.

The CEE transition countries were also required to create a regulatory and supervisory framework for transformation from central planning to market economies. Therefore, prudential banking laws have been enacted to bring these countries in line with the EU directive and the Bank for International Settlements guidelines. Since transition economies had a financial system focusing on the banking sector, the effectiveness of the regulations and control mechanisms in the banking system supported the much-needed stability in the financial structure. Therefore, these countries gave much more importance to the banking supervision process by the year 1996. Table 4 presents a general outlook on banking supervision in selected CEE countries by 1996. All countries generally followed a similar path in developing their supervisory structure in banking (Scholtens, 2000). Universal banking was basically put into practice in most of the CEE countries, with a few constraints in Bulgaria and Hungary. The central banks were the main authorities, responsible for the supervision of the banking system. However, in Hungary and Slovenia, the supervision of the banking system was carried out both by the central banks and other supervisory authorities (Yildirim, 2003).

Most transition countries have satisfied the minimum 8% capital adequacy requirement and also other core principles determined by the Basle Committee Banking Supervision for the effective banking supervision. However, since the EU capital adequacy average stood at about 12%, a capital adequacy ratio of only 8% was not considered satisfactory (Schröder, 2001). Transition countries were allowed

to make provisions for loan losses. Concentration of credit was limited to 15% to 25% of bank capital and non-bank participation was allowed to a certain extent. Moreover, to protect the depositors from the losses and bank failures, all countries except Latvia, have employed deposit insurance systems. Unfortunately, adhering to the Basle capital adequacy requirements and banking supervision guidelines could not prevent a country from exposure to severe banking crises (IMF, 1998). The last two rows of Table 4 indicate the progress of reform programs in banking and securities market.

All the reforms that have been directed through the improvement of the financial system have assisted towards the openness of the financial markets, which in turn has enhanced banking intermediation.

There was a rapid large scale privatization and a more liberal policy towards the elimination of barriers and reforms, leading to development through the creation of the institutional structure of regulatory and supervisory framework and a radical change of mindset. This change was substantial considering it was achieved in only a period of approximately ten years. Especially, the perspective of EU membership and the pre-accession requirements accelerated the reform process and contributed to the development by the transfer of know-how. The catching up process is still ongoing in most of these transition countries.

Table 4: Banking supervision in Central and Eastern Europe

	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Supervisor[a]	CB	CB	CB	CB	SA+CB	CB	CB	CB	CB	CB	SA+CB
Capital requirements ($ mn)	5.5	3	15	5.5	0.1-15	5.5	5.5	6	6.2	14.4	4.1
Capital Adequacy (%)	12	8	8	10	8	10	10	8/12-15	8	8	8
Large credit exposures	25% of capital	20% of capital	25% of capital	25% of own funds	25% of capital	25% of capital	25% of capital	15% of capital	20% of own funds	25% of capital	25% of capital
Total non-bank participations	N.A.	70% of capital	25% of capital	-	51% of capital	60% of own funds	10% of capital	25% of capital	20% of capital of non-bank entity	25% of capital	N.A.
Deposit insurance	Under consideration	$11,700	$2,900	In preparation	$4,900	None	$12,500	$3,400	$2,500	Being setup	N.A.
Reserves/provisions for bad debts	1.25% loans; according to risk categories	Provisions for different risk categories	1% of loans, provisions for different risk categories	Yes	1.25% loans; provisions for different risk categories	According to risk categories	Yes	Provisions for different risk categories	2% loans	Provisions for different risk categories	N.A.
Reform											
Banking	2	3	3	3	3	3	3	3	3	3	3
Markets	2	2	3	2	3	2	2	3	2	3	3

CHAPTER 3

BANKING EFFICIENCY AND STOCK PERFORMANCE IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

3.1. Introduction

The relation between stock returns and publicly available information has traditionally attracted the attention of researchers in accounting and finance. While the majority of the literature focuses on earnings, some recent studies examine other firm attributes such as accruals, revenue surprises, and economic value added. Motivated by the limited research in banking, this study examines the relationship between the cost and profit efficiency change and stock returns in 39 banks of CEE countries, as well as Turkey to see whether these changes have an explanatory power on stock price returns. Notwithstanding the significant body of literature examining the banking system and stock markets, there is not a comprehensive and satisfactory empirical research, especially in CEE countries, where a number of changes in the regulatory framework of financial system during the integration process of the EU, have been brought about.

Share price performance is the best measure to determine whether banks are creating value for shareholders or not. Therefore, it may be expected that efficient banks' better performance may be reflected in their market prices (directly through lower

costs or higher output or indirectly through higher customer satisfaction and higher prices which in turn may improve share price performance). Relying on different theories and hypothesis, such as the theory of the firm, theory of international trade, agency theory and market discipline hypothesis or their combinations, some studies have examined whether ownership structure, organization form or corporate governance is related with differences in frontier efficiency. Implicit in most of these theories is that in the banks or organizations where the type of the ownership or organizational form producing stronger incentive to control costs and/or augment profits is expected to be more efficient. Market discipline hypothesis implies that banks whose shares are publicly traded would be expected to be more efficient, other things held constant, to the extent that stockholders of the firm can put forth discipline over the management (Isik & Hassan, 2003). Therefore, the easily transferable ownership structure of firms produces incentive for both shareholders to monitor management performance and for bank managers to improve their performance, since it includes risk related with moral hazard practices (Mamatzakis et al., 2008).

In an efficient market, stock prices capitalize the effects of managerial behavior for future profits and the resulting information can be used in contracts between shareholders and managers (Fama, 1970).

The rest of this section is organized as follows. A brief review of literature focusing on the determinants of banking efficiency and their relationship with the stock performance of banks is presented in subsequent section. Section 3.3 describes the

data and the methodology is presented in section 3.4. Section 3.5 presents the empirical results followed by a conclusion.

3.2. Literature Review

3.2.1. Theoretical Background

In the recent years, the rapid globalization of the financial system along with the developments in the technological innovations gave rise to competitive pressures in the international financial markets. Thus, the need to enhance the competitiveness of the financial system against these pressures and to compete in this more liberalized environment have become one of the major issues of bank managers, the central banks as well as the governments. As a result of these changes, the degree of bank complexity has increased since the banks moved away from being traditional intermediaries to more-market oriented institutions. Therefore, 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 et.al., 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.

The efficiency of banks has some peculiarities that deserve special treatment as the banks carry great importance in stability of the financial system. In order to survive and succeed in the competitive environment, banks should operate efficiently. Banks

that operate efficiently can sustain their competitive advantage in the market and thus produce sustainable profits. The stock prices rise in value with the stockholders' expectations, and thus, create value for the shareholders. Efficiency estimations of banks can be used an important proxy to represent a bank's competitive advantage which has an influence on current and future potential profitability.

Efficiency measures are assumed to have several advantages over traditional ratios in explaining the stock performance, since they are more likely to be informative[5]. Thanassoulis (1996) argued that the efficiency measures derived from estimation models take into account simultaneously both the inputs and outputs of the banks, rather than the traditional accounting ratios, where one input (e.g. total assets) is associated with one output (e.g. profit) each time. According to Bauer et al. (1998), the efficiency measures seem to be superior relative to the standard traditional ratios from financial statements to assess the performance of the banks. They claimed that this stems from the fact that the estimation of efficiency requires the use of programming or statistical techniques that attempt to remove the effects of differences in input prices and other exogenous market factors influencing the standard performance ratios. More specifically, even though the accounting ratios do not create a distinctive feature for each bank, efficiency estimates result in a distinction among the banks because they include unique information not covered by balance sheet data.

The efficiency measures, which primarily consist of operating efficiency and market efficiency, provide information about the performance of the financial institutions

[5] The study of Beccalli et al. (2006) supported that a model that includes efficiency estimates derived from analysis explains a much higher variability in stock prices than a model developed with traditional accounting ratios.

and markets (Stiglitz 1981). Farrell (1957) defines operating efficiency in terms of cost minimizing (consuming less inputs for the same level of outputs) or profit maximizing (producing more outputs for the same amount of inputs) based on the accounting values.

According to a major stream of financial literature, market efficiency, referred as information efficiency (Ball 1989), is the degree to which stock prices reflect all available, relevant information. The concept of efficiency first emerged with Roberts (1959). Later, Fama (1965) who first used the term "market efficiency" in the context of securities markets, defined it as:

> "a market where there are large numbers of rational, profit maximizers actively competing with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants."

In an informationally-efficient market, prices on the traded assets, e.g., stocks, bonds, or property, already incorporate all relevant publicly known information, implying that it is impossible to consistently outperform the market using information that the market is aware of. Information or news in the efficient market hypothesis is defined as anything that can affect the prices that is unknown in the present and thus appears randomly in the future.

An important aspect in the efficient market theory is the term "*information*". The information set can be extended beyond past prices to publicly available information such as public earnings announcements and stock splits. Efficient market hypothesis requires that

a) publicly-available information is costlessly available to all market participants, b) transaction costs are ignored in the trading securities, c) all market participants agree on the implications of current information for the current and futures prices the each security. Efficient market hypothesis also assumes that the reactions' of investors should be random and follow a normal distribution pattern. In an efficient market, it is unlikely that a consistent, abnormal profit can be made.

Fama (1970) maintained his search into the efficient market hypothesis by distinguishing the nested information into three sets; historical prices, publicly-available information and all information including private information. By taking into account these three different sets of information, he developed three forms in which the efficient market hypothesis is stated, "weak form efficiency", "semi-strong form efficiency" and "strong form efficiency". Each of these forms requires different implications for how the markets work. In a weak form efficient market, no investor can earn excess return by developing trading rules based on the historical price or return. In the case of the semi-strong form efficiency, all the publicly available information is incorporated into the prices. The final type of market efficiency is the strong-form efficiency, supporting the view that prices would reflect all publicly available and insider trading information. Brealey and Myers (1991) implies that stock value performance is the best measure whether the firm is creating value for its shareholders, by finding a positive relationship between estimated banks' efficiencies and their stock prices.

Efficiency measures are estimated by using the financial statements of the banks. It is expected that efficient firms (directly through lower costs or higher outputs) perform

better than inefficient firms and thus this criteria will result in a change in market prices, suggesting that higher efficiency levels lead to higher customer satisfaction and thus higher stock performance.

Considering the importance of the financial institutions on the development of the financial system in a specific country, researches have become much more interested in the relationship between the efficiency estimates of banks, which convey a competitive advantage to a financial institution and their stock performance.

3.2.2. Empirical Research

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, Demsetz and Strahan, 1999). Taking the structural changes in European banking industry into account, there is relatively more and a growing literature on European banking efficiency.

Altunbas, Evans and Molyneux (1995) used stochastic frontier analysis (SFA) to calculate the technical inefficiencies using a data set of 196 German banks in 1988. They found a mean inefficiency score of 24%, suggesting that if the German banks were to operate efficiently, they could produce the same output with only using 76%

of the inputs. The results indicated that banks offering a wider range of mixed products were more efficient than other banks, implying the significance of the product diversification. There are several studies that attempt to measure the efficiency scores of the German banks by applying different types of methodology (Lang and Welzel, 1996; Lang, 1996; Lang and Welzel, 1998; Welzel and Lang, 1997).

In these studies, different approaches were used to study the efficiency of all types of German banks, such as credit, savings and cooperative banks and the evidence of economies of scale and economies of scope were also studied. Lang and Welzel (1996) studied the cost efficiency of German cooperative banks employing stochastic cost frontier approach. They found that the overall cost efficiency of cooperatives deviate from the frontier. They also found clear evidence of economies of scope. Lang (1996) studied the efficiency of German credit, savings and cooperative banks. The evidence of the study showed a considerable degree of X-inefficiency and scale inefficiency for the German banking system. On the other hand, Lang and Welzel (1998) used the thick frontier approach to study cost efficiency of German universal banking system. They found the minimum efficient size for German banks to be about 2 to 5 billion marks of total assets. This size is smaller than optimal sizes for other European banks that have been found in the previous studies. The authors also found the economies of scope for only medium-sized banks, even though small and large banks suffered from diseconomies of scope.

In another study, Welzel and Lang (1997) used DEA to study the efficiency of German universal banking system. They found a considerable degree of cost

inefficiency across all bank sizes. The technical inefficiency was found to be greater than allocative inefficiency. The results also suggested a tendency for overall efficiency to slightly increase with bank size. However, there was one result which contradicted the findings of Lang and Welzel (1998). Using nonparametric approach, Welzel and Lang (1997) found the optimal bank size to be around 100 to 250 million marks, smaller than the 2 to 5 billion marks of the previous study by Lang and Welzel (1998) which was based on parametric approach.

Favero and Pari (1995), in a study in Italy, attempted to measure technical and scale efficiencies of 174 commercial banks during 1991. Using data envelopment analysis (DEA), their results indicated the existence of both technical and allocative inefficiencies. Several reasons were given to explain the inefficiency estimates, such as differences in size, productive specialization and location of the banks. Larger banks seemed to be more efficient than smaller ones. The significance of productive specialization was perceived as evidence of higher efficiency for banks engaging in universal banking. The geographic differences in efficiency estimates may be treated to the different size of the banks that operate in two distinct regions of Italy.

Resti (1997) investigated the cost efficiency of 270 Italian banks between 1988 and 1992. By comparing both parametric and non-parametric techniques, Resti (1997) found that two estimation methods yield similar results, resulting in the efficiency estimates of around 70% to 80%, which remain constant over the whole sample period. Also, the results of the comparison pointed out that the cost efficiency measures do not differ dramatically because of very high rank-order correlation between DEA and SFA. He indicated that banks operating in Northern Italy were

more efficient those in Southern Italy. This confirms the regional differences in efficiency estimates due to the different size of banks between the Northern and Southern Italy.

Girardone et al., (2004) analyzed the main determinants of Italian banks' cost efficiency to measure X-efficiencies[6] and economies of scale over the period between 1993 and 1996, by using a Fourier-flexible stochastic frontier. They found that mean X-inefficiencies range between 13 and 15 percent of total costs and tend to increase over time for all banks irrespective of size. Following Spong et al. (1995), they implemented a profitability test to allow for the identification of banks that are both cost and profit efficient. The results of the study suggested that the most efficient and profitable institutions are able to control all aspects of the costs. Moreover, the authors carried out a logistic regression model to consider the bank – specific and market factors that affect the efficiencies' of Italian banks. The results were in line with those of Mester (1993, 1996), implying that bank inefficiencies were negatively correlated with capital strength and positively correlated with the level of non-performing loans in the balance sheet. One interesting conclusion that can be inferred from the study was that banks quoted in stock markets appeared to be more efficient than their non-quoted counterparts.

Mendes and Rebelo (1999) studied efficiency, productivity and technological change in Portuguese banks over the 1990 and 1995 time period, using a translog variable cost function and SFA. They found that increased competition due to deregulation, the opening of borders, granting of new banking licenses, and privatization over the

[6] X-efficiency is defined as the ratio of minimum costs that could have been used to to produce a given output bundle.

last few years did not lead to an increase in the overall efficiency performance of banks in Portugal. The existing entry barriers such as language, culture and market knowledge may have vanished with the crescent European integration and the launch of a single currency. The annual efficiency scores did not substantially increase over time; and the number of banks became less increased when compared to early 1990s.

A more recent study by Canhoto and Dermine (2003) investigated the impact of deregulation process, which was accompanied by the creation of new banks in the market, on the efficiency gains of the Portuguese banking system over the years 1990-1995. They also attempted to quantify the relative efficiency of new domestic banks compared to that of older existing banks. Using non-parametric DEA technique, they concluded that the new banks outperformed the older ones in terms of efficiency with an average score of 77% compared to 62%.

In a study by Lozano-Vivas (1997), profit efficiencies were estimated for 54 Spanish savings banks over the 1986-1991 time period by applying the thick frontier approach. The authors measured the profit inefficiencies of the banks by employing cost and revenue inefficiencies. They suggested that revenue inefficiency may be as large as or even larger than the cost inefficiency for these Spanish saving banks as the profit inefficiency was twice as large as the cost inefficiency. The empirical results also found that the average difference in profits between the most and the least profitable banks in Spain was 40%. They suggested that two thirds of the difference was due to the overuse of inputs or mispricing of outputs.

Moreover, Grifell-Tatje and Lovell (1997) applied DEA technique and the generalized Malmquist productivity index techniques on commercial and saving banks of Spain over the 1986-1993 time period. They provided evidence of an increase in productivity growth consistently for both kinds of banks. The results of this study suggested that the deregulation process in Spanish banking sector was not completely over. A few other studies analyzed the banking efficiency of Spanish banks employing different techniques such as Generalized Malmquist productivity index, DEA for different time periods and samples utilizing different input and output variables (Pastor et al, 1994).

More recent studies have expanded these analyses to several developing countries, where the developments of financial systems have shown an increasing trend as a result of the financial liberalization policies in the early 1980s.

Applying two alternative input-output models using a Malmquist total productivity index, Leightner and Lovell (1998) measured the total productivity growth of Thai banks during the period 1989-1994. The authors revealed that the productivity of banks increased after the liberalization process since these policies removed the government control over the financial system by producing a more competitive and flexible environment for the banks.

Two major works on the Korean banks showed contradictory results. Using a similar approach to Leightner and Lovell (1998), Gilbert and Wilson (1998) stated that the financial liberalization enhanced the productivity of Korean banks. Conversely, in a more recent study, Hao et al. (2001) employed a parametric stochastic frontier

approach. The results indicated that financial liberalization in Korea did not have a positive impact on the efficiency of banks.

Kumbhakar and Sarkar (2003) examined the growth in total factor productivity to see the impact of financial liberalization on 23 public sector banks and 27 private domestic banks of India over the 1985-1996 period by estimating a translog cost function and dividing total factor productivity into three basic components, a technological change, a scale and a miscellaneous part. The empirical results suggested that deregulation did not materially enhance total factor productivity of public banks in India. Moreover, the authors found a considerable over-employment of labor in Indian banks.

By employing Distribution Free Approach (DFA), Hardy and Patti (2001) analyzed the effects of the financial sector reform on the profitability and efficiency of 33 banks in Pakistan during 1981-1988. The main conclusion obtained was that the principal effect of financial market reforms resulted in an increase in both revenues and costs. However, the benefits of improvements in revenue efficiency were swept away by cost inefficiencies (such as borrowers and depositors). Thus, the reform program did not lead to a rise in overall profitability of the banks due to the higher deposit interest rates and intensified competition.

Sufian (2009) contributed to the existing literature by providing new empirical evidence on the impact of East Asian crisis on the efficiency of banks operating in

Malaysia during the period of 1995-1999. The non-parametric frontier-based (DEA) method was used to estimate the technical, pure technical and scale efficiencies[7]. This study concentrated on three basic approaches, namely intermediation approach, value added approach and operating approach[8] to investigate the robustness of the estimated efficiency scores under a variety of alternatives and compare how efficiency scores altered with respect to the changes in inputs and outputs. Finally, he analyzed whether the ownership structure and different bank specific characteristics such as size, non-performing loan ratio and capitalization affect the efficiency estimates.

The finding revealed considerable inefficiencies in Malaysian banks, especially subsequently after the East Asian crisis. Furthermore, Sufian (2009) found that bank efficiency was positively related to intensity of loans and negatively related to expense preference behavior[9] and economic conditions.

[7] The basic DEA model, developed by Charnes et al. (1978) implied the assumption of constant returns to scale (CRS). However, this assumption was relaxed for the use of variable returns to scale and scale economies. The output of this model is the overall technical efficiency of each decision making unit. The use of variable returns to scale (VRS) divides the overall technical into a product of two components; pure technical efficiency and scale efficiency (Banker.et al., 1984). Even though the pure technical efficiency is related with the ability of managers to use firms' given resources, the scale efficiency refers to using scale economies where the production frontier shows CRS.

[8] In the banking literature, there are main approaches that attempt to define inputs and outputs of the banking institutions. These reflect different ways in which efficiency of banks can be evaluated. The production approach evaluates the efficiency from the perspective of cost/revenue management. Banks use capital and labor as inputs; produce "deposit and loan" service. Under the intermediation approach, financial firms act as an intermediary between savers and borrowers and total loans and securities are considered as outputs whereas deposits along with labor and physical capital are defined as inputs. On the other hand, value added approach assumes that all the assets and liabilities of the bank have the characteristics of 'product'. Therefore, the items that yield higher returns, in other sense, higher value, are considered as 'main products'.

[9] Expense preference theory, which was proposed by Williamson (1963), states that managers of firms that possess market power and in which ownership is separate from control will employ an input mix that deviates from the cost minimizing input mix. Managers of these firms would like to maximize utility, thereby spending more than the cost minimizing amount on certain inputs for which they have a preference. This theory has been tested extensively in the savings and loan, banking, and utility industries. (see Awh and Primeaux 1985; Blair and Placone 1988; Edwards 1977; Hannan and Mavigna 1980; Mester 1989).

Furthermore, a number of other studies have used cross-country samples. Allen and Rai (1996) compared the cost efficiency in banking among a group of countries including Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Sweden, Switzerland, U.K., and the U.S. Using parametric techniques on 194 banks for the 1988-1992 period, the empirical findings revealed that smaller banks in all of these countries showed evidence of significant economies of scale.

Berger and Humphrey (1997) gathered 130 studies that applied frontier efficiency analysis to financial institutions in 21 countries to test banking efficiency. They outlined that depository financial institutions (banks, savings & loans and credit unions) experienced an average efficiency of around 77%. Cost efficiency was found to be more important than market concentration in explaining financial institution profitability. Results from this study suggested that deregulation of financial institutions could either increase or decrease efficiency, depending upon industry conditions prior to deregulation. Similar findings are valid for mergers and acquisitions, implying that consolidation appeared to bring no clear and significant cost improvement.

Maudos et al. (2002) investigated the cost and profit efficiency of banks in a sample of ten EU countries for the period 1993-1996. Using panel data frontier approaches[10], they found high levels of efficiency in costs and lower levels in profits, implying the importance of inefficiencies on the revenue side of banking industry. Due to the

[10] Four parametric panel data approaches are employed; fixed effects model, random effects model, stochastic frontier approach (SFA) with panel data and the discounted frontier approach (DFA).

different banking systems of the EU, some explanatory variables[11] have been used to reflect the differences in efficiency estimations in these countries. From these results, the variation in profit efficiency was found to be greater than cost efficiency.

In addition to the concentration on the banking efficiency of both individual countries within developing markets as well as cross-country samples, there have been a few recent studies that examined the banks operating in CEE countries. Even though some of these studies concentrated on individual countries in CEE, the main emphasis was given to the cross-country samples.

Hasan and Marton (2003) evaluated the cost and profit efficiencies of banks in Hungary which stood as the first country in the region to establish a privately owned banking sector that successfully overcame the burden of bad debts, massive under-capitalization and high concentration (National Bank of Hungary, NBH, 1998). Using SFA and a sample period of 1993-1998, the pooled average estimates indicated a cost inefficiency of 28.76 and profit inefficiency of 34.50. Therefore, this implies that an average bank could improve its cost and profit inefficiencies by 28.76% and 34.50% respectively, thus matching its performances with the best performing bank[12]. Banks with foreign ownership were found to be significantly less inefficient than their domestic counterparts.

[11] Size, specialization, other characteristics specific to each bank (loans divided by total assets, standard deviation over time of bank's annual return on assets), and characteristics of the market in which they operate (Herfindahl index, GDP growth, network density).

[12] Cost or profit efficiency analysis is a sophisticated way to 'benchmark' the relative performance of production units based on the distance (in terms of cost and profit) of a production unit from the best-practice equivalent. This is given by a scalar measure ranging between zero (the lowest efficiency measure) and one (corresponding to the optimum production unit), implying that the best practice firms are 100% efficient.

In a more recent study on the Polish banks, Nikiel and Opiela (2002) estimated the relationship between banking efficiency and ownership during 1997-2000 by using the distribution free approach. They reported that foreign banks servicing foreigners and business customers are more cost-efficient but less profit efficient than other banks in Poland.

Jemric and Vujcic (2002) analyzed the relative efficiency of banks in Croatia over the period 1995- 2000 using a non-parametric DEA based on the size, ownership structure, date of establishment and quality of assets. The results showed that foreign-owned banks were found to be more efficient than state and private-owned banks. Moreover, they have found that smaller banks provided a higher efficiency performance globally whereas larger banks seemed to be locally efficient. The main particular factors contributing to the poor performance of the state owned and older banks versus foreign-owned and newer banks were the number of employees and fixed assets. Furthermore, the banks having relatively less non-performing loans in their balance sheets were more efficient, which is consistent with the operating and intermediation approach. With the ongoing consolidation process, this relationship became increasingly evident in Croatia.

By using SFA, Weill (2002) estimated the cost efficiency of banks in Poland and Czech Republic for 1994 and 1997 period in order to test whether the restructuring programme implemented in Poland brought an improvement on cost performances for the whole Polish banking system. The general findings of the comparative evolution indicate that even though the average cost efficiency improved in both countries within two years, Polish banks generated higher efficiency scores than

Czech banks. The findings supported the argument that the Polish banking system had benefited from the restructuring programme.

Subsequently, Weill (2003) employed SFA to measure cost-efficiency scores for a sample of thirty-one Polish and sixteen Czech banks in 1997, taking into account the ownership structure of the banks. He found that the efficiency estimates of the foreign-owned banks (70.4 percent) were higher than the domestic-owned banks (62 percent), which is in line with many other studies. One possible explanation for this difference may be the differences in size, structure of activities as well as risk management between foreign and domestic-owned banks. In both studies by Weill, country specific variables, taking into account the differences in financial and economic system for each country, were not included into the model.

Kasman (2005) provided an empirical analysis for the estimation of cost efficiency and scale economies of Polish and Czech banking institutions for the period of 1995 to 2000 including country-specific environmental variables[13] into the common cost frontier in SFA. The findings suggested that, without environmental variables, banks operating in Poland appeared to produce much higher efficiency scores than the ones in the Czech Republic. However, with the inclusion of the environmental variables into the common frontier estimation, the differences between both banking sectors declined dramatically. Conclusively, the results of this study indicated the

[13] Due to the differences in the macroeconomic environments as well as the banking structures in each country, a common frontier is estimated with taking several geographic, market structure and depth variables into account. These variables are divided into three specific groups. The first group includes density of population, income per capita and the density of demand for each country. The second group contains average capital ratio and intermediation ratio. The final group includes some environmental variables such as GDP, GDP growth, inflation and main telephone lines per 100 inhabitants.

importance of including environmental variables in the definition of the common frontier.

Furthermore, the results of this study suggested that the foreign owned-banks were significantly more efficient than domestic banks in the Czech banking system. Thus, this indicated that the degree of the openness of the banking market to foreign competition had a positive impact on the performance of Czech banks. This study also found significant economies of scale for both countries. Similar to the previous findings, although significant economies of scale were found for small banks, for large banks, the results suggested significant diseconomies of scale.

Besides the efficiency literature on transition countries, there have been a number of studies on efficiency issues of Turkish banks (Oral and Yolalan, 1990; Zaim, 1995; Mercan and Yolalan, 2000; Cingi and Tarim, 2000; Altunbas et al., 2001; Isik and Hassan, 2002, Isik and Hassan, 2003). The increase in the competition led to the reduction in costs, resulting in termination of unprofitable branches and reduction in the number of staff. In some earlier studies (Zaim, 1995; Ertugrul and Zaim, 1996), the impact of financial liberalization on the efficiency of Turkish banking sectors was examined. The results indicated that the liberalization programs and regulations produced a positive impact on efficiency.

Mercan and Yolalan (2000) compared the efficiency scores of Turkish banks before and after the liberalization. They concluded that although the efficiency of Turkish banks was an increasing trend until the year 1993 with the support of financial liberalization, after which it started to decline, possibly due to the effects of the 1994

financial crisis. Çingi and Tarim (2000) estimated the efficiency scores of private and public banks in Turkey between 1989 and 1996. They found that public banks were less efficient than the private banks. In addition, they provided a strong evidence of the scale problem in the banking sectors.

In a more recent study, Isik and Hassan (2003) used DEA to create a Malmquist total factor productivity index for Turkish banks during 1980-1990 interval. The empirical findings suggested that the performance of the banks improved after the financial liberalization programs, which was consistent with the findings of Zaim (1995) and Ertugrul and Zaim (1996). In contrast, using non-parametric DEA, Yildirim (2002) revealed that both pure technical and scale efficiency measures of Turkish banks showed a large disparity through 1988 and 1999 interval. Furthermore, Turkish banks did not produce any efficiency increase in the selected period. These differences could result from the variations in the methodologies and the sample period. He has also asserted that efficient banks were more profitable and both technical efficiency and scale inefficiency were positively related to size.

A number of more recent studies examined the efficiency levels in cross-country samples including many countries in transition economies to enrich limited literature on these economies. Fries et al. (2002) explored the performance and profitability of 515 banks in 16 transition economies over the years 1994-1999, focusing particularly on their credit policy. The general findings suggested that performance of banks depends significantly on the reform environment and the competitive conditions, in which they operate. The authors concluded that banks with high market shares have higher costs and also achieve lower margins on loan and deposit activities. With the

significant progress in banking and related enterprise reforms, banks have been earning higher margins over their marginal cost of funds in the loan market and appeared to offer competitive margins on deposits whilst still providing overall negative returns on equity. On the other hand, banks had been providing high negative returns on loans, largely at the expense of depositors. The results indicate that the loan management was more efficient in high reform countries compared to low reform countries.

Grigorian and Manole (2002) conducted a comprehensive cross-country analysis of the Central European (CE), the Southeastern European (SEE) and Commonwealth of Independent States (CIS)[14] countries between 1995 and 1998. Employing a non-parametric DEA approach, they considered differences in commercial bank efficiency across transition countries against a wide array of variables describing macro environment, regulatory regime, institutional quality and enterprise restructuring. The results of the DEA analysis revealed that with the exception of 1997, banks in the CE region are more efficient than those in other countries in terms of both revenue-generating process as well as ability to provide service to their clients In addition to stressing the importance of this wide range of variables, the results of the study suggested that the privatization of banks does not necessarily lead to significant improvements in efficiency.

Yildirim and Philippatos (2002) estimated the efficiency by using SFA and distribution free approaches for a sample of the banks on 12 transition countries

[14] The first cluster, Central Europe (CE), includes Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia. The second cluster, Southeastern Europe (SEE), consists of Bulgaria, Croatia, Romania, Estonia, Latvia and Lithuania. Finally, the third cluster, the Commonwealth of Independent States (CIS) includes Armenia, Belarus, Kazakhstan, Moldova, the Russian Federation, and Ukraine.

during the period 1993-2000 by comparing the efficiency level against non-transition countries, including Russia and Macedonia. They found that foreign-owned banks were more cost efficient but less profit efficient than other banks in these transition countries. In addition to the analysis of the existing studies, Yildirim and Philippatos (2002) included the country and time effects in the estimation and found significant country differences in profit and cost efficiency.

One of the most comprehensive and recent cross-country study for the efficiency measures in transition countries was conducted by Fries and Taci (2005). They conducted an analysis on the cost efficiency of 289 banks in 15 East European countries to gain a clear understanding of the transformation process in the banking system. The empirical findings provided stronger evidence of non-linear relationship between the progress in banking reform and cost efficiency. Their results asserted that private banks were more efficient than state-owned banks, which is consistent with the results of earlier studies in the transition countries.

With the inclusion of country-specific variables into stochastic cost and profit frontiers, Kasman and Yildirim (2006) investigated cost and profit efficiencies in eight CEE countries that became the members of European Union during the period 1995-2002. The average cost inefficiency and profit inefficiency scores were found to be 0.207 and 0.367 respectively. The results of this study displayed a wide range of cost and profit inefficiency results across countries and across different size groups. However, there was no consistent increase in the efficiency scores of the banks over time. The findings associated with the impact of the foreign ownership on the efficiency levels of the banks supported the earlier studies, suggesting that the

efficiency scores of foreign banks in those selected countries outweighed the domestic banks.

The studies mentioned above explored various issues of bank efficiency. Most of the existing studies in the literature mainly dealt with the estimates from different approaches (Berger and Mester, 1997; Bauer et al., 1997). Other studies in the literature compared the efficiencies of foreign banks and domestic banks (Sabi, 1996; Mahajan et al., 1996; Havrylchyk, 2006; Kraft et al., 2006 and Sensarma, 2006), whereas some studied the impact of risk on banking efficiency estimates (Mester, 1996; Kwan and Eisenbeis, 1997; Altunbas et al., 2000 and Pasiouras, 2008). Furthermore, the other studies in literature focused on the off-balance sheet activities (Tortosa and Ausina, 2003 and Pasiouras, 2008) or the role of environmental factors on bank efficiency (Dietsch and Lozano-Vivas, 2000; Berger and DeYoung, 2001; Chaffai et al., 2001; Cavallo and Rossi, 2002).

3.2.2.1. Banking Efficiency and Stock Performance Literature

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. Among few studies that tried to evaluate the explanatory power of various efficiency scores on bank stock market returns, publicly listed bank data was utilized. Over the past decades, the traditional accounting performance measures were used to explain the stock price changes. Moreover, in these studies, it was stated that the magnitude of changes in stock prices did not reflect the magnitude of

changes in earnings[15]. However, the use of accounting-based financial ratios to measure the bank performance has been criticized since accounting data ignores the current market value of the bank and does not present economic-value maximizing behavior (Kohers et al., 2000). In addition, these financial ratios do not take into account the input price and the output mix (Berger and Humphrey, 1992). Due to these difficulties, Berger and Humphrey (1997) and Bauer et al. (1998) concluded that in terms of measuring performance, efficient frontier approaches seem to be superior when compared with the traditional financial ratios analysis gathered from the accounting statements. Furthermore, Berger and Humphrey (1997) claim that, together with the economic optimization mechanism, frontier approaches provide an overall objective numerical score, ranking and an efficiency proxy. Hence, they argue that efficiency proxies of the frontier approach are better measures of bank performance. In subsequent studies, the focus of investigation is shifted from the traditional accounting measures to the efficiency frontier approaches to observe how they affect the stock prices or returns.

Cooper et al. (2003) and Beccalli et al. (2006) pointed out that the literature on accounting information and stock returns generally does not include banking institutions because of their high leverage and other distinguishing characteristics peculiar to the industry (e.g. regulations). In an attempt to close this gap, in the recent years, some studies have examined the relationship between banking efficiency and stock returns[16]. However, this specific strand of literature remains rather limited with only a handful of country-specific studies covering Australia, Greece, Malaysia,

[15] Kothari (2001) for a complete review of the literature.

[16] In addition to the bank efficiency and stock return studies, Cooper et al. (2003) investigated the predictability of the cross-section of bank stock returns by using information contained in individual bank fundamental variables such as income from derivative usage, previous loan commitments, loan-loss reserves, earnings and leverage.

Spain, Singapore and the U.S. As such, Adenso-Diaz and Gascon (1997) sought to establish a relationship between stock performance and four different measures of partial efficiency, namely, production costs, branch network distribution estimated by the use of DEA, systematic risk and unsystematic risk in the Spanish banking sector. The data included the twenty three of twenty eight banks currently quoting on the Madrid Stock Exchange over the period 1993 through 1995. The empirical evidence suggested that the most significant explanatory variable in explaining bank stock performance was the unsystematic risk of banks. In a similar study, with the use of DEA, Chu and Lim (1998) conducted a detailed analysis to estimate the relative cost and profit efficiencies of a panel of six Singapore-listed banks over the period 1992-1996. The authors reported higher average cost efficiency compared to average profit efficiency. The regression results documented that changes in bank stock prices were more related to changes in profit rather than cost efficiencies.

Eisenbeis et al (1999) explored the impact of cost efficiency estimates for a sample of large US bank holding companies by employing DEA and SFA to investigate whether these estimates could explain the risk-taking behavior, managerial competence and bank stock returns. Based on the results of the study, consistent with the studies of Adenso-Diaz and Gascon (1997) and Chu and Lim (1998), they found a negative relationship between cost inefficiency and stock returns. Furthermore, they suggested that the cost efficiency results of SFA produced more information associated with the bank stock returns when compared with the DEA efficiency estimates. The majority of the studies solely concentrated on the individual countries.

Using DEA, Kirkwood and Nahm (2006) constructed an efficient frontier for ten banks listed on Australian Stock Exchange to estimate their profit efficiency and then related the profit efficiency scores to stock returns[17]. The results indicated that changes in profit efficiency are statistically significant in determining the stock returns of banks, particularly the regional banks, in the sample, implying that all publicly available information regarding the prospects of a firm is reflected in the stock price.

In a more recent study by Pasiouras et al. (2008), the association between the efficiency estimates and share performance of 10 commercial listed banks in Greece over the period 2001-2005 has been examined using DEA approach. Due to the constant returns to scale and variable returns to scale assumption of DEA, the average technical efficiency score under constant returns to scale was found to be 0.931, whereas this score increased to 0.977 under the variable returns to scale assumption. The scale efficiency of the Greek banks resulted in a level of 0.953. Following the efficiency scores, the regression results reported a that technical efficiency was statistically significant and positively related to stock returns, however, no significant relationship was found between the scale efficiency and stock returns.

Sufian and Majid (2006) investigated the association between cost and profit efficiencies and their stock performance in Malaysian banks, listed in Kuala Lumpur Stock Exchange during 2002-2003. This is one of the limited number of studies in the emerging markets. The cost and profit efficiencies were derived from DEA

[17] They included profit efficiency, rather than cost efficiency, as an explanatory variable into the model since they stated that profit efficiency captures both cost and revenue efficiency.

estimation models. They found that the cost efficiency of Malaysian banks was on average significantly higher compared to profit efficiency. Additionally, similar to the findings of Chu and Lim (1998), they suggested that the stock prices of Malaysian banks react more towards the improvements in profit efficiency rather than the improvements in cost efficiency.

In a similar study, Erdem and Erdem (2008) examined whether three efficiency scores (technical, allocative and economic efficiency) of Turkish banks traded on Istanbul Stock Exchange over the period 1998-2004 had a significant explanatory power in stock price returns. The efficiency scores obtained from DEA was included into the CAPM model as an explanatory variable. They concluded that average efficiency scores of the banks showed a significant decline between 1999 and 2001, and started to increase after the financial crisis in 2001. They found that changes in the economic efficiency could not explain the variation in stock price return movements.

Majid and Sufian (2008) investigated the relation between Chinese banks' efficiency and their share price performance during the period of 1997-2006, while controlling for other banks' specific traits[18]. The technical, pure technical and scale efficiency were estimated by using DEA. Bank efficiency was found to be related to bank characteristics. Furthermore, they found that although changes in technical efficiency are statistically significant in determining banks' share returns, scale efficiency has no explanatory power on the variation in stock price returns.

[18] Bank specific factors that included in the model are total bank deposits, ratio of total loans to bank total assets, total bank assets, total non-interest expense divided by total assets, total non-interest income divided by total assets, total shareholders equity divided by total assets, return on asset and finally investment capacity measure, calculated as investment divided by total assets.

In a cross-country setting, Beccalli et al. (2006) estimated the cost efficiency scores of banks located in France, Germany, Italy, Spain and UK in 2000 by using DEA and SFA. They have enriched the study by determining the link between such measures and market performance of financial institutions. The findings indicated that reflected percentage changes in cost efficiency were reflected in changes in the bank stock prices. This association was, especially, more apparent with the efficiency estimates obtained from DEA rather than SFA. The authors stated that one possible explanation could be the proximity of DEA with the accounting measures of performance.

Ioannidis et al. (2008) examined the relationship between bank efficiency change and stock returns for a sample of Asian and American banks over the period 2000-2006. They employed SFA to estimate the cost and profit efficiency of banks, while accounting for environmental differences. The results of this study indicated a positive and robust relationship between profit and cost efficiency changes and stock performance.

Overall, the existing literature provides similar findings in terms of the dependence between the efficiency scores of the publicly listed banks and their stock price return performance, suggesting that changes in efficiency measures are reflected in stock returns. Despite these facts, the literature still suffers from a scarcity of studies on CEE countries that include the new members of the EU as well as candidate countries. In fact, to date, no single study that investigates the link between the bank efficiency and stock performance was found. In this respect, this study attempts to fill in this gap and provide a significant contribution to the literature. Moreover, the

selection of an updated dataset will help the bank managers, policy authorities to review their policies in a dynamic environment.

3. Data

In this section, a brief discussion of characteristics of data set is provided. Data set for the annual balance sheets and income statements of publicly traded banks were obtained from Bankscope[19]. This database allows the researchers to make comparisons across countries. This is a cross-country study that must consider the accounting heterogeneities across different systems. Since this database classifies the firms in terms of specialization, it provides consistency in accounting systems. Additionally, in this dataset, the data are available both in national currencies and U.S. dollars.

The data series chosen is denominated in U.S. dollar to avoid different inflation rates and parity differences observed in each of the selected country. Monthly stock prices of all listed banks were obtained from stock exchanges of each country in the sample. The national stock price data is converted into U.S. dollar by adjusting the exchange rate against dollar.

The full data set is comprised of commercial banks over the period 1995-2006 from the seven CEE countries, which already joined the EU or are candidates. The countries included with the number of banks in parentheses are Croatia (14), Estonia (2), Hungary (2), Latvia (2), Poland (9), Slovenia (1) and Turkey (9). Some of the

[19] This financial database is distributed specifically by BVD-IBCA, which is an informational agency that reports published financial statements from financial institutions worldwide and homogenizes the information into an easily readable global format.

transition countries are excluded from the sample because of the data inavailability. Accordingly, after reviewing the data for reporting errors and other inconsistencies, this study includes an unbalanced panel data of 39 listed banks consisting of 183 bank-level observations over the period 1995-2006. Additionally, for a comparison, 202 non-listed firms are taken into account. Listed banks account for approximately 20% of the sample. With regard to the number of total observations, the overall sample consists of 1255 bank-level observations over the period 1995-2006.

In the empirical literature on banking efficiency, the banking efficiency scores often reach seemingly contradictory results. Regardless of the measurement techniques, it generally stems from '*how a banking firm is modeled'* and depends on the determination of inputs and outputs.

A variety of approaches have been proposed on the banking cost structure literature. According to Humphrey (1985), it is assumed that banks are considered as producers of different types of loans and deposit accounts, using capital, labor and materials to do so. In this approach, the appropriate measure of bank output includes either the number of loans, deposit accounts or the number of transactions performed. Total costs include all operating costs used in the production of outputs. This view is referred to as the "production approach". On the other hand, based on the "intermediation approach", which was originally developed by Sealey and Lindley (1977), banks are treated as the collectors of funds, and later these funds can be intermediated into loans and other assets. The bank output is measured by the monetary value of loans and investments, whereas labor, capital and deposits are considered as the inputs under this process. Under this approach, besides operating

costs, interest costs are also included in the total cost measurement, thereby, it provides greater viability to the banks (Berger et al., 1987; Ferrier and Lovell, 1990). Production approach has been criticized since it concentrates on operating cost but ignores interest expense. The intermediation approach, however, has been criticized as it does not take into account the fact that banks use considerable resources for supplying transactions and savings deposits (Berger and Humphrey, 1992). Neither of these two approaches is fully accepted since neither fully covers the dual roles of banks.

In determining the type of services to be considered as bank outputs and inputs, Berger and Humphrey (1992) classified activities of banks according to the creation of high added-value, such as loans and deposits as important outputs, labor, physical capital and purchased funds as important inputs. This approach is referred to as "value added" approach. Following Humphrey and Pulley (1997), banks are assumed to provide two main categories of financial services: (1) intermediation and loan services; (2) payment, liquidity and safekeeping services. Thus, deposits are considered as input and output at the same time when the value-added approach is used. The interest paid in deposits is considered as part of the costs and the rate paid is counted as an input price (Berger and Humphrey, 1997). Alternatively, "user-cost" framework[20] is based on the user cost of money as developed by Donovan (1978) and Barnett (1980). The user cost of each asset is calculated as the difference between the bank's opportunity cost of capital and its holding revenue. On the other hand, the user cost of each liability is calculated as the difference between its holding cost and the bank's opportunity cost of money. In this sense, bank assets or

[20] User –cost framework is adopted by Aly et al., (1990), Hancock (1991), Fixler and Zieschang (1992).

liabilities are treated as outputs or inputs depending on the sign of the user cost of asset or liability[21]. Despite the existence of some differences, these two approaches suggest similar classifications for inputs and outputs. The main difference lies in the classification of deposits. Although deposits are classified as output in most user-cost studies, deposits are classified as input and output at the same time in the value-added approach studies[22] (Wheelock and Wilson, 1995).

Although there is little agreement among economists on the explicit definition of banking inputs and outputs because of the nature and functions of financial intermediaries (Berger and Humphrey, 1997), the value-added approach (Berger and Humphrey, 1992) is adopted in this study. 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. In this context, deposits as well as assets are treated as having some output characteristics.

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[23]. The price of physical capital is computed by dividing the total operating costs net of personnel expenses by total fixed assets. The

[21] When the holding revenue of the asset exceeds the opportunity cost of capital, the asset is classified as output and when the opposite is true; this will contribute to the financial firm's cost and is therefore classified as inputs. The same is true of liabilities, which can be classified as either input or output depending on the difference between holding cost and the bank's opportunity cost of money.
[22] See Berger and Humphrey (1992) for more details.
[23] This approximation is common in all studies using IBCA dataset. See Altunbas et al. (2000) and Maudos et al. (2002).

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.

Table 5, Table 6 and Table 7 provide descriptive statistics for the bank level variables of listed (publicly traded) and non-listed banks[24] as well as whole banks over the period 1995-2006[25]. Comparing the mean values of these variables across listed banks and non-listed banks in the CEE countries, there are large differences in the output and total cost values. The higher mean values of total loans, other earning assets, total deposit and total assets of listed banks, when compared to non-listed banks, are not surprising. Due to the awareness, trustworthiness and corporate transparency, banks whose shares are publicly traded are preferred for loans and deposits. Nevertheless, regarding the standard deviations, so called variables of listed banks illustrate higher volatility. A close examination of average input price values suggests that the most expensive factor of production in the input market is physical capital, which is a typical characteristic for developing countries. In particular, even though both the prices of labor and purchased funds are approximately the same, some deviation is evident for the price of physical capital across listed and non-listed banks. As suggested by the standard deviations, input price values of non-listed banks are quite volatile; specifically the price of physical capital has the highest standard deviation.

[24] Listed banks refer to the banks whose shares are publicly traded whereas non-listed banks whose shares are not.
[25] In addition to the descriptive statistics of the publicly traded banks, the values of non-listed banks as well as all banks in the sampled transition countries are reported in order to make inference and allow for comparison.

Table 5. Descriptive statistics of bank level variables for 1995-2006 (All banks)

Variables	Mean	Median	Maximum	Minimum	Standard Deviation	Coefficient of variation
y_1 = Total loans	808769	149619	21162740	157	1974068	2.440
y_2 = Other earning assets	906904	141854	37282788	61	3015217	3.325
y_3 = Total deposits	1433082	265043	43034419	960	3804554	2.654
p_1 = Price of labor	0.020	0.017	0.141	0.002	0.012	0.627
p_2 = Price of physical capital	1.519	0.956	9.373	0.059	1.553	1.022
p_3 = Price of purchased funds	0.066	0.044	0.572	0.002	0.065	0.988
tc = Total costs (interest expenses + noninterest expenses)	221715	31282	8268838	858	698135	3.145
ta = Total assets	1922266	346950	53374590	8566	5296664	2.755
tc / ta	0.108	0.093	0.569	0.013	0.065	0.605
Equity / ta	0.135	0.108	0.903	0.006	0.095	0.700
Net income / ta	0.012	0.012	0.214	-0.219	0.027	2.171

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

Furthermore, the lower coefficient of variation values of listed banks, in other words – the risk per unit return- is consistent with results above. On the other side, listed banks incur approximately three times higher total cost values than non-listed banks, implying that there are enormous differences in their interest and non-interest expenses. The higher standard deviation of total cost values of listed banks results in a lower coefficient of variation. These observed differences between these two types of banks provide direct justifications for the evaluation of the efficiency estimates.

Such differences may be attributed to the difference strategies followed by each banking industry after the intense competition in CEE countries in the pursuit of EU membership period.

Table 6. Descriptive statistics of bank level variables for 1995-2006 (Listed banks)

Variables	Mean	Median	Maximum	Minimum	Standard Deviation	Coefficient of variation
y_1 = Total loans	2423764	877856	21162740	5340	3723204	1.536
y_2 = Other earning assets	2731953	709445	28063367	3619	4729832	1.731
y_3 = Total deposits	4216855	1559014	36737899	10923	6420475	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)	678359	152259	8268838	1880	1215929	1.792
ta = Total assets	5842067	2021709	53374590	15093	9369051	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 millions of US dollars.

Table 7. Descriptive statistics of bank level variables for 1995-2006 (Non-Listed Banks)

Variables	Mean	Median	Maximum	Minimum	Standard Deviation	Coefficient of variation
y_1 = Total loans	748691	146380	16628180	157	1690272	2.258
y_2 = Other earning assets	884918	136375	37282788	61	2996825	3.387
y_3 = Total deposits	1371502	259378	43034419	960	3620458	2.640
p_1 = Price of labor	0.020	0.017	0.141	0.002	0.012	0.622
p_2 = Price of physical capital	1.492	0.946	9.373	0.059	1.524	1.022
p_3 = Price of purchased funds	0.066	0.044	0.044	0.002	0.065	0.981
tc = Total costs (interest expenses + noninterest expenses)	214864	30524	7527098	858	665403	3.097
ta = Total assets	1829800	329972	51031773	9712	4940340	2.700
tc / ta	0.108	0.093	0.569	0.013	0.065	0.607
Equity / ta	0.137	0.108	0.903	0.006	0.096	0.705
Net income / ta	0.012	0.012	0.214	-0.219	0.027	2.202

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

3.3.1. Environmental Variables

The estimated common frontier approach depends based upon the conjecture that efficiency measurement differences among banks are determined especially country-specific differences rather than by technological ones. Thus, 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 the differences in the cost and profit functions of the banks across countries (Dietsch and Lozano-Vivas (2000). Due to the globalization of the regional economies and financial markets many studies have estimated cost and profit efficiency scores in the context of multi-country common cost and profit frontiers (Dietsch and Lozano-Vivas, 2000; Ruthenberg and Elias, 1996; Maudos et al., 2002; Pastor et al., 1997; Allen and Rai, 1996; Berger and Humphrey, 1997; Hughes et al., 1996; Berg et al., 1993; Fecher and Pestieau, 1993). Therefore, since the aim is not to conduct a micro-level study, but a cross-country study, identifying a common frontier by taking into account different environmental variables becomes more relevant for the banking efficiency measurement. When a common frontier is developed with the environmental variables for the banking sector at a regional level, differences in banking efficiency scores across banks and countries can be explained by a global best practice banks. Country-specific variables may affect the efficiency level of all banks in the country as well as the quality of services provided with loans and deposits. Furthermore, including the environmental variables into frontier is essential because the estimates that measure banking efficiency differences among countries without considering environmental conditions ignore cross-country differences in regulation, economic and demographic conditions, resulting in estimation bias[26]. Several empirical studies have emphasized the importance of environmental variables in the efficiency estimates in banking literature (Allen and

[26] One limitation of the model without environmental variables is based on the assumption that in the standard model estimating the efficiency of banks in cross-national scenario, a common efficiency frontier is constructed for all firms, regardless of their home country. Even though the cross-country efficiency differences may mainly result from the managerial decisions within the commercial banks, different regulatory, economic and demographic conditions across countries may explain the differences in the efficiency (Lozano-Vivas et al., 2002)

Rai, 1996[27]; Dietsch and Lozano-Vivas, 2000; Lozano-Vivas et al., 2001; Lozano-Vivas et al., 2002). 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.

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' that aims to determine the basic conditions that the banks operate. This first group includes three indicators; 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. In low population density areas, as the supply of banking services creates higher banking costs, it does not encourage banks to increase their efficiency levels. Per capita income, which serves as a proxy for the general economic development, includes also the information about the quality of institutions and their skills. It is measured by ratio of gross domestic product (GDP) per square kilometer. This indicator would have an effect on various factors associated with the demand and supply of banking services, especially deposits and loans. Banks which operate in the countries with a higher per capita income would have a more mature and developed environment resulting in more competitive interest rates and profit margins. The interest rate levels can affect the interest costs of the banks and hence, efficiency levels. Furthermore, the overall development in the economy may result in a decrease in the associated costs of the banks because of

[27] 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.

the corresponding improvements in the quality of institutions (Fries and Taci, 2005). The density of demand, the last indicator of this first set, is measured by the ratio of total deposits per square kilometer. It has a crucial impact on determining the efficiency level of the banks because banks operating in economic environment with a lower density of demand would charge higher expenses in mobilizing deposits and loans throughout their branches.

The second group, named 'bank structure and regulation', includes the basic variables that characterize the structure of the banking industry. It is thought that those variables may affect the banking technology and service quality in the market. These are average capital ratio, degree of concentration and intermediation ratio 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. Following Mester (1996) and Altunbas et al. (2000), the importance of including the level of equity into the estimated cost function has been recognized in order to control for differences in risk preferences. If managers of a bank are more risk-averse, they can hold a higher equity level than the cost-minimizing equity level. Accordingly, if the level of equity is ignored, a bank is considered as inefficient even though it behaves optimally given the risk preferences of its managers (Weill, 2003).

Berger and Mester (1997) have stated two further reasons for introducing this level of equity into the function. The first reason is the level of equity captures both

capitalization and insolvency risk. Since the insolvency risk has a crucial impact on the bank costs through the risk premium, the bank has to pay to borrow funds. This issue is of particular importance for the transition economies because of the high proportion of non-performing loans in their credit portfolios. The second important reason behind this inclusion is based upon the fact that equity is considered as an alternative funding source for loans of banks. Increasing the level of equity in a bank implies higher associated costs than increasing the deposit levels although deposits involve financial costs, but equity does not. Hence, neglecting the level of equity will make the banks rely more on equity for the funding of loans even if the equity is more costly than deposits.

Despite these arguments that support the importance of including the equity level in the cost function model, the number of empirical studies in the literature considering equity is very scarce. Only a few papers have employed this variable in their cost efficiency estimations (Mester, 1996; Berger and Mester, 1997; Altunbas et al. 2000). However, due to the specific conditions of banks in the transition countries, the possibility of risk preference differences between bank managers and especially the reality of bank insolvency risk strongly entails the inclusion of this variable. Furthermore, omitting this variable may yield unbiased efficiency results. Hence, in this study, instead of introducing the equity level, average equity is used as a proxy for the measurement of insolvency risk. A higher capital ratio leads to higher efficiency levels since holding more equity implies less risk taking, which makes the banks borrow at lower interest rates, thereby, normally resulting in lower cost.

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. Higher concentration may be related with either higher or lower costs. If higher concentration is a result of market power, both concentration and costs go in the same direction (Leibenstein, 1966). On the other hand, if concentration is the result of either superior management or greater efficiency of the production processes, higher concentration can be associated with lower costs (Demsetz, 1973).

The last variable, 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. A higher intermediation ratio can be associated with lower banking costs and thus, a higher efficiency level[28].

The final category of the environmental variables includes macroeconomic variables. Since the macroeconomic environment of the countries where the banks operate can undoubtedly affect the banking structures and their performances, these variables must inevitably be introduced into the cost and profit estimation equations. Inflation is included as an indicator of macroeconomic stability. It is directly related to the interest rate levels and thus, interest expense and revenue. A bank's ability to manage interest rate risk under inflationary conditions can affect the cost structure of the banks. Accordingly, the banks operating in a higher inflationary environment are likely to be less cost efficient.

[28] The first two sets of the environmental variables are quite similar to those of Dietsch and Lozano-Vivas (2000).

The level of financial development is crucial to bank efficiency. Therefore, the ratio of M2 to GDP, which serves as a proxy for the overall size of the financial intermediary sector, is included into the estimated functions. Higher levels of financial intermediation may contribute to the bank performance and result in higher bank efficiency scores. More importantly, this variable may affect the level of non-bank competition that the banks are exposed to (Kasman and Yildirim, 2006). Finally, GDP growth and market capitalization as a percentage of GDP are additional control variables. A higher GDP growth is assumed to induce banks to operate in a more developed and mature environment. The market capitalization is also used in the cost and profit functions as an indicator of the financial market development.

The list and averages of several geographic, market structure and financial depth variables by countries over the 1995-2006 period are reported in Table 8.

Table 8. Average values of environmental variables (1995-2006) (All banks)

	Density of population	Income per	Density of Demand	Average Capital	Degree of Concentration	Intermediation ratio	Inflation (%)	Money	GDP growth	Capitalization (%)
Croatia	79.156	5565.001	9.255	0.174	0.159	0.514	4.637	0.531	4.257	21.498
Estonia	30.491	5646.631	12.263	0.141	0.406	0.506	10.729	0.347	7.322	29.214
Hungary	108.297	7658.880	14.703	0.113	0.181	0.487	10.325	0.493	4.036	25.847
Latvia	36.625	4333.621	5.907	0.122	0.159	0.390	7.424	0.322	7.071	8.376
Poland	122.790	5449.067	4.269	0.123	0.123	0.481	8.798	0.402	4.672	18.364
Slovenia	97.891	12609.609	53.917	0.119	0.224	0.537	7.532	0.469	4.126	16.731
Turkey	84.269	3452.791	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)

By taking into account different environments where the banks operate, these arithmetic mean values suggest large differences among countries in terms of main conditions of banking activities. The density of population ratios vary across the countries, within the range of 30.491 in Estonia and 97.891 in Slovenia. However, this ratio is significantly higher for Hungary with the ratio of 108.297 and Poland with the ratio of 122.790. Regarding the income per capita and density of demand values, Slovenia has the highest level among the sample countries. Particularly, differences in the average values of income per capita variable are significant, ranging from $3,452.79 in Turkey to $7,658.880 in Hungary. In terms of density of demand variable, this ratio also differs across the countries, with Estonia and Hungary standing out with higher ratios. Overall, in terms of the main conditions of the banking activities across countries, the striking result is that Turkey and Latvia indicate relatively lower values among the countries. Therefore, it could be more expensive and more challenging to perform banking activities – to collect a given level of resources or manage a given assets portfolio- in these two countries.

The mean values of the banking industry and regulation variables show that there are important differences in the degree of concentration and intermediation ratio. Even though the degree of concentration variable is broadly quite similar in Croatia, Hungary, Latvia, Poland and Turkey in the range of 0.123- 0.181, it is notably higher in Estonia and Slovenia with levels of 0.406 and 0.224 respectively. The higher concentration of the banking industry in Estonia and Slovenia may be due to the market power, superior management or greater efficiency of the production processes. Intermediation ratio is broadly similar in many countries in the range of 0.481-0.514. However, in Latvia and Turkey, this ratio is quite lower, ranging 0.373

for Turkey 0.390 for Latvia. This results implies that the banks operating in Latvia and Turkey have to collect a higher level of costly deposits (in terms of operating costs) to support the same value of loans. Under these conditions, it is ceteris paribus more expensive to conduct banking activities in these two countries. Despite the higher lending growth rates observed in these transition countries in recent years, average capital ratios are still remain high, implying that banks have attempted to expand their credits without damaging their capital positions. Therefore, the average capital ratio ranges from 11.3% in Hungary to 17.4% in Croatia. The high equity ratio can be particularly attributed to the restructuring process of state-owned financial institutions. Furthermore, credit institutions in these countries may require a higher than required capital adequacy ratio to signal their solvency and also attract more funds needed for the credit expansion in a business environment which is specifically more risky than that of the old EU regime (Fries and Taci, 2002). However, as seen, the average capital ratio is stable across the countries, with Croatia and Estonia standing out with higher ratios.

Regarding the country-level environmental factors, differences in the average values of macroeconomic variables are significant, especially in the inflation and market capitalization. Inflation ranges from 4.637% in Croatia to 10.729% in Estonia. However, it is significantly higher in Turkey with a percentage of 46.731. Similarly, the market capitalization as a percent of GDP is broadly similar in Croatia, Estonia, Hungary, Poland and Turkey within the range of 18.364% - 30.164%. However, it is substantially lower in Latvia with a value of 8.376% and Slovenia with a value of 16.731%. This implies that financial market development in Latvia and Slovenia is

not as advanced as those in other countries. On the other hand, GDP growth and money as measured by the ratio of M2 to GDP do not vary greatly across countries.

3.4. Methodology

3.4.1. Stochastic Frontier Approach

Most microeconomic analyses have concentrated on the "efficiency" estimates of the firms since the managers aim to maximize their profits by producing in an efficient manner in a more competitive environment. In microeconomic theory, productive efficiency measures how successfully the firms optimize their behavior with respect to input and output decisions. The history of the theoretical literature on productive efficiency goes back to 1950s with the works of Koopmans (1951), Debreu (1951) and Shephard (1953). Koopmans (1951) defines a production plan as "technically efficient" if there is no way to produce more output without producing less of some other output or utilizing more of some input. Farrell (1957) measured the productive efficiency empirically by decomposing it into two components; technical efficiency and allocative efficiency. Besides the definition of technical efficiency, allocative efficiency is defined as the firm's ability to use optimal input proportions, given their respective prices. Leibenstein (1966) defined the X-efficiency as the combination of technical efficiency and allocative efficiency and used this measure as the quality of management. Cost efficiency, which refers to both technical and allocative efficiency, is defined by Berger and Mester (1997) as "how close a bank's cost is to what a best practice bank's cost would be for producing the same output bundle under the same conditions". Profit efficiency, which is another economic efficiency concept, on the other hand, measures how close a bank is to producing the maximum

possible profit given a particular level of input prices, output prices and other variables as well. Profit efficiency is assumed to be more superior to cost efficiency since it measures the overall performance of the firm by combining both costs and revenues in the measurement of efficiency. Accordingly, in this study, cost and profit efficiency measures are used together to make an overall evaluation about the performance of the banks.

In terms of utilizing multiple inputs to produce multiple outputs, Shephard (1953, 1970) described distance functions as a functional characterization of the structure of production technology as these functions basically measured the distance of a production activity from the boundary of production possibilities. The basic role of the distance functions was generally set in the duality theory, developed by Shephard (1970). Duality theory (Shephard, 1970) claimed that under certain conditions a production frontier is dual to a cost frontier or profit frontier. Therefore, productive efficiency can be defined in terms of distance a particular frontier. In theoretical framework, the production functions of fully efficient firms are assumed to be known. However, since the production functions are not known in practice, Shephard's duality theory provided the ability for the firms to estimate the production function through the usage of cost and profit function. Therefore, given the information on the quantities and the prices of the inputs, firms are able to solve economic optimization problems.

In the theory of perfect competition, it is assumed that production plans and cost levels of the firms are obtained from rational and efficient decisions. Thus, it is impossible to measure inefficiency in production and the error terms are assumed to

be symmetrically distributed with zero means. However, in practice, the rational and efficient decisions are no longer available when analyzing firm behaviors due to the unfavorable operating environment. The unfavorable operating environment, including some errors, lack of motivation stemming from a lack of competition, the inability of the managers to implement production plans, inertia in human behaviors and distorted communication and uncertainty, may cause the so-called X-inefficiency[29]. The evidence of X-inefficiency may cause the real data to deviate from the optimum.

The efficiency of banks, like other firms, can be measured by applying frontier analysis through the separation of the production units that by some standard perform well from those that perform poorly. Frontier efficiency measures the degree of proximity of the banks to a best-practice frontier. Even though frontier analysis is not a simple way to evaluate the efficiency of the firms, it provides overall and objective numerical efficiency values and ranking of firms (Berger and Humphrey, 1997). Different types of estimation methodologies –non-parametric and parametric techniques- have been employed in assessing the efficiency of the firms.

Two main techniques in the literature are the non-parametric and the parametric approaches. The efficiency scores from various techniques provide different information and might be used as the basis for decision making. Non-parametric approaches require the non-probabilistic assumption and behave as if noise and inefficiencies are combined. They only concentrate on technological optimization, discarding economic optimization since they ignore the price information. In

[29] X-inefficiency, which is the term used first by Leibenstein (1966), is defined as "the ratio of the minimum cost that expended to produce a given output bundle to the actual costs expended, varies between 0 and 100 percent."

addition, non-parametric approaches assume a deterministic process rather than stochastic process (Berger and Mester, 1997; Coelli et al., 2003). Parametric approaches, on the other hand, are probabilistic and attempt to separate noise from inefficiencies (Lee, 2002).

The non-parametric approaches to efficiency measurement include the data envelopment analysis (DEA)[30] and the free disposal hull (FDH)[31]. Both analysis allows efficiency to change over time and requires no prior assumption regarding the form of the distribution of efficiencies across observations. The parametric approaches include the Stochastic Frontier Analysis (SFA), the distribution-free approach (DFA) as well as the thick frontier approach (TFA). Among these, SFA is the most widely applied technique.

The SFA, also referred to as the econometric frontier approach, was independently developed by Aigner et al. (1977), Meeusen and van den Broeck (1977) and Battese and Corra (1977). Starting with a standard cost or profit function, SFA estimates the minimum cost or maximum profit frontier with factors of inputs and outputs. After the minimal cost or maximum profit is determined based on these functions, an efficiency frontier sample is generated. The efficiency of each bank is then measured as the distance of its cost or profit to the frontier value.

[30] DEA, developed firstly by Charnes et al. (1978) as a mathematical programming approach is formed to establish a linear surface which combines the set of all the best practice observations for creating a convex production possibility set. As such, DEA does not need to express the explicit specification of the functional form of the underlying production relationship.

[31] FDH, which is a special case of DEA, requires the assumption of free disposability of inputs and outputs. Under the FDH, the points on lines connecting the DEA vertices are not included in the frontier. FDH is likely to estimate larger efficiency scores than DEA since the FDH frontier is either congruent with or interior to the DEA frontier (Tulkens, 1993).

The proposed stochastic frontier production model of the form is specified as follows:

$$\ln TC_i = \ln f(w_i, y_i, z_i; \beta) + v_i + u_i \qquad for \quad i = 1,....., N \tag{1}$$

Where TC_i denotes the observed total cost of the i th firm, w_i, y_i, *and* z_i represent the vectors of input prices, output and country-specific environmental variables. β represents a vector of unknown parameters. Based on this approach, the specification of the functional form of the frontier is assumed to have an error term comprised of two components. The first component of the error term, v_i, incorporates the statistical noise component and is assumed to follow a symmetrical normal distribution ($v_i \sim N(0, \sigma_\varepsilon^2)$). It is a two sided standard statistical error term. The combined effect of inadvertent omission of relevant variables from the measurement and approximation errors arising from the choice of the functional is referred to as 'statistical noise'. The second error term, u_i , which is one sided stochastic element, corresponds to the effects of bank's inefficiency, including both allocative and technical inefficiency. Since inefficiency cannot be negative, the value of u_i must be greater or equal to zero. Therefore, it is assumed to follow an asymmetric, usually half normal distribution[32,33], i.e., $N(\mu_{it}, \sigma_{uit}^2)$, in which both the mean μ_{it} and the variance σ_{uit}^2

[32] Unlike SFA, DFA uses a different way to break up the inefficiency from random error. Instead of a strong assumption about the distribution of inefficiency and idiosyncratic error terms, it assumes that the efficiency level of the firm is constant over time while random error averages out to zero over time.
TFA provides a functional form which specifies the random error as the deviations from estimated performance values within the highest and lowest performance quartiles of observations and defines inefficiency as the deviations in predicted performance between the highest and lowest quartiles. Specifically, it tends to provide a general level of overall efficiency instead of point estimates of individual firms' efficiency. Under this approach, no distributional assumptions are required either on inefficiency or random error (Berger and Humphrey, 1997).

[33] Greene (1990) reported that the using half-normal distribution assumption on the inefficiency measurement is not as flexible as the other distributions, such as gamma, truncated etc., because it arbitrarily restricts most firms to be clustered near full efficiency. However, in this study, half-normal assumption is used as it is the most common in the efficiency literature.

may vary. Together they constitute the composed error term ($\varepsilon_i = v_i + u_i$), where v and u are independently distributed. Using equation (1), the coefficients and the combined error term, $\varepsilon_i = v_i + u_i$, are estimated and then efficiency score is calculated for each observation in the sample. Maximum likelihood function can be used to compute the estimates of this model (Olson et al., 1980). Efficiency levels are estimated by using the regression errors.

According to Jondrow et al., (1982), the estimated inefficiency is taken by utilizing the mean of the inefficiency term conditional on the estimate of the composed error term, E [u_i / $v_i + u_i$]. The mean of this conditional distribution is depicted as

$$E(u_i \mathrm{I} \varepsilon_i) = \frac{\sigma\lambda}{1+\lambda^2}\left[\frac{f(\varepsilon_i\lambda/\sigma)}{1-F(\varepsilon_i\lambda/\sigma)} + \left(\frac{\varepsilon_i\lambda}{\sigma}\right)\right] \qquad (2)$$

where $\lambda = \sigma_u / \sigma_v$ and total variance, $\sigma^2 = \sigma_u^2 + \sigma_v^2$; $F(.)$ and $f(.)$ are the standard normal distribution and density functions, respectively. $E(u \mathrm{I} \varepsilon)$ is an unbiased but inconsistent estimator of u_i, because regardless of N, the variance of the estimator becomes non-zero (Greene, 1993). Jondrow et al., (1982) have indicated that the ratio of the variability for u and v are used to estimate relative efficiency of banks, where $\lambda = \sigma_u / \sigma_v$ measures the amount of variation emanating from inefficiency relative to noise for the sample. In order to obtain an estimate of inefficiency for each bank in the sample, the estimated distributional parameters and the estimated ε_i are substituted into equation (2). The model assumes that the composed error term should be orthogonal to input, output or environmental variables determined in the estimated equation.

It is particularly challenging to determine which approach dominates the other, since each has its own advantages and disadvantages. Even if DEA requires fewer assumptions, less data and a less small sample, the key drawback to this non-parametric approach is that it is assumed to have no random error and no measurement error in the construction of the frontier. Therefore, this can lead to severe problems in shaping and positioning the frontier. Furthermore, due to the use of relative efficiency measures instead of absolute measures, it may not make sense to use DEA as an efficiency measurement for the comparison among firms (Schmidt, 1986). Additionally, conventional test of hypothesis associated with the existence of inefficiency and the structure of the production technology can not be conducted with DEA[34]. Because of these DEA drawbacks, this approach is not properly appropriate for this study.

Recent empirical studies on the efficiency estimates of banks indicate that different assumptions of the one-sided component of the composite error term do not lead to the same results in terms of efficiency estimates. By using panel data, distributional assumptions of the error terms might be avoided. Therefore, the "distribution free" approach developed by Schmidt and Sickles (1984) and Berger (1993) allows using balanced panel data to estimate efficiency levels. However, in this study, "distribution free" approach (DFA) is not properly used because creating a balanced panel data set for our study results in a decrease in the number of our observations. Therefore, due to the drawbacks associated with DEA and DFA, this study employs

[34] For a more detailed discussion of advantages and disadvantages of each approach, see Coelli et al. (2005).

the parametric stochastic frontier approach (SFA) to establish the cost and profit efficiency frontiers of the banks[35].

SFA needs to specify a particular distributional form for the inefficiency term associated with the behavioral assumptions and a functional form for the production function (Coelli et al. 2005). Most importantly, the choice of the right form is very important. If the functional form is not correctly specified, the estimated efficiency may be confounded with the specification errors (Berger and Humphrey, 1997).

There are some common functional forms including linear, Cobb-Douglas, normalized quadratic, Fourier Flexible and translog specifications. The translog specification is used in modeling cost and profit functions. The vast majority of empirical studies in banking literature have used this specification since it has well-known advantages of including a Flexible form and as a particular case, Cobb-Douglas specification[36]. The multi-product cost function (including three inputs-three outputs), originally developed by Diewert (1974), can be expressed as follows:

$$\ln TC_{st} = \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_{ist} + \frac{1}{2} \sum_{i=1}^{3} \sum_{k=1}^{3} \alpha_{ik} \ln y_{ist} \ln y_{kst} + \sum_{j=1}^{3} \beta_j \ln w_{jst} \quad (3)$$
$$+ \frac{1}{2} \sum_{j=1}^{3} \sum_{m=1}^{3} \beta_{jm} \ln w_j + \sum_{i=1}^{3} \sum_{j=1}^{3} \delta_{ij} \ln y_{ist} \ln w_{jst} + \sum_{l=1}^{10} z_{lst} + v_{st} + u_{st}$$

[35] Berger and Mester (1997) employed both the distribution free approach and stochastic frontier approach for the translog cost function. The results of this study showed that empirical findings in terms of either industry efficiency or ranking of individual banks are broadly similar across these two methods.

[36] Some empirical studies (Mitchell and Onvural, 1996); Berger et al., 1997a; 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 was very small. More specifically, as Fourier form requires additional truncations of data, employing translog specification is much more appropriate (Hasan and Marton, 2003).

where TC is the total cost of a given bank s at time t, y_i is the ith output, w_j is the price of the jth input and z_l is the lth 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 addition to cost efficiency estimations, profit efficiency, based on the underlying assumption of profit maximization, is conducted. Profit efficiency implies that managers should not only pay attention to reducing a marginal dollar of costs but also, to raising a marginal dollar of revenue. Profit efficiency has become a favorite model among researchers for evaluating the overall performance of banks in recent years. Estimating profit efficiencies is worthwhile since it takes into account the errors both on the output side and input side and is also based on the earlier empirical evidence regarding inefficiencies on the output side may be as large or larger than those on the input side (e.g., Berger et al., 1993).

The profit functions are estimated similarly as cost functions in equation (3) except that the total costs are replaced with total profit on the left hand-side of the equation. There are two profit functions; the *standard* profit function and the *alternative* profit function. As discussed by Berger and Mester (1997), standard profit efficiency and alternative profit efficiency functions are differentiated from each other by the fact that the latter would be helpful in situations in which the firms exercise some market power in setting of the output prices.

In this study, alternative profit function (Pulley and Humphrey, 1993; Berger et al. 1996) is adopted in contrast to standard profit function, which assumes the existence of perfect competition in the markets for outputs and inputs since the banks are assumed to have a market power in output markets. In alternative profit function, profits are defined as a function of both input prices and output quantities, but the bank can choose input quantities and output prices. This contrasts with the standard profit function of perfectly competitive output markets, where revenues are determined as a function of input quantities and output prices but the bank can choose its output quantities based on given prices. When the output quantities are exogenous, meaning that banks can choose output prices, it is more likely to adopt alternative profit function (Bonin et al., 2005).

Furthermore, it would be more appropriate to employ alternative approach when there are substantial unmeasured differences in the quality/specialization among the individual banks in the sample, when output prices are not accurately measured, and when the output markets are not perfectly competitive. Therefore, alternative profit function, as opposed to standard profit function, is more likely to be used when the sample includes diverse of group of countries with different levels of competition.

For the 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 the profit values of some banks in the sample may take negative values, a constant, θ, of a size sufficient is added to the profits of all firms in order to correct for the negative values[37].

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

Besides, in measuring the efficiency under the profit function, the composite error term is considered as $\varepsilon_i = v_i - u_i$.

The stochastic frontiers for cost and profit are estimated using LIMDEP program developed by Greene (2002).

3.4.2. Panel Data Regression Analysis

Bank stock performance is represented by cumulative annual stock returns (CASR), calculated on the basis of monthly returns[38] using the following equation:

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

To investigate the relationship between bank efficiency and stock performance and also examine whether stock returns reflect changes in profit and cost efficiency, 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[39]. 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

[38] 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, Beccalli et al. (2006) calculated the annual returns by adding daily returns. Beccalli (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.

[39] 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.

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

$$Efficiency\ \ change\ in\ \ year\ t = \frac{Efficiency\ score_t - Efficiency\ score_{t-1}}{Efficiency\ score_{t-1}} \quad (4)$$

In the analysis, panel data analysis is employed in order to analyze the association between the efficiency of CEE countries banks and their stock price performance. Since our sample includes 39 banks belonging to 7 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[40]. Additionally, there are several advantages of using panel data analysis. First of all, by pooling the data the panel analysis improves the accuracy of the parameter estimates and thus allows the estimation procedure to have more degrees of freedom and sample variability. Secondly, panel estimation procedure gives the opportunity to reduce estimation bias. Finally, it provides the specification of more complicated behavioral hypothesis. Furthermore, this model allows modeling the differences among the subjects, referred to 'heterogeneity'. In this study, the countries in the sample differ in terms of their economic background, their financial institutions, their reforms, and their social and political facilities. Therefore, all of these country specific variables affect the variables to be estimated.

[40] In the study of Beccalli 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.

Time series data on some countries cannot be obtained. Thus each group in the data set has different numbers of observations due to missing values. Accordingly, unbalanced panel estimations with bank and period fixed effects are performed by using panel least square methods. Specifically, in an unbalanced panel data set, the total number of observations is not equal to N x T.

A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables in both time-series dimension and cross-section dimension which can enhance the quality and quantity of data. The panel data regression can be expressed as follows

$$y_{it} = \alpha + X_{it}^{'}\beta + u_{it} \qquad i = 1,2,.....,N;\ \ t = 1,2,.....,T_{\mathrm{I}} \tag{5}$$

where i denotes subjects (households, individuals, firms or countries) as the cross-section dimension and t denotes time as the time-series dimension . α is a scalar, β is K x 1 and X_{it} is the it th observation on K explanatory variables. The error component model for the disturbances is represented by

$$u_{it} = \mu_i + v_{it} \tag{6}$$

where μ_i denotes the unobservable individual specific effects over time and v_{it} denotes the remainder disturbance, μ_i is assumed to be identically and independently distributed $N(0,\sigma_\mu^2)$ and is independent of v_{it} [41]. Due to the data availability, this model is unbalanced in the sense that there are N individuals observed over varying time period length (T_i *for* $i = 1,2,.....,N$).

[41] v_{it} is also assumed to be identically and independently distributed $N(0,\sigma_v^2)$.

The parameters of the panel data regression can be estimated by fixed effect and random effect models. Panel data models study fixed and/or random effects of subject (household, individual or country) or time.

In the context of a panel data regression, one intuitive way to account for individual and/or time differences is that some regression coefficients are assumed to vary across individuals and/or through time. Although the regression coefficients are not known specifically, the parameters are fixed. When these coefficients are allowed to change in one or two dimensions, this model is referred to as 'fixed effect model'. In the context of this model, the intercept is allowed to vary across individuals (households, firms or countries), whereas the slope parameters and error variances are assumed to be constant in both individual and time dimensions.

Generally, there are different types of fixed effects model. One type of fixed effect model assumes constant slopes but different intercepts across time. In this case, the model would have no significant cross-sectional differences but might have autocorrelation problem due to the lagged time effects. The variables are homogenous across the regions. In another model, even though the slope coefficients are again constant, the intercept varies across cross-sectional observations through time. To account for the time and cross-sectional effects, time and cross-sectional dummies are included into the regression model.

In the random effect model, in contrast, the heterogeneity is modeled using random quantities instead of fixed parameters. These random quantities are known as *random effects*. This model assumes that the intercept and slope parameters do not vary

whereas the error variances components are supposed to vary across individuals and/or times. When there are too many parameters in the fixed effects models or a fixed effect model leads to enormous loss of degrees of freedom, the random effect model is a more appropriate specification. In this case, the standard assumption is that the specific individual effect, μ_i (in equation 6) behaves like a random variable, $\mu_i \sim IIDN(0, \sigma_\mu^2)$, $v_{it} \sim IIDN(0, \sigma_v^2)$ and μ_i are independent of the v_{it}. Additionally, the X_{it} are independent of the μ_i and v_{it} for all *i* and *t*. As mentioned in the studies of Judge et al. (1988), Baltagi (2001) and Park (2005), the random effect model is used when N individuals are drawn randomly from a large population.

The choice between the fixed effect and random effect model has been controversial issue among econometricians for many years. The selection of the appropriate model is dependent upon the assumptions made about the interrelationship of the exogenous variables, both cross-sectionally and across time, assumptions regarding the error term(s), and/or the researcher's desires to obtain either less bias or greater efficiency in the estimators.

Even though fixed effects model will generally have less efficiency, they are more likely to be unbiased and consistent. Fixed effects models are also generally less restrictive than the random effects model. The random effects model, considered as a special case of the fixed effects model, requires far more assumptions.

There are some basic differences between fixed effects and random effects models. The random effects model can produce coefficient estimates for time-invariant variables whereas fixed effects model does not produce coefficient estimates for

them, it just controls for the time-invariant predictors. However, unlike the random effects model, the fixed effects model controls for all time-invariant variables, not just include in the regression model. Also, random effects model has the ability to allow for autoregressive and other covariance structures on the v_{it} disturbance term, if needed. Generally, while the random effects model has less sampling variability which results in more efficient estimators, if the assumptions cannot be met, it can easily lead to biased estimators. Fixed effects model is more favored because of its less restrictive nature and unbiased estimators. Random effects model is necessarily used when the coefficient estimates are needed for time-invariant variables[42].

One important consideration is to determine which of these two models can best deal with missing or unbalanced data, such as occurs in this study. Both the fixed effects and random effects model can handle unbalanced designs of the data, which generally preserve degrees of freedom compared to excluding observations to create a balanced data (Batalgi and Chang, 1994).

In this study, the fixed effects model is expected to be the appropriate method for this study since our estimating sample is identical to the population of interest [43] and does not include time-invariant regressors. However, as it is common in the literature, the appropriate model that most fits the sample and the objective of the research must be selected. Hausman and Taylor (1981) test is used primarily to determine whether

[42] The key consideration between the fixed effects and random effects model is the orthogonality of the μ_i (in equation 6). If μ_i is uncorrelated with the explanatory variables, then random effects is the appropriate estimation model. Rather, if μ_i is correlated with the explanatory variables, fixed effects model is more appropriate.

[43] Our sample includes all the publicly traded banks of the selected CEE countries over the period of our analysis rather than a random sample from the population of listed banks in these CEE countries. For more details, see Judge et al. (1988) and Gizycki, (2001).

random effects model, which is more efficient, if it is consistent is rejected in the data against the less efficient but consistent fixed effects model. In the model Hausman and Taylor (1981), the correlation between individual effects and regressors are tested. Under the null hypothesis, there is no correlation between individual effects and regressors. The test statistic is represented by

$$\hat{H} = \hat{p}' \left[\text{cov}(p)\right]^{-1} \hat{p} \tag{7}$$

where $\hat{p} = (\hat{\beta}_{GLS} - \hat{\beta}_{LSDV})$ and $\text{cov}(\hat{p}) = \text{cov}(\hat{\beta}_{LSDV}) - \text{cov}(\hat{\beta}_{GLS})$. $\hat{H}$ is distributed as chi-squared (χ^2) with K degrees of freedom.

For an unbalanced panel sample of N individual over T periods, our general panel regression model takes the following form:

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \tag{8}$$

where dependent variable y_{it} denotes the annual stock return of bank *i* in year *t*; X_{it}, 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 bank *i* in year *t*; β represents the slope parameters and u_{it} are the error terms for *i=1,2, ….N* cross-sectional units (banks) observed for dates periods *t=1,2,….T*; whereas the parameter α represents the overall constant in the model, and the remaining disturbance, u_{it}, stochastic.

The use of White heteroscedasticity consistent covariance estimator with OLS estimation with corrected degrees of freedom can generate standard errors robust to

unequal variance along the predicted line (Greene, 2002; Wooldridge, 2002) and therefore, the cross-section heteroscedasticity can be controlled[44].

More specifically, the fixed effect portions of the specification are handled using orthogonal projections. These estimations include the familiar approach of removing cross-section or period specific means from the dependent variable and exogenous regressors and then carrying out the specified regression on the demeaned series (Baltagi, 2001).

3.5. Empirical Results

3.5.1. Cost and Profit Efficiency Estimates

The estimates of cost efficiency scores, based on common frontier with country specific environmental variables[45], have been obtained from stochastic translog cost function defined as Equation 3, which includes output levels, input prices and country-specific environmental variables. The average estimated cost efficiency scores of all banks, listed banks as well as non-listed, across country and time are reported in Table 9. The measure of efficiency takes a maximum value of 1, which corresponds to the most efficient bank in the sample. The overall estimated mean score for the cost efficiency for the whole sample is 0.810, or cost inefficiency level of 0.190. This suggests that an average bank produces with a 0.810 of cost efficiency or an average bank in the sample could have saved about 19% of total cost

[44] Under the null hypothesis of the White's heteroscedasticity test, it is assumed that the errors are homoscedastic and independent of the regressors and that the linear specification of the model is correct. If any of these assumptions fail results in a significant test statistic. On the other hand, an insignificant test statistic is desirable because it indicates that none of these assumptions is violated.

[45] Once the country specific variables are included in the analysis, the impact of those variables on the efficiency scores of the banking sector is in line with the expectations. All of the coefficients on the environmental variables in the estimation of cost and profit function are found to be statistically significant.

if it had used the best practice technology, thereby, matching its performance with the best-performance bank.

Table 9. Average cost efficiency scores (1995-2006) (All banks)

Countries in the sample	**Mean**	**Standard Deviation**	**Coefficient of variation**
Croatia	0.803	0.114	0.142
Estonia	0.850	0.064	0.076
Hungary	0.800	0.082	0.102
Latvia	0.786	0.151	0.192
Poland	0.824	0.096	0.117
Slovenia	0.820	0.089	0.109
Turkey	0.817	0.111	0.136
Overall	0.810	0.111	0.137
Trend			
1995	0.778	0.133	0.171
1996	0.807	0.114	0.141
1997	0.806	0.113	0.140
1998	0.796	0.133	0.167
1999	0.825	0.121	0.146
2000	0.812	0.106	0.130
2001	0.828	0.105	0.127
2002	0.808	0.105	0.130
2003	0.815	0.124	0.152
2004	0.815	0.084	0.103
2005	0.809	0.093	0.115
2006	0.809	0.098	0.121

The results of cost efficiency scores across countries reveal that efficiency levels do not vary considerably, though some variation is evident. Cost efficiency values range

from 0.786 in Latvia to 0.850 in Estonia. The banking system in Estonia reports the highest cost efficiency score (0.850) during the sample period, a finding which is accordance with the other studies (Kasman and Yıldırım, 2006). Based on the results, Poland trails behind Estonia with an average cost efficiency score of 0.824. Latvia (0.786) has the most cost inefficient system. Even though Estonia, in particular, was to deal with the financial and banking crises mainly attributable to the legacies of the Soviet past, its good performance can be explained by higher participation rates of international institutional investors and also higher strategic foreign ownership observed in the banking sector. In the case of Poland, given the relatively well-developed nature of its banking industry, this result does not come as a surprise. This result might be attributed to the increased foreign participation with more efficient operating techniques in Poland. However, in Latvia, which, like Estonia, is one of the three Baltic countries like Estonia, the reason for having the highest cost inefficiency in the banking system might be due to the lack of international institutions and international investment funds, the highly concentrated structure of the banking markets, and the lack of competition. Overall, cost efficiency scores below the average value of the whole sample are reported for Croatia, Hungary and Latvia. In general, the findings of cost efficiency scores imply that banks in transition countries can significantly reduce their production costs if they can utilize their productive inputs more efficiently.

The average estimated cost efficiency scores show less variation along the 12 years of our sample, reaching the minimum in 1995 (0.778) and the maximum in 2001 (0.828). As a preliminary observation, though the average cost efficiency has risen from 0.778 in 1995 to 0.828 in 2001, it declined to 0.809 in 2006. However, the

observed increase in average efficiency is not continuous over the 1995-2001 period, reflecting a slight decrease to 0.796 in 1998. This result suggests that the cost efficiency of banking system has deteriorated after the year 2001 for the overall sample of the transition countries. On the other hand, this result is not followed by the standard deviation in efficiency scores, which report a substantial decrease from 0.133 in 1995 to 0.098 in 2006.

Table 10 reports the evolution of average estimated cost efficiency scores for each country over 1995-2006 period. The results indicate that, in general, the cost efficiency estimates of individual countries do not represent any uniform trend. However, in particular, Latvia represents the highest upward trend among the sample countries over the analyzed period. While cost efficiency estimates appear to have an upward trend in Croatia and Estonia, it has a downward trend in Hungary. For the other countries, namely, Poland, Slovenia and Turkey, cost efficiency estimates do not seem to show any obvious trend over the period.

Table 10. Evolution of cost efficiency (1995-2006) (All banks)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Croatia	0.731	0.782	0.770	0.764	0.837	0.842	0.833	0.799	0.819	0.799	0.814	0.797
Estonia	0.834	0.870	0.826	0.785	0.853	0.752	0.844	0.879	0.896	0.900	0.856	0.888
Hungary	0.806	0.822	0.798	0.799	0.830	0.812	0.813	0.786	0.834	0.793	0.770	0.747
Latvia	0.613	0.666	0.747	0.710	0.743	0.768	0.842	0.855	0.825	0.853	0.841	0.851
Poland	0.805	0.857	0.860	0.858	0.874	0.850	0.850	0.821	0.762	0.785	0.805	0.768
Slovenia	0.864	0.825	0.824	0.814	0.773	0.811	0.749	0.809	0.884	0.865	0.814	0.821
Turkey	0.824	0.838	0.845	0.867	0.874	0.711	0.815	0.740	0.794	0.823	0.787	0.858

A comparison of average cost efficiency estimates across listed and non-listed banks is reported in Table 11 and 12. The results reveal that stock-exchange listed banks in Hungary, Latvia, Poland and Turkey display superior cost efficiency compared with non-listed firms, implying that the listed banks are more cost-efficient. This finding, which is in accordance with other studies (Berger and Mester, 1997; Casu and Molyneux, 2000), may be indicative of the impact of the added regulatory pressure, informational transparency (through extra disclosure requirements) and market disciplining mechanism faced by the listed banks to operate more efficiently than non-listed banks. Moreover, this result is consistent with the market discipline hypothesis. More specifically, listed banks frequently have controlling shareholders who are regulated by a combination of legal and market techniques. However, in the case of Croatia, Estonia and Slovenia, average cost efficiency scores of non-listed banks are higher than the average for the listed banks. This result contrasts with much evidence from conventional banks, especially in the European area (Casu and Molyneux, 2000). It is, however, consistent with the result of study in Islamic banking (Yudistira, 2003)[46]. This may be due to slow developments of capital markets in these countries. Also, the expected disciplinary role and regulatory pressure may not materialize in the countries with emerging and transition markets, such as those included in the sample, because of the lack of corporate transparency. As can be inferred, no a priori expectation can be formed regarding the association of this variable with bank efficiencies. With respect to the overall cost efficiency scores, listed banks, with an average efficiency levels of around 0.817, are shown to be slightly more

[46] In these studies the dummy variable, which takes the value of 1 for listed banks is included into the analysis to distinct the efficiency scores between listed and non-listed banks. However, in this study, the average efficiency scores of listed and non-listed banks are estimated and thus a comparison of these scores has been reported.

efficient than their non-listed counterparts. The standard deviation in overall cost efficiency scores reveal that listed banks show a less variation than non-listed banks.

Table 11. Average cost efficiency scores (1995-2006) (Listed banks)

Countries in the sample	**Mean**	**Standard Deviation**	**Coefficient of variation**
Croatia	0.799	0.132	0.165
Estonia	0.787	0.124	0.158
Hungary	0.829	0.086	0.104
Latvia	0.802	0.075	0.093
Poland	0.837	0.080	0.095
Slovenia	0.799	0.035	0.044
Turkey	0.832	0.091	0.110
Overall	0.817	0.106	0.130
Trend			
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

Table 12. Average cost efficiency scores (1995-2006) (Non-Listed banks)

Countries in the sample	Mean	Standard Deviation	Coefficient of variation
Croatia	0.803	0.112	0.140
Estonia	0.850	0.066	0.078
Hungary	0.799	0.082	0.103
Latvia	0.779	0.155	0.199
Poland	0.826	0.099	0.120
Slovenia	0.826	0.071	0.086
Turkey	0.809	0.120	0.148
Overall	0.808	0.112	0.139
Trend			
1995	0.783	0.133	0.170
1996	0.806	0.118	0.146
1997	0.802	0.119	0.148
1998	0.778	0.144	0.185
1999	0.825	0.126	0.153
2000	0.818	0.095	0.116
2001	0.829	0.103	0.124
2002	0.813	0.094	0.116
2003	0.812	0.124	0.152
2004	0.806	0.085	0.105
2005	0.813	0.095	0.117
2006	0.803	0.106	0.131

The overall trend in the cost efficiency scores for both listed and non-listed banks is increasing. However, listed banks, with an increase of 0.041, performed better than non-listed over the time. Cost efficiency score reached maximum in 1998 (0.850) for the listed banks and in 2001 (0.829) for the non-listed banks.

Estimates of alternative profit efficiency scores of all banks in the sample for each country and the average for the all countries over the period 1995-2006 are reported in Table 13. Average profit efficiency score of all banks in the sample is 0.574, implying that during the period, the earnings of banks would have needed 57.4% of their potential profits on average. In other words, a profit inefficiency score of 0.476 indicates that an average bank could increase its profits by 47.6% if it was to meet the performance of the best-practice bank.

Comparing the efficiency scores obtained from cost and profit estimates, it seems that banks are more efficient in controlling costs than in generating profits, confirming the findings of previous studies (e.g. Berger and Mester, 1997; Lozano, 1997; Rogers, 1998; Maudos et al., 2002, Yıldırım and Philippatos, 2007 and Lozano-Vivas and Pasiouras 2008). 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, as 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 13. Average profit efficiency scores (1995-2006) (All banks)

Countries in the sample	**Mean**	**Standard Deviation**	**Coefficient of variation**
Croatia	0.630	0.149	0.237
Estonia	0.576	0.188	0.327
Hungary	0.487	0.252	0.517
Latvia	0.582	0.215	0.369
Poland	0.576	0.203	0.353
Slovenia	0.652	0.141	0.216
Turkey	0.481	0.273	0.569
Overall	0.574	0.213	0.371
Trend			
1995	0.647	0.164	0.254
1996	0.559	0.196	0.351
1997	0.566	0.204	0.361
1998	0.497	0.211	0.425
1999	0.556	0.215	0.387
2000	0.543	0.209	0.386
2001	0.514	0.235	0.458
2002	0.586	0.198	0.338
2003	0.597	0.209	0.349
2004	0.605	0.226	0.374
2005	0.618	0.216	0.350
2006	0.604	0.211	0.350

Regarding comparison of the cost and profit efficiency scores of banks in transition economies, a detailed explanation is needed due to their peculiar characteristics. The financial liberalization process and the integration of CEE countries to the EU put pressure the banking firms on improving their efficiency levels. After the elimination of the restrictions on the entry of foreign banks, there has been a heightened competitive pressure on the banks of transition countries from the developed European financial institutions, which operate at relatively lower margins due to the intense competition. In order to compete both in the domestic and international markets, banks have to minimize their operation costs, make optimal production plans, keep pace with the advanced technology and decrease excess capacity by merging with more efficient banks. Additionally, they may need to increase their production capacity through offering new services and products and concentrating on non-interest-income generating activities. Some banks which cannot keep pace with these developments in the industry will either be acquired or eventually driven out of market due to strong competition. Particularly, the customers of those banks will benefit from the increase in the efficiency levels as the decrease in costs will result in lowered prices and improved service quality. More importantly, the capacity of the banking system will be improved through increased efficiency and therefore, the changing needs of the customers of financial services will be better met.

Unlike the cost efficiency scores, profit efficiency scores vary greatly across countries, whereas the country ranking based on banks' average profit efficiency differs from that for cost. Profit efficiency scores range from 0.481 in Turkey to to 0.652 in Slovenia. After Slovenia, which has the highest profit efficiency score,

banking systems in Croatia were the second most profit efficient during the sample period. Regarding the overall average profit efficiency score of 0.574, Hungary (0.487) and Turkey (0.481) present profit efficiency scores below the average. These two countries have the least profit efficient banking systems among the sample countries. The coefficients of variation show greater dispersion for profit efficiency than for cost efficiency.

This result is consistent with the results of earlier studies such as those of Maudos et al., 2002, Kasman and Yıldırım, 2006. The difference between the least profit efficient system (Turkey) and the most profit efficient system (Slovenia) is around 0.171 points (17.1%). In all countries of the sample, profit efficiency is lower than cost efficiency, the extreme case being the difference of about 0.336 points. This implies that the performance of banks on the cost side are not be matched by their capability to create revenue. In the case of Latvia and Croatia, their profit efficiency scores are higher than the average for the region, in contrast to their cost efficiency, which is reported lower than the average in accordance with the result of other studies (Mamatzakis et al. 2008). Mamatzakis et al. (2008) explain that this improvement for Latvia and Croatia's ranking could be the outcome of providing financial services of higher quality, which generates additional profits at the expense of increasing operating costs. However, the opposite results are observed in the case of Turkey.

The inter-temporal comparison of scores suggests that profit efficiency score of the banks fell dramatically between 1995 and 2001, a continuous improvement is observed during the period 2002-2006[47], though not reaching the level of the year 1995. This result occurred in parallel with the impact of the transformation process conducted in the banking systems of the transition countries. The period 1995-2001 was characterized by the restructuring and privatization of state-owned banks, completion of debt consolidation, elimination of the restrictions on the domestic and market entries, recapitalization of banks and also development of regulatory frameworks and supervision. With these developments, the number of banks in these countries has fallen. However, the second period, where the profit efficiency score has shown a dramatic increase, corresponds to the impacts of these developments on the banking systems of transition countries (Kasman et al, 2010) Therefore, this result occurred in parallel with developments in the banking business, the stability of the regulatory framework and the relative stable macroeconomic conditions after the year 2002. In response to growing domestic and international competition and the integration process of the European markets, many banks aim to catch up with advances in technology stimulated by the foreign banks. The variation in profit efficiencies seems to have risen over time, indicating that the profit efficiency gap between the best and worst practice banks is widening. The standard deviation of efficiency score has jumped from 16.4% in 1995 to 21.1% in 2006.

[47] There is no a continuous improvement or decline in the cost efficiency scores of the banks during the period.

Table 14 presents the evolution of profit efficiency in each country. In general, there does not seem to be an obvious trend in the profit efficiency scores of each country over the sample period. However, particularly, profit efficiency scores have shown an increasing trend after the period 2002 in Croatia, Estonia, Poland and Slovenia, whereas the profit efficiency scores do not achieve the beginning level in 1995 for Estonia and Slovenia.

Table 14. Evolution of profit efficiency (1995-2006) (All banks)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Croatia	0.631	0.590	0.686	0.570	0.598	0.576	0.602	0.658	0.649	0.663	0.675	0.688
Estonia	0.669	0.659	0.474	0.443	0.500	0.499	0.466	0.604	0.692	0.685	0.639	0.509
Hungary	0.597	0.613	0.497	0.325	0.417	0.536	0.534	0.475	0.481	0.403	0.505	0.507
Latvia	0.705	0.562	0.598	0.512	0.618	0.595	0.486	0.606	0.645	0.663	0.554	0.469
Poland	0.646	0.474	0.509	0.476	0.526	0.406	0.433	0.577	0.695	0.703	0.688	0.720
Slovenia	0.714	0.612	0.560	0.619	0.622	0.620	0.696	0.622	0.630	0.713	0.726	0.691
Turkey	0.606	0.510	0.503	0.437	0.541	0.650	0.372	0.504	0.373	0.398	0.476	0.541

A comparison of average profit efficiency scores of listed and non-listed banks is reported in Table 15 and 16. The results indicate that listed banks in Estonia, Hungary, Poland and Turkey are more profit efficient than non-listed banks in these four countries. This result is consistent with the comparison of the cost efficiency results across listed and non-listed banks, except Latvia. Particularly, it can be stated that more cost efficient listed banks are also more profit efficient ones. On the other hand, in the case of Croatia, Latvia and Slovenia, non-listed banks display superior profit efficiency scores than those of listed banks. Specifically, the profit efficiency gap between listed and non-listed banks is highest in Slovenia, indicating that listed banks do not perform well in terms of profit efficiency. Regarding also relatively the lower cost efficiency scores of listed banks than non-listed bank in Slovenia, this result might be attributed to the slow development of Slovenia's capital markets. Among the listed bank average profit efficiency scores across countries, Croatia presents the highest profit efficiency score (0.592) whereas Slovenia displays the lowest score (0.429). Nevertheless, regarding the non-listed banks, the average profit efficiency score reaches the maximum level in Slovenia (0.665) and a minimum in Turkey (0.465). The opposite results observed reveal that while listed banks perform better in Turkey, non-listed banks are more profit efficient in Slovenia. Given relatively the structure of the system development in these countries, these results are not surprising. In the case of Slovenia, despite its successful transition to a market economy, Slovenia has lagged behind its EU peers in terms of financial system development. Due to the characteristics of the Slovenia's financial system, such as lower stock market turnover, rare public offerings and almost non-existent derivatives products, the higher cost and profit efficiency gap between non-listed and listed banks in Slovenia does not come as a surprise.

Table 15. Average profit efficiency scores (1995-2006) (Listed banks)

Countries in the sample	**Mean**	**Standard Deviation**	**Coefficient of variation**
Croatia	0.592	0.216	0.366
Estonia	0.584	0.144	0.247
Hungary	0.584	0.214	0.367
Latvia	0.532	0.267	0.502
Poland	0.587	0.180	0.307
Slovenia	0.429	0.108	0.252
Turkey	0.582	0.207	0.356
Overall	0.583	0.200	0.342
Trend			
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

Table 16. Average profit efficiency scores (1995-2006) (Non-Listed banks)

Countries in the sample	Mean	Standard Deviation	Coefficient of variation
Croatia	0.633	0.153	0.242
Estonia	0.581	0.178	0.307
Hungary	0.476	0.254	0.533
Latvia	0.576	0.217	0.376
Poland	0.573	0.205	0.357
Slovenia	0.664	0.130	0.196
Turkey	0.465	0.279	0.601
Overall	0.571	0.216	0.377
Trend			
1995	0.631	0.178	0.282
1996	0.553	0.203	0.368
1997	0.573	0.211	0.367
1998	0.496	0.225	0.454
1999	0.540	0.225	0.416
2000	0.537	0.204	0.381
2001	0.516	0.239	0.464
2002	0.587	0.199	0.340
2003	0.587	0.213	0.363
2004	0.602	0.228	0.378
2005	0.628	0.214	0.340
2006	0.608	0.196	0.322

3.5.2. Regression Results

Table 17 presents descriptive statistics for cumulative annual stock return series of banks for the seven countries studied. Within the period examined, the banking system in Croatia has exhibited the highest annual stock return of 86.3%, while that in Estonia exhibited the lowest annual stock return of 10.2%. Risk, measured by standard deviation of returns, ranges from 0.1% in Slovenia to 151.5% in Croatia. Of the seven countries' bank stock returns, Croatia, Hungary and Turkey are the most volatile, while Slovenia and Estonia are the least volatile.

The return distribution is positively skewed for all data countries except Latvia. The skewness in Slovenia is equal to zero, which is the characteristic of normal distribution. This may be due to the lack of sufficient data for the analysis. The relatively large value of kurtosis statistics exceeding three in Croatia and Poland suggest that underlying data are leptokurtic, or fat-tailed and sharply peaked about the mean when compared with the normal distribution. The rest return series with kurtosis of less than three have a platykurtic distribution, which has a lower, wider peak around the mean and thinner tails. The Jarque-Bera statistics and corresponding *p*-values in Table 17 are used to test the null hypothesis that the distribution of the return series is normally distributed. All *p*-values are greater than the 0.01 level of significance indicating that stock return series can be approximated by a normal distribution with the exception of Poland.

Table 17. Descriptive statistics of stock return series of bank

	Mean	Median	Maximum	Minimum	Standard Dev.	Skewness	Kurtosis	Jarque-Bera	No. of obs.
Croatia	0.863	0.487	7.658	-0.872	1.515	2.957	13.111	308.740 (0.688)	54
Estonia	0.102	0.068	0.806	-0.400	0.349	0.173	2.212	0.525 (0.769)	17
Hungary	0.309	0.181	1.469	-0.897	0.681	0.002	2.097	0.748 (0.000)	22
Latvia	0.508	0.607	0.945	-0.144	0.477	-0.265	1.374	0.731 (0.694)	6
Poland	0.119	0.084	1.932	-0.963	0.499	1.148	5.943	25.554 (0.000)	44
Slovenia	0.145	0.145	0.146	0.144	0.001	0.000	1.000	0.333 (0.846)	2
Turkey	0.349	0.358	1.770	-0.773	0.685	0.191	1.935	2.080 (0.353)	39

Regression results, derived from estimating equation 8, are reported in Table 18. As discussed in the methodology in detail, in choosing between fixed effects and random effects specifications, the Hausman test result is also presented to test the correlation between the effects and the regressors. In both cases, the chi-squares indicate that the fixed effects model should be preferred[48].

Table 18. 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)
R^2	0.527
Adjusted R^2	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)
R^2	0.526
Adjusted R^2	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).

[48] A main assumption in random effects estimation is the assumption that the random effects are not correlated with the explanatory variables. For this reason, a Hausman test is employed to compare the fixed and random effects estimates of coefficients (Baltagi, 2001). The Hausman test resulted in 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 5% level.

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[49] (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).

[49] 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).

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).

3.6. Summary and Conclusions

With the integration process of the EU, a special attention should be given to CEE countries because of enough credit for their achievements in creating market-oriented banking systems from almost a scratch to a moderate level in such a short time period. Even though there have been considerable disparities among their progress of achievement, most of these countries have passed the threshold point of other developed western countries that have made them part of the free market system.

As mentioned above, they were rather successful in the implementation of the privatization process, competitive policies and regulatory framework. The results of the privatization policies and large scale foreign participation in their banking systems led to an increase in the competitiveness of these CEE countries banks. Therefore, competition between banks, between banks and other financial institutions, domestic and foreign banks elevates the issue of cost and profit efficiency to the top of bank management priorities. Cost and profit efficiency

estimates of banks in transition economies are viewed as important ways to create economic soundness and survival.

Specifically, previous studies have concentrated in the examination of the cost and profit efficiency estimates in transition countries. However, 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. It aims to fill this void in the CEE countries banking literature.

The study goes further, looking for empirical evidence to support the hypothesis that publicly available information are reflected in the stock prices and also market discipline hypothesis which implies that banks whose shares are publicly traded would be expected to be more efficient, other things held constant, to the extent that stockholders of the firm can put forth discipline over the management.

To achieve the objectives of this study, stochastic frontier analysis is employed to estimate the cost and profit efficiency scores of banks of 39 banks operated in 7 transition countries during 1995-2006, while taking into account 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 results obtained from this study help clarify the ongoing debate of whether publicly available information are included in the stock prices in the transition countries.

The empirical tests reveal interesting results. The estimates of cost efficiency scores, based on common frontier with country specific environmental variables, have been obtained from stochastic translog cost function, including output levels, input prices and country-specific environmental variables. The results of cost efficiency scores across countries reveal that efficiency levels do not vary considerably, though some variation is evident. Cost efficiency values range from 0.786 in Latvia to 0.850 in Estonia. The results of the evolution of average estimated cost efficiency scores for each country over 1995-2006 period indicate that, in general, the cost efficiency estimates of individual countries do not represent any uniform trend.

A comparison of average cost efficiency estimates across listed and non-listed banks reveals that stock-exchange listed banks in Hungary, Latvia, Poland and Turkey display superior cost efficiency compared with non-listed firms, implying that the listed banks are more cost-efficient. This finding, which is in accordance with other studies (Berger and Mester, 1997; Casu and Molyneux, 2000), may be indicative of the impact of the added regulatory pressure, informational transparency (through extra disclosure requirements) and market disciplining mechanism faced by the listed banks to operate more efficiently than non-listed banks. Moreover, this result is consistent with the market discipline hypothesis. More specifically, listed banks frequently have controlling shareholders who are regulated by a combination of legal and market techniques. Comparing the efficiency scores obtained from cost and

profit estimates, it seems that banks are more efficient in controlling costs than in generating profits.

Unlike the cost efficiency scores, profit efficiency scores vary greatly across countries. Profit efficiency scores range from 0.481 in Turkey to 0.652 in Slovenia. The inter-temporal comparison of scores suggest that profit efficiency score of the banks dramatically fell between 1995 and 2001, a continuous improvement is observed during the period 2002-2006[50], though not reaching the level of the year 1995. The evolution of profit efficiency in each country shows that there does not seem to be an obvious trend in the profit efficiency scores of each country over the sample period. However, particularly, profit efficiency scores have shown an increasing trend after the period 2002 in Croatia, Estonia, Poland and Slovenia whereas the profit efficiency scores do not achieve the beginning level in 1995 for Estonia and Slovenia.

The results of average profit efficiency comparisons of listed and non-listed banks indicate that listed banks in Estonia, Hungary, Poland and Turkey are more profit efficient than non-listed banks in these four countries. This result is consistent with the comparison of the cost efficiency results across listed and non-listed banks, except Latvia. Particularly, it can be stated that more cost efficient listed banks are also more profit efficient ones. On the other hand, in the case of Croatia, Latvia and Slovenia, non-listed banks display superior profit efficiency scores than listed banks.
Turning to the relationship between efficiency changes and stock returns, the regression results indicate that profit efficiency changes have a positive and

[50] There is no a continuous improvement or decline in the cost efficiency scores of the banks during the period.

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[51] (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.

[51] 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).

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.

This study has contributed to the existing literature by presenting a panel data methodology and including some selected transition countries. Unfortunately, the availability of data restricted both the number of observations and the number of countries in the sample. For further research, even more robust results could be attained by expanding the sample period and countries with availability of a larger dataset.

CHAPTER 4

THE RELATIONSHIP BETWEEN ACCOUNTING AND MARKET MEASURES OF RISK

4.1. Introduction

The impact of accounting data on the stock prices of companies has received considerable attention of academic and investment communities for many years. The early empirical studies (Abdullah, 1993, 1995) indicate that stock prices either do not respond to the release of accounting data or that some variables are more influential on the stock price.

CEE countries have been operating organized stock markets in the last twenty years and went through a number of changes and developments in the process of economic development and during transition into EU. One of the issues between risk and stock market on which little research has been carried out in CEE countries is the link. This may be attributed to the absence of organized stock markets or to the difficulties in obtaining the required data to test the theoretical models developed mainly in the developed economies. The present study is conducted with the main objective of filling this gap via studying the relationship between accounting-based and market-determined risk measures of commercial banks of CEE countries during the period of 1995-2006. In particular, this section determines the extent to which accounting

variables explain the total and market risks (that will be defined later) in the banking industry.

The motivation of this study is two-fold. First, research on CEE countries` banks is important, as they stand as the predominant source of finance for businesses. Since the alternative sources of funds are not well-developed in these countries compared to their developed counterparts, the impact of borrowing on the financial statement of banks may be greater than in countries with more developed financial markets, when corporations are exposed to financial difficulties. Thus, using merely accounting ratios may be problematic. Second, due to the transition process into a market economy, the integration with the EU and its relative effects on the financial system, this study highlights the need for a set of market and accounting risk measures that are applicable across these countries.

The investigation of the link and degree of association between accounting-based and market-determined risks in banking institutions deserves special treatment because the deteriorating position of the financial institutions and a number of recent bank failures require renewed interest in investigating risk and stock price volatility of banks. Due to changes in the economic and regulatory environment including liberalization and globalization of financial markets, the uncertainty associated with the investment in bank stocks have increased. The financial regulatory authorities have been trying to monitor financial institutions more closely than before. A number of risk-adjusted financial ratios[52] have been used to reflect the riskiness of an institution to guide the depositors and investors in their financial decisions. However,

[52] A large number of different ratios have been used in the literature. These ratios provide information about banks' overall position, including capital adequacy, asset quality, management, earnings, liquidity and market risk.

because of the developments in the financial system and the regulatory environment, the accounting data is not solely sufficient for the assessment of the condition of the banking institutions. Thus, the shift has moved from the accounting risk measures to market-determined risk measures for the purpose of providing adequate information for depositors, investors and regulators to monitor the riskiness of each bank.

Accounting and capital market risk measures can be substituted for each other if they contain the same type of information and are expected to recommend the same decisions for the market participants. In case of difficulty of accessing the data on one risk measure due to the being costly or unavailable, the other alternative can be employed for decision making process without extra cost. However, if these two risk measures are not associated with each other, they will provide different types of information. Moreover, they will recommend conflicting results for the participants. Using both, rather than either, of these two risk measures is essential as each indicator incorporates new information.

The rest of this study is organized as follows. Section 4.2 discusses the risks in providing financial services. Section 4.3 reviews the existing literature. Section 4.4. describes the data and the methodology is presented in section 4.5. Section 4.6 presents the empirical results and section 4.7 includes concluding remarks.

4.2. Risks in Providing Financial Services

Banks, which provide financial services to the market participants due to the ability of banks to provide market knowledge, transaction efficiency and funding capability act as a principal in the transactions. They use their balance sheets to facilitate these transactions and to absorb the risks associated with it. Since the banks are in the risk business, they are exposed to many types of risks. “Risk”, in this context, may be defined as reductions in bank value due to the changes in the business environment. The risks that a bank face can be judged by looking at accounting data such as asset composition, quality, liquidity and capital adequacy. Financial theory states that the risk sensitivity of a bank can be judged by examining the returns required by financial markets. The financial characteristics of banks in many countries of transition economies will be determined using both accounting-based and market-based measures. In providing their financial services, banks expose to credit, liquidity, interest rate and capital (leverage) risks.

Asset quality is particularly important for the banks since it includes both the credit and interest rate risk exposures. Credit risk arises possibility of default by a borrower. It may arise from either an inability or unwillingness to perform in the pre-committed contracted manner. Therefore, the financial condition of the borrower as well as the current value of the underlying collateral is of considerable interest to the bank (Santomero, 1995). Credit risk is estimated by the proportion of assets that consist of loans or relative amount of past-due loans as well as loan losses. Credit risk is higher if the bank has more loans relating with the proportion of the total

assets or high loan loss reserves over the gross loans. This high leverage can bring insolvency and lead to write-offs.

Interest rate risk is concerned with the changes in the asset and liability returns and values due to the fluctuations in interest rates. Large fluctuations in interest rates can cause great depreciation or appreciation in the values of the assets or liabilities. Interest rate risk is measured by the ratio of interest-sensitive assets to interest-sensitive liabilities. If a bank has a ratio above 1.0, the returns of the banks will decrease with a decline in the interest rates, and increase with an increase in the interest rates. Because of the difficulty of predicting the direction of the interest rates, many banks suggest that if they have an interest rate sensitivity ratio close to 1.0, they can minimize interest rate risk. However, although it is difficult for some banks to achieve this ratio, this often can be reached only at the cost of lower returns on assets, such as short-term securities or variable-rate loans.

Liquidity risk shows the relationship of a bank's liquidity needs for meeting deposit outflows and loan increases versus its actual or potential sources of liquidity from either selling an asset it holds or acquiring additional liabilities. Liquidity risk can be approximated by the proportion of the liquid sources in the form of short-term securities in the total assets. This relationship is a beginning indicator of the liquidity risk of most banks. However, investment in short-term securities provides a sacrifice for the greater profitability of long term securities for the liquidity of short-term ones. The reverse would be the case if the long term securities were increased. Hence, if the bank holds more liquid assets over the total assets- a larger liquidity ratio-, it indicates that the bank can meet the needs for deposit outflows or loan

increases. The bank will be less risky, but also less profitable (Hempel and Simonson, 1999). In order to protect against the liquidity risk, a bank can lengthen the maturity of its liabilities or increase the marketability of its asset portfolio, therefore, giving itself the flexibility to take action to adverse developments in the markets for its liabilities by selling its assets. However, the efforts to reduce the liquidity risk by lengthening the maturity of the liabilities simultaneously affect the bank's exposure to interest rate risk given the difficulty of the future direction of the interest rates in developing countries, where the market is so volatile. As a consequence, the net effect of each adjustment on overall bank risk can be determined in detail.

Leverage (capital) risk, among other types of risks, has special interest to the regulators since the equity capital provides a cushion against the losses from operations or defaults on assets and lowering bankruptcy costs. The level of equity capital relative to total assets measures how much capital banks should hold against the losses. In order to minimize the capital risk the banks are exposed to and to avoid the insolvency, capital ratios are determined by the regulators in the markets. A lower ratio of equity capital to total assets increases the probability that temporary losses will reduce the banks capital below the level needed by the regulators from closing the banks and also indicates a greater exposure to the risk of failure, or smaller cushion to absorb losses from operations or defaults on assets. Banks benefit from a high equity capital to total assets ratio as it does not need to fund equity. However, higher equity ratio reduces returns to shareholders on their equity.

These accounting risk measures, which reflect the decisions of the banks about the uses and sources of the funds, determine the return and the level of risk for bank's shareholders. The net effect of the bank's decisions as reflected by their accounting-risk measures on the bank's market risk- in terms of return a bank must earn to compensate stockholders for bearing this risk can be determined only by relating them to market-determined risk measures estimated from stock price data.

4.3. Literature Review

4.3.1. Theoretical Background

Standing as the primary means of reducing uncertainty under which external users act, accounting data appears to provide useful information for potential investors, creditors and other users in making rational investment decisions under uncertainty. It is, however, argued that accounting data should also provide information which helps investors in assessing the market risks.

Portfolio theory specifies risk measures solely in terms of market variables (e.g., stock price variable). However, as discussed by Beaver et al., (1970), the risk determination is not complete without taking exogenous variables (e.g., non-price data) into account in evaluating security prices and price changes. Even though price levels as well as changes are the net ultimate decision variables regarding risk-return tradeoff an investor faces during the holding period, the current system in terms of decision-making criterion can not be assessed without knowledge of the interaction between the accounting data and market price variables.

Relevant literature has begun in the late 1960s with the publications of Sharpe (1964), Lintner (1965), and Mossin (1966). They extended the theory of Markowitz (1952, 1959) to a more simplified portfolio model, called as “diagonal model” and later on developed the famous a capital asset pricing model (CAPM). Markowitz (1959) defined the riskiness of a portfolio in terms of the variance of the portfolio’s return. The variance of a portfolio’s return includes two terms. The first term is the variances of the individual securities in the portfolio; the second term is the paired covariance of the each individual security with the rest of securities on the portfolio. As the number of securities increases in the portfolio, the portfolio may benefit from the diversification effect if the securities have negative or low covariance with other securities in the portfolio.

One limitation of the Markowitz portfolio theory is the huge amount of parameter estimation required to evaluate the variance of a portfolio’s return. Therefore, Sharpe (1963) suggested “diagonal model”, which decompose the return of the security into two components; a systematic component, which reflects movement of a single security’s return with the average return of all other securities in the market (economy-wide impacts) and individualistic component which reflects the residual portion of the security’s return. Similar to Markowitz model, as the number of securities increases, the second term goes to zero through efficient diversification in diagonal model. The only remaining component that can not be eliminated is the systematic component. The variance of the portfolio will differ among the portfolios with respect to the magnitude of the beta, B_i, systematic or unavoidable risk of the security, measuring the security’s sensitivity to market-wide factors.

The earlier studies by Sharpe (1964), Lintner (1965), and Mossin (1966) have then extended the portfolio models to CAPM, determines the equilibrium prices for all securities in the market. CAPM asserts that there exists a linear relationship between return and risk of a security. This risk-related variation in returns is generally not of interest to researchers concentrating on firm-specific accounting information and its relation to the firm-specific component of the stock return. Hence, the CAPM, along with the efficient market hypothesis, was helpful in estimating the firm-specific return component. The securities with identical beta do not necessarily result in the same total risk. The difference in total risk is due to the differing levels of firm-specific risk.

The market-determined risk measures refer to total risk, which is composed of two risks; systematic and unsystematic risk. Variations in accounting data relate to a stock's total risk. Systematic risk, which is important for the rational investors holding well diversified portfolios, is measured by beta[53] of stock. Unsystematic risk relates to the residual error terms from the market model[54]. Accounting risk measures[55], which convey information about the financial performance of firms, are used to determine whether they are impounded in the market-determined risk measures. If an association is observed between the accounting risk measures and market-determined risk measures, this supports the joint hypothesis that accounting

[53] Beta measures the volatility of an asset's rate of return in relation to the market rate of return.

[54] Statistical market model separates the total risk in two components. The expected rate of return on an asset is a linear function of a market factor common to all assets and of an independent factor unique to the particular asset. The statistic representing residual errors refers to the firm-specific risk, not explained by the market factors.

[55] Various accounting risk measures are used in the literature. See literature review for more discussion.

data reflect underlying events that determine the riskiness of the securities and also such events are also reflected in the market price of securities.

In terms of security valuation, accounting data is used to assess the "intrinsic value" of the securities for the purpose of discovering "overvalued" or "undervalued" securities (Graham et al., 1962). The notion of efficient market hypothesis (as mentioned above) supports the hypothesis that security prices are unbiased estimates of the intrinsic value and the market reacts simultaneously to the new information (Fama, 1965, Fischer et al., 1967, Ball and Brown, 1968). Without the possession of private information, the search for "overvalued" or "undervalued" securities would not be an optimal decision strategy. In efficient market hypothesis, the accounting-based data plays a crucial role in the decision-making process of the investors since it assists the investors in estimating the riskiness of the securities. Accordingly, they can select the optimal portfolio which maximizes their utility at a certain risk tolerance. In some cases where the accounting-based data can be employed to produce superior risk forecasts, the decision-making process of the individual investors can be improved.

4.3.2 Empirical Literature Review

A significant amount of literature has focused on the market measures of risk and accounting information in examining the risk assessment of the banking institutions. The pioneering work in the commercial banks was carried out by Pettway (1976), who studied the relation between market measures of risk and accounting information by considering the impact of the bank's capital position and other

accounting variables on market beta and the price-earnings ratios[56]. Using a sample of 38 large US banks and holding companies over the period 1971-1974, he found that bank equity was a significant determinant of a bank's price to earnings ratio in year 1972 and 1974 and of a bank's market beta in 1974.

Likewise, Jahankhani and Lynge (1980) analyzed the relationship between accounting measures of risk and market measures of risk[57] drawn from a sample of 95 commercial banks and bank holding companies in U.S. over the period 1972-1976. When market beta was used as the dependent variable, the dividend payout ratio, the loan-to-deposits ratio and the coefficient of variation of deposits were found to be statistically significant. The accounting variables in this model explained 26% of the variability in systematic risk. Using total risk (standard deviation of returns) as the dependent variable, all the accounting variables, with the exception of loan-to-deposit ratio were found to be statistically significant and they explained 43% of the variability in the total risk.

Rosenberg and Perry (1981) examined 124 large U.S. banks between the period March 1969-June 1977. Systematic and residual risks were used as dependent variables and a number of accounting variables were employed as independent variables. The results indicated that when systematic risk (beta) was used as the

[56]Even though capital asset pricing model is based upon *ex ante* observations, he used primarily *ex post* data. Market beta, as a dependent variable in the model, was derived from the past weekly prices. Breen and Lerner (1972) found that historical beta estimations would provide good predictions of company betas if the financial policies of the companies are consistent over time. Other accounting variables used in the model are return variables, price-relative variable (price-expected earnings ratio) risk variables (total capital / risk assets) and earning stability measure.

[57] While systematic and total risks were used as market-determined risk measures, seven accounting variables such as dividend payout, leverage, coefficient of variation of deposits, coefficient of variation of earnings per share, loan to deposit ratio, loan loss experience and liquidity ratio were used as proxies for accounting risk.

dependent variable, size, equity capitalization, dividend yield and the asset-to-long term-liability ratios were statistically significant. On the other hand, earnings variability and leverage in the capital structure were found to be the simple predictors of residual risk.

Lee and Brewer (1985) employed cross-section and time-series methodologies to examine the relation between accounting and market-determined risk measures for a sample of 44 banks and bank holding companies quarterly data over the period 1979-1982. The volatile liability ratio[58], leverage and dividend payout ratio were found to be statistically significant variables in explaining the systematic risk[59] and had the expected signs. When residual risk was introduced into the model as a dependent variable, most estimated coefficients had the expected signs and most of the variables were found to be statistically significant.

Karels et al. (1989) investigated the relationship between market-determined risk measures and an accounting risk measure proxied by the 'capital adequacy ratio' by using a sample of 24 U.S. banks' quarter data over the period 1977-1984. They found a negative relation between the capital adequacy ratio and systematic risk for each quarter, supporting the view that higher capital adequacy ratio provides a greater buffer against default risk and thus, implying less risk. They found a negative but statistically significant relation between the capital adequacy ratio and total risk

[58] Volatile liability ratio compares a bank's level of short term investment securities to volatile liabilities. Volatile liabilities are defined as short-term borrowed funds plus jumbo deposits. This ratio also gives an indication of the extent to which "hot" money is being used to fund the riskiest assets of the bank.

[59] Within each quarter, for each bank, systematic risk was estimated using market model based on daily return data for each bank and the S&P 500 index.

measure. However, the signs of the relation between capital adequacy ratio and unsystematic risk for each year were mixed.

Building upon the earlier work of Jahankhani and Lynge (1980), Mansur, Zangeneh and Zitz (1993) examined the effectiveness of financial ratios of banks in reproducing the market-determined measures of risk for a sample 59 U.S commercial banks over the period January 1986-September 1990. Several accounting variables such as stockholders' equity to total deposits, total loans to total deposit, net income to total asset, total loans to total assets, total loan loss reserve to total loan, cash and due from banks to total asset and coefficient of variation of deposits were used as independent variables, whereas total risk and systematic risk were used as dependent variables[60]. They reported that only the loan-loss-reserve- to-total-loans ratio and the coefficient of variation of deposits were found to be statistically significant determinants in explaining the systematic risk. Accounting variables in this model explained 35% of variability in systematic risk. However, using total risk as the dependent variable, only the liquidity ratio was found statistically significant and it explained 24% of the variability in total risk. Overall, these studies revealed that accounting and capital market risk measures are significantly related for US banks.

Elyasiani and Mansur (2005) examined a sample of 52 Japanese banks over the period 1986-1996. They analyzed the link between accounting variables and market measures of risk cross-sectionally by employing OLS and ridge regression techniques. Moreover, to estimate the market, interest and exchange rate risk of

[60]For each bank, accounting ratios were computed using quarterly data. The market-determined risk measures, systematic risk and total risk were calculated over the same time period using daily returns data.

Japanese banking institutions, a multi-factor GARCH model was employed. Empirical findings of this study illustrated that accounting variables contained some explanatory power in describing banks' market and foreign exchange risk. Based on the market beta model, assets-held-in-trading and dealing-accounts, cash and due from banks, provisions for credit loss, deposits of customers, and non-interest expense were all found to be significant. These variables also presented the expected signs. Furthermore, non-interest income, and foreign exchange denominated assets had an impact on the exchange rate risk. The contemporaneous association of market beta and accounting variables was found to be weaker in Japanese banking institutions compared to their U.S counterparts. It is worthwhile to note that Japanese banking institutions engage in a broader set of activities including investment and mortgage banking and ownership of stocks in commercial firms. As a result, the riskiness of these institutions tends to show less sensitivity to bank-related corporate decision variables in the short run.

Agusman et al. (2008) investigated the relation between accounting and capital market risk measures for 46 listed Asian Banks over the period 1998-2003. By employing a panel data analysis including a control for country-specific factors, the empirical results of this study indicated that the standard deviation of the return-on-assets and loan-loss-reserves-to-gross-loans are significantly related to total risk. Furthermore, gross-loans-to-total-assets and loan-loss-reserves-to-gross-loans are significantly related to unsystematic risk. Notwithstanding significant differences across Asian countries in terms of banking activities, capital adequacy requirements, and deposit insurance protection, these researchers strongly suggest that firm-specific risk is more important than systematic risk in their selected Asian countries.

4.4. Data

The accounting data – including balance sheet and income statements of banks – was drawn from BankScope database, which covers data belonging to10,227 banks world-wide. The BankScope data are supplemented with the data and information from annual reports of the banks. Daily closing prices of each bank were obtained from stock exchanges of each country in the sample. Accounting variables from the balance sheet and income statements are annual in frequency whereas stock return data are daily. The data set consists of end of day stock prices in local currencies. The local currencies are converted into U.S. dollar. Daily market indices for each country were extracted from Datastream. The data were adjusted for reporting errors, inconsistencies, missing values and extreme values.

The sample set includes information for an unbalanced of 191 observations on 39 commercial banks operating in seven CEE countries, that are already members of EU or are in the candidate status over the period from 1995 to 2006. The selection of countries is based on the data availability of bank stock price data. The countries included in the sample are Croatia (14), Estonia (2), Hungary (2), Latvia (2), Poland (9), Slovenia (1) and Turkey (9).

4.4.1. Variables

Accounting risk measures employed in the study as possible explanatory variables are equity to total assets ratio, gross loans to total assets ratio, loan loss reserve to gross loans ratio, liquid assets to total assets ratio. Table 19 presents the variables employed in this study along with their use in previous studies.

Table 19: Descriptions of independent variables and their use in previous studies

Independent Variables	Description	References
EQTA	Equity to total assets ratio	Pettway (1976); Jahankhani and Lynge (1980); Brewer and Lee (1986) and Karels et al. (1989)
GLTA	Gross loans to total assets ratio	Brewer and Lee (1986) and Mansur et al. (1993)
LLRGL	Loan loss reserve to gross loans ratio	Mansur et al. (1993) and Hassan (1993)
LQATA	Liquid assets to total assets ratio	Jahankhani and Lynge (1980) and Mansur et al. (1993)

Equity to total asset ratio, which is an important aspect of bank characteristics, is used as a proxy for leverage risk. This ratio measures the extent to which bank shareholders finance total assets. An intuitive argument is that lower ratio of equity to total assets provide a less buffer against default and therefore implies more market risk. This means that banks are most likely to go into bankruptcy when it is in trouble and facing default. Theoretically, therefore, a negative correlation would be expected between the equity to total asset ratio and various market risk measures.

Gross loans to total assets ratio measures both liquidity and credit risk for a bank. A high gross loan to total assets ratio could point out possible liquidity problem for a bank in the case of large unexpected deposit withdrawals or in a tight credit market environment. Subsequently, since the loans are considered as the most risk assets held by the bank, an increase in the loan to total asset ratio will increase the bank's credit risk. Therefore, theoretically, this ratio is expected to be positively related to market risk measures.

Loan loss reserve[61] to gross loans ratio, one of the common bank specific indicators, is used to measure the credit risk of a bank. Since the *ex ante* level of loan portfolio risk is not easily accessible, the allowance for loan loss reserve reveals the management's estimate of exposure to credit risk. A higher loan loss reserve ratio indicates that a higher degree of loss is expected in the loan portfolio. Hence, a positive relationship between the ratio of loan loss reserve to total loans and various measures of market risk is hypothesized.

Liquid assets to total assets ratio, which measures the percentage of total assets that are invested in the liquid assets, is used as a proxy for the liquidity risk of a bank. A higher ratio of liquid assets to total assets reflects the greater ability of the bank to absorb a cash outflow in the short run and therefore decreases the illiquidity risk. In this context, this ratio is expected to have a negative impact on various market risk measures.

Capital market risk measures, which are employed in the model as dependent variables, include systematic risk, unsystematic risk and total risk. As mentioned earlier, according to Markowitz (1959) theory, the riskiness of a portfolio is determined in terms of the variance of its returns, $\sigma^2(R_i)$. Sharpe (1964) extended the work of Markowitz and developed the *market model*. More specifically, based on this model, the return of a security is expressed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it} \qquad (9)$$

[61] Loan loss reserve is a contra-asset account to reflect the amount that a bank sets aside to cover estimated losses in the loan portfolio.

where R_{it} is the rate of return on security i on day t, α_i is the intercept, β_i is the market beta coefficient of security i, R_{mt} is the rate of return on market index for each country on day t and e_{it} is the disturbance term, which is assumed to be normally distributed with zero mean and variance of $\sigma^2(e_i)$. Market beta coefficients are estimated by using ordinary least square (OLS) technique and were corrected for autocorrelation wherever appropriate. A high beta reflects the expectations of the investors about a bank whose returns are more volatile compared to return on market portfolio.

Following the portfolio theory developed by Markowitz (1959) and market model by Sharpe (1964), the total risk of security, $\sigma^2(R_i)$, can be represented as

$$\sigma^2(R_i) = \beta_i^2 \sigma^2(R_m) + \sigma^2(e_t) \quad (10)$$

where the first term, $\beta_i^2 \sigma^2(R_m)$, is called as *systematic risk* of the ith security, which measures the sensitivity of a security to the market events, the second term, $\sigma^2(e_t)$ is called the *unsystematic risk*, which can be reduced to zero through diversification, is the residual errors from the market model. Even though the only relevant risk of security for a risk-averse investor is the systematic risk, two banks with the same beta do not necessarily result in the same total risk due to the differing levels of unsystematic risk. In this study, the systematic risk is measured by the beta of banks' stock returns and unsystematic risk is computed as the annualized standard deviation of residual errors form the market model and total risk is computed as the annualized standard deviation of the banks' daily stock returns.

4.5. Empirical Model

This study uses a panel data methodology. It has many advantages over othe methodologies. Panel data methodology controls for individual heterogeneity, gives more informative data, provides more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Klevmarken, 1989; Hsiao, 1986 and Baltagi, 2003). Furthermore, Baltagi (2003) and Hsiao (1986) indicate that panel data methodology specifies the time varying relation between dependent and independent variables.

There are several types of panel data models including constant coefficients model[62], fixed effects model and random effects model. To determine the choice of the appropriate methodology, several specification tests are employed. The likelihood ratio (LR) test is used to determine whether the fixed effects model outperforms the pooled OLS. The appropriateness of the random effects model relative to the pooled OLS is examined with the Breusche-Pagan Lagrange Multiplier (LM) test. Hausman's test is conducted to compare the fixed effects model with the random effects model. In all the specifications, pooled OLS is rejected at conventional significance levels. In a majority of specifications, the Hausman test urges the use of fixed effects estimation.

[62] 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).

In the light of previous literature and in the sprit of the earlier work of Jahankhani and Lynge (1980), Mansur et al. (1993) and Agusman et al. (2008), this study empirically tests the relations between accounting ratios and capital market risk measures by using the following specification:

$$CPMRM_{its} = \alpha + \beta_1 EQTA_{its} + \beta_2 GLTA_{its} + \beta_3 LLRGL_{its} + \beta_4 LQATA_{its} + \varepsilon_{it} \quad (11)$$

where $CPMRM_{its}$ represents total return risk, systematic risk or unsystematic risk respectively of bank i at time t in country s, $EQTA$ denotes equity to total assets ratio, $GLTA$ denotes gross loans to total assets ratio, $LLRGL$ denotes loan loss reserves to gross loans ratio, $LQATA$ denotes liquid assets to total assets ratio. α represents the overall constant in the model, whereas β's represents slope parameters and ε_{it} are the error terms for *i=1,2, ….N* cross-sectional units (banks) observed for dates periods *t=1,2,….T*.

4.6. Empirical Results

Table 20 represents descriptive statistics of the market-determined and accounting-based risk measures. The data in general are highly skewed except systematic risk measure and gross-loan to total assets ratio. Systematic risk measure has the highest standard deviation. The results of which estimate the relationship between each market-determined risk measure and the accounting-based risk measures are shown in Table 21.

Table 20. Descriptive statistics of the market-based and accounting-based risk measures

Variables	Mean	Median	Standard Deviation	Minimum	Maximum	Skewness
Total return risk	0.073	0.034	0.165	0.011	1.737	7.034
Systematic risk	0.371	0.588	3.641	-0.018	0.103	-2.354
Non-systematic risk	0.105	0.027	0.647	0.000	8.793	12.840
EQTA	0.113	0.103	0.053	0.028	0.435	1.873
GLTA	0.527	0.534	0.125	0.222	0.853	-0.068
LLRGL	0.050	0.038	0.050	0.000	0.258	1.227
LIQATA	0.386	0.381	0.127	0.077	0.693	0.048

This table presents the descriptive statistics of the raw variables. This study uses annual observations of capital market listed commercial banks in 7 countries in Central and Eastern European over the period 1995-2006. Total return risk is the annualized standard deviation of the bank's daily stock returns. Systematic risk is the beta of the bank's stock returns Non-systematic risk is the annualized standard deviation of residual errors from the market model. EQTA is the ratio of equity to total assets; GLTA is the ratio of gross loans to total assets; LLRGL is the ratio of loan loss reserves to gross loans; LIQATA is the ratio of liquid assets to total assets. There are 191 observations.

Table 21. Estimated coefficients from regressing market-based risk measures on accounting risk measures, years 1995-2006

Dependent Variables		**Panel A Total return risk**		**Panel B Systematic risk**		**Panel C Non-systematic risk**	
Independent Variables	***Expected Sign***	***Pooled OLS***	***Fixed Effects Model***	***Pooled OLS***	***Fixed Effects Model***	***Pooled OLS***	***Fixed Effects Model***
Constant		— 0.284 (-1.388)	-0.413 (-1.488)	7.185** (1.969)	5.381*** (4.212)	-0.494 (-0.596)	-0.208 (-0.312)
EQTA	Negative	0.079 (0.355)	-0.460* (-1.902)	0.325 (0.081)	10.161 (1.188)	1.919** (2.107)	-2.033 (-0.712)
GLTA	Positive	0.380* (1.694)	0.636** (2.208)	-8.071** (-2.018)	-7.127*** (-3.279)	0.617 (0.679)	0.920 (1.364)
LLRGL	Positive	0.865*** (3.425)	0.115 (0.905)	1.202 (0.267)	0.717 (0.230)	0.621 (0.606)	0.125 (0.292)
LIQATA	Negative	0.272 (1.204)	0.511* (1.704)	-6.380 (-1.584)	-5.810** (-2.996)	0.069 (0.075)	0.136 (0.511)
R^2		0.10	0.43	0.03	0.28	0.04	0.31
F statistics		1.378	-	1.212	-	1.879	-
N		191	191	191	191	191	191
Specification Tests: F-test (pooled OLS vs. Fixed Effects Model Hausman Test (Fixed Effects Model vs. Random Effects Model			2.048*** 7.628*		1.020*** 7.715*		1.191*** 8.989*

Total return risk is the annualized standard deviation of the bank's daily stock returns. Systematic risk is the beta of the bank's stock returns Non-systematic risk is the annualized standard deviation of residual errors from the market model. EQTA is the ratio of equity to total assets; GLTA is the ratio of gross loans to total assets; LLRGL is

the ratio of loan loss reserves to gross loans; LIQATA is the ratio of liquid assets to total assets. There are 191 observations. ***, ** and * statistically significant at the 1. 5 and 10% levels respectively. *t*-statistics are in parentheses. The estimated model below represents the relationship between accounting and capital market risk measures;

$$CPMRM_{its} = \alpha + \beta_1 EQTA_{its} + \beta_2 GLTA_{its} + \beta_3 LLRGL_{its} + \beta_4 LQATA_{its} + \varepsilon_{it}$$

Where $CPMRM$ refers to the total return risk. systematic risk and non-systematic risk. β_1 . β_2 . β_3 . β_4 refer to the accounting risk measure coefficients.

The significant F-test indicates that the fixed-effects model outperforms the pooled OLS. Additionally, the Hausman test resulted in a Chi-square statistic equal to 7.628 (with 4 degrees of freedom) for total risk and 7.715 (with 4 degrees of freedom) for systematic risk, and 8.989 (with 4 degrees of freedom) for unsystematic risk which are both statistically significant at the 10% level. Therefore, Hausman test indicates that the fixed effects model is more superior to the random effects model for these three equations. The presence of heteroskedasticity and autocorrelation is removed using appropriate tests[63].

Panel A in Table 21 presents the results of the relationship between total risk and the selected accounting-based ratios, including equity to total asset ratio (EQTA), gross loans to total assets ratio (GLTA), loan loss reserve to gross loans ratio (LLRGL) and liquid assets to total assets ratio (LIQATA). The fixed effects specification indicates that when total return risk is used as the dependent variable, the equity to total assets ratio, gross loans to total assets ratio and liquid assets to total assets ratio are found to be statistically significant. However, loan loss reserve to gross loan ratio is not statistically significant determinant in explaining the total return risk of the banks. The equity to total assets ratio and gross loans to total assets ratio have the expected signs, whereas the sign of the coefficients of the liquid assets to total assets does not conform the hypothesized relationship. The equity to total assets ratio, which is also a measure of capital adequacy ratio, indicates that how much total asset values may decline before the position of the bank's depositors and other creditors is

[63] Since the data are pooled, heteroskedascitiy and autocorrelation may influence the results of OLS. For the panel data analysis, as the presence of heteroskedasticity and autocorrelation will be serious failures, the coefficients are not consistently estimated. Hence, a likelihood ratio test and the Wooldridge test identified the heteroskedasticity and autocorrelation, respectively.

jeopardized[64]. Hence, an increase in the equity to total asset ratios will result in a decrease in the bank's return risk that the shareholders will be exposed to since the shareholders know that the bank to hold more equity against the default.

The gross loans to total assets ratio is used as a measure of the credit risk, which is defined as the risk that the interest, or principal, or both, on securities and loans will not be paid as promised. If the bank has more loans, it will be exposed to more credit risk. Therefore, this results in an increase in the market risk of the banks as the shareholders perceive the higher loan level as a risky position. These two accounting based risk measures are used as the explanatory variables in explaining the total return risk.

The liquid assets to total assets ratio is a proxy measure for the liquidity risk of a bank. Liquidity risk shows the relationship of a bank's liquidity needs for meeting deposit outflows and loan increases versus its actual or potential sources of liquidity from either selling an asset it holds or acquiring additional liabilities (Hempel and Simonson, 1999). Thus, a large liquidity ratio for a bank indicates a less risky bank. However, even though the sign is expected to be negative, the coefficients of the liquidity to total assets ratio turns out to be positive, indicating that an increase in the liquidity ratio results in an increase in the bank risk. The sign of this ratio is not consistent with the results of similar studies carried out in the most developed stock markets those of Jahankhani and Lynge (1980) and Mansur et al. (1993). This difference can be explained by the argument that shareholders perceive the increase in the liquid assets (such as short term instruments and securities) of a bank as a risky position since the stock markets and, of course, the instruments in those stock

[64] A bank with 10 percent equity to total assets ratio could withstand greater declines in asset values than a bank with 5 percent equity to total assets ratio.

markets of transition countries are not well-developed. The reliance on these is not so high by the shareholders.

Panel B in Table 21 presents the relationship between the systematic risk and the accounting-based ratios. The F-test indicates that the fixed effects model outperforms the pooled OLS and the Hausman test determines that the fixed effects model is more superior to random effects model[65]. The coefficients of the fixed effects model pertaining to the dependent variable of systematic risk, with the exception of equity to total assets ratio and gross loans to total assets ratio, carried signs which had been hypothesized in Table 19. However, only the coefficients associated with gross loans to total assets ratio and liquid assets to total assets ratio are statistically significant at 10% and 5% levels, respectively. Equity to total assets ratio and loan loss reserves to gross loans ratio are not statistically significant in explaining the variation in systematic risk. When the systematic risk is used as the dependent variable in this study, only the coefficients of the equity to total assets ratio turned out to be statistically insignificant. This indicates that even though equity to total assets ratio has an explanatory power in explaining the variation in total return risk, it does not explain the variability in the systematic risk. Surprisingly, the sign of the coefficient of the gross loans to total assets ratio turned out to be the negative which is the opposite of what has been hypothesized in Table 19, when the systematic risk is used as the dependent variable. This means that an increase in ratio of loans to total assets will result in a decrease in the systematic risk of the banks. The reason behind this is that the higher level of loans does not produce a threat for the systematic risk. In the

[65] The F-test resulted in a statistic equal to 2.048 is statistically significant at 1% level, which rejects the null hypothesis, which states that the panel data are not poolable. The Hausman test resulted in a Chi-square statistic equal to 7.715 (with 4 degrees of freedom), which is statistically significant at the 10% level.

case of systematic risk used as the dependent variable, the ratio of liquid assets to total assets ratio exhibit expected negative relationship, which has been hypothesized above.

The final panel, Panel C in Table 21, indicates the results of the relationships between the unsystematic risk and the selected accounting-based financial ratios. Both the results of the F-Test and the Hausman test suggest that the fixed effects model is more superior to the Pooled OLS and the random effects model[66]. Surprisingly, when unsystematic risk is used as the dependent variable, none of the coefficients are statistically significant, implying that they do not have any explanatory power in explaining the variability in unsystematic risk. However, all of the coefficients, with the exception of the liquid assets to total assets ratio, have the expected sign, which has been hypothesized in the table above.

These findings suggest that total return risk and systematic risk are perceived more by the shareholders in these countries than unsystematic risk. The accounting variables are more important in explaining systematic and total retrun risk than unsystematic risk. When total risk or systematic risk is the dependent variable, some of the coefficients have an explanatory power in explaining the variation in these risks. However, it is noteworthy that none of the coefficients are able to explain the variability in unsystematic (firm-specific) risk. These are not consistent with the results of similar studies carried out in developing countries' stock markets those of Agusman et al. (2008). In the study of Agusman et al. (2008), unsystematic risk is found to be more important in the Asian countries than systematic risk, consistent

[66] The F-test is statistically significant at 1% and the Hausman test resulted in a Chi-square statistic equal to 8.989s (with 4 degrees of freedom), which is statistically significant at the 10% level.

with the results of Claessens et al. (2000) who imply the fact that most Asian listed firms are controlled by a single shareholder. This would also suggest this major shareholder can substantially impact the behavior of the bank and may be concerned with bank-specific (unsystematic risk) than systematic risk (country-risk). However, this study reveals the fact that many of the transition countries are affected by the systematic risk rather than unsystematic risk. As opposed to the Asian listed banks, the banks in CEE countries are not controlled by the major shareholders. The key reforms implemented at the transition process include restructuring, rehabilitation and privatization of the state-owned banks to create competitive pressure and increase the efficiency of the sector. Through the eliminations of the restrictions on foreign entry, the number of banks also dramatically increased (Tang et al. 2000). Foreign banks, which dominate the banking sector in most CEE countries, were considered to produce positive externalities to the sector as a whole by providing know-how and expertise. Allowing the entry of foreign banks also enhanced the competition and efficiency of the banking sector with strong competitive pressure. Therefore, the foreign banks and also international investors became more concerned with the banking sector in each transition country. On the other hand, systematic risk measure, which is country-specific or market risk, is more pronounced in the transition countries[67]. Instead of individual bank risk management, general capital market conditions in these countries become more important. The country-specific characteristics such as different regulatory environments, capital adequacy requirements and also market sophistication are not so homogenous across these transition countries even though the EU has tried to provide uniformity through the

[67] Even though the finance literature mostly investigates the important role of the systematic risk (beta), some researchers, such as Goyal and Santa-Clara, (2003), state that unsystematic risk (firm-specific risk) is much more important.

financial and economic adaptation. Economic factors, changes in the interest rate levels, inflation, as well as political factors refer to the systematic risk factors.

Specifically, the ratio of loan loss reserves to gross loans produced a statistically significant relationship with the systematic risk in the study of Mansur et al. (1993) and statistically significant relationship with the systematic risk and total risk in the study of Agusman et al. (2008). However, the ratio of loan loss reserves to gross loans in this study did not have a statistically significant relationship with the total risk, systematic risk and unsystematic risk.

As a comparison, the pooled OLS results indicate that gross loans to total assets ratio and loans loss reserves to gross loans ratio have a positive and significant relationship with total return risk. However, when systematic risk is used as the dependent variable, only gross loans to total assets ratio shows the significant but the opposite sign, which has been hypothesized in the table above. In the case of unsystematic risk, only the equity to total assets ratio produces a significant but positive relationship, which is the opposite of what has been expected.

In terms of the explanatory power, the use of panel data methodology produces R^2 values for the total return risk, systematic risk and unsystematic risk. Accounting-based risk measures explain 43% of the variability in total return risk; 28% of variability in systematic risk and 31% of the variability in unsystematic risk. The results are comparable to Agusman et al. (2008) who use the similar techniques in the Asian banks and report an R^2 of 63% for total return risk, 45% for systematic risk and 60% for unsystematic risk models. The reason of producing lower R^2 values

compared to the results of Agusman et al. (2008) may be due to the lower number of observations.

4.7. Summary and Conclusions

Knowledge of the impact of financial decisions about the uses and sources of funds on the bank risk is an important issue to the management of the bank trying to maximize the wealth of the bank shareholders. Despite its special importance, little recent literature focuses on this issue. The majority of the studies has concentrated on developed markets, particularly the U.S. and Japan but ignores the developing countries[68]. This study aims to fill this gap in the literature by providing further insight into the relationship between accounting and market-determined risk measure by focusing on the transition countries, which have different economic and financial backgrounds from other developing countries. The slow development of the stock markets in transition countries relative to the developed countries and the difficulties in obtaining the required data to test the theoretical models, which are developed and examined mainly in developed economies, caused these countries not to be studied well. Specifically, this study scrutinizes the relationship between accounting and market-based risk measures and whether the financial decisions determined by the managers as reflected by the accounting risk measures can affect market risk in terms of return a bank must earn to compensate stockholders for bearing this risk by concentrating on the following primary objectives:

a) For the assessment of the condition of the banking institutions, identify the accounting-based risk measures that are reflected in the balance sheet of the

[68] Agusman et al. (2008) was the first study who investigated this issue on the emerging countries.

banks as a result of the financial decisions, and determine which accounting variable explains which type of risk,

b) Since accounting-based data is not solely sufficient for the assessment, specify market-based risk measures for the purpose of providing adequate information,

c) Determine the extent to which accounting variables explain total, systematic or unsystematic risk, which is calculated by using the stock price data of the banks traded in the transition economies' stock market.

The results obtained from this study help clarify the ongoing debate about the impact of the accounting data on the stock prices.

To achieve the aforementioned objectives, an unbalanced 191 observations of 39 commercial banks operating in seven CEE countries, that are already members of EU or are in the candidate status over the period from 1995 to 2006 have been used. The accounting-based risk measures, which are chosen with respect to their proxy for the risk exposure, are the ratio of equity to total assets, the ratio of gross loans to total assets, the ratio of loan loss reserves to gross loans and the ratio of liquid assets to total assets. In addition to accounting-based risk measures, market-determined risk measures are divided into three, namely total risk, systematic risk and unsystematic risk.

Panel data methodology, which controls for individual heterogeneity and reduces the problems associated with multicollinearity and estimation bias, is used to investigate the relationship between these two risk measures. The Hausman test indicates that

fixed-effects model is more superior to the random effects model. Empirical tests reveal some interesting results.

The fixed effects specification indicates that when total return risk is used as the dependent variable, the equity to total assets ratio, gross loans to total assets ratio and liquid assets to total assets ratio are found to be statistically significant. However, loan loss reserve to gross loan ratio is not statistically significant determinant in explaining the total return risk of the banks. The equity to total assets ratio and gross loans to total assets ratio have the expected signs, whereas the sign of the coefficients of the liquid assets to total assets does not conform the hypothesized relationship. As a consequence, the equity to total assets ratio and gross loans to total assets ratio are used as the explanatory variables in explaining the total return risk. An increase in the equity to total asset ratios will result in a decrease in the bank's return risk that the shareholders will be exposed to since the shareholders know that the bank to hold more equity against the default. If the gross loans to total assets ratio, used as a proxy for credit risk, increases, this will result in an increase in the market risk of the banks as the shareholders perceive the higher loan level as a risky position.

However, for the liquid assets to total assets ratio, even though the sign is expected to be negative, the coefficients of the liquidity to total assets ratio turns out to be positive, indicating that an increase in the liquidity ratio results in an increase in the bank risk. The sign of this ratio is not consistent with the results of similar studies carried out in the most developed stock markets those of Jahankhani and Lynge (1980) and Mansur et al. (1993). This difference can be explained by the argument that shareholders perceive the increase in the liquid assets (such as short term

instruments and securities) of a bank as a risky position since the stock markets and, of course, the instruments in those stock markets of transition countries are not well-developed. The reliance on these is not so high by the shareholders.

When systematic risk is used as the dependent variable, all the accounting variables, with the exception of equity to total assets ratio and gross loans to total assets ratio, carried expected signs. However, only the coefficients associated with gross loans to total assets ratio and liquid assets to total assets ratio are statistically significant at 10% and 5% levels, respectively. Equity to total assets ratio and loan loss reserves to gross loans ratio are not statistically significant in explaining the variation in systematic risk. This indicates that even though equity to total assets ratio has an explanatory power in explaining the variation in total return risk, it does not explain the variability in the systematic risk.

When the unsystematic risk is used as the dependent variable, none of the coefficients are statistically significant, implying that they do not have any explanatory power in explaining the variability in unsystematic risk. However, all of the coefficients, with the exception of the liquid assets to total assets ratio, have the expected sign, which has been hypothesized above.

These findings suggest that total return risk and systematic risk are more important in these countries than unsystematic risk. When total risk or systematic risk is the dependent variable, some of the coefficients have an explanatory power in explaining the variation in these risks. However, it is noteworthy that none of the coefficients are able to explain the variability in unsystematic (firm-specific risk). These are not

consistent with the results of similar studies carried out in developing countries' stock markets those of Agusman et al. (2008). This study reveals the fact that many of the transition countries are affected by the systematic risk rather than unsystematic risk. The banks in CEECs are not controlled by the major shareholders. The key reforms implemented at the transition process include restructuring, rehabilitation and privatization of the state-owned banks to create competitive pressure and increase the efficiency of the sector. The foreign banks and also international investors became more concerned with the banking sector in each transition country. On the other hand, systematic risk measure, which is country-specific or market risk, is more pronounced in the transition countries[69]. Instead of individual bank risk management, general capital market conditions in these countries become more important. The country-specific characteristics such as different regulatory environments, capital adequacy requirements and also market sophistication are not so homogenous across these transition countries even though the EU has tried to provide uniformity through the financial and economic adaptation. Economic factors, changes in the interest rate levels, inflation, as well as political factors refer to the systematic risk factors.

Similar to previous studies, the accounting ratios explain a substantial portion of capital market risk. Surprisingly, the results are robust, although some differences exist across transition countries in banking activities, capital adequacy requirements and the depth of the stock markets.

[69] Even though the finance literature mostly investigates the important role of the systematic risk (beta), some researchers, such as Goyal and Santa-Clara, (2003), state that unsystematic risk (firm-specific risk) is much more important.

The results of this study also include vital implications for depositors, investors and regulators who monitor the riskiness of the banks. Accounting and capital market risk measures can be substituted for each other if they contain the same type of information and are expected to recommend the same decisions for the market participants. In case of difficulty of accessing the data on one risk measure due to the being costly or unavailable, the other alternative can be employed for decision making process without extra cost. However, if these two risk measures are not associated with each other, they will provide different types of information. Moreover, they will recommend conflicting results for the participants. Using both, rather than either, of these two risk measures is essential as each indicator incorporates new information.

This study has attempted to provide deeper insight into the effect of the accounting-based risk measures on the market-determined risk measures of banks and contributed to the existing literature by presenting a panel data methodology and including some selected transition countries. Unfortunately, the availability of data restricted both the number of observations and the number of countries in the sample. For further research, even more robust results could be attained by expanding the sample period and countries with availability of a larger dataset.

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APPENDIX A: Charts and Plots of the Efficiency Scores and the Respective Return Series

Figure 3

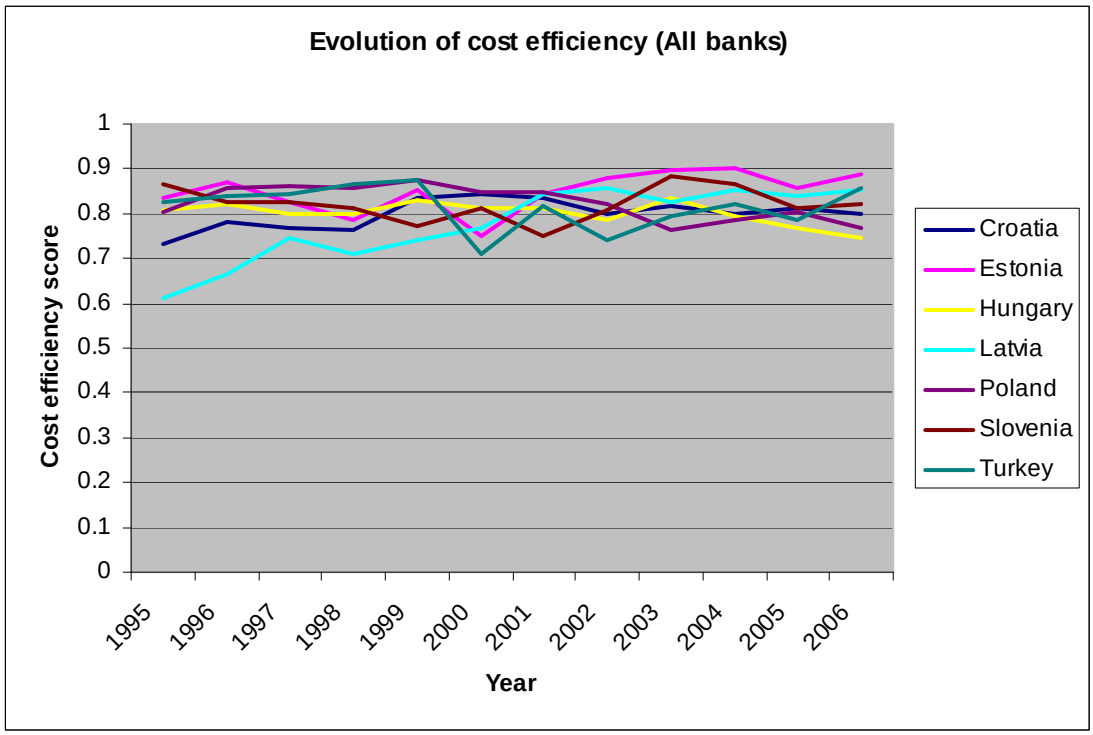


Figure 4

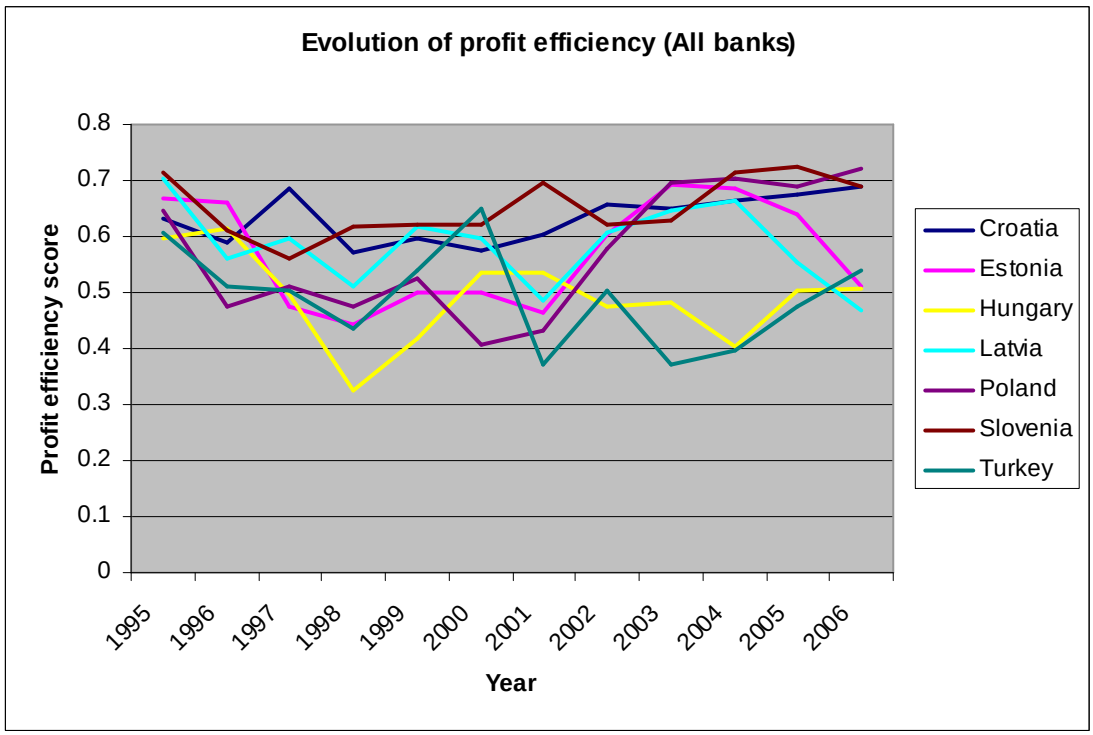


Figure 5

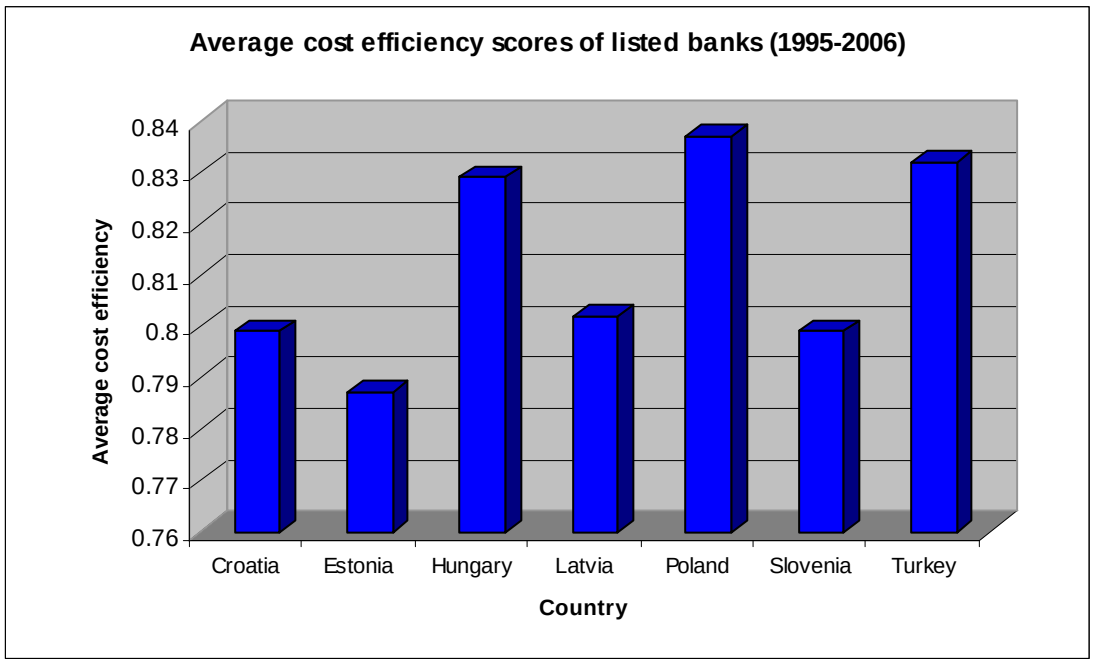


Figure 6

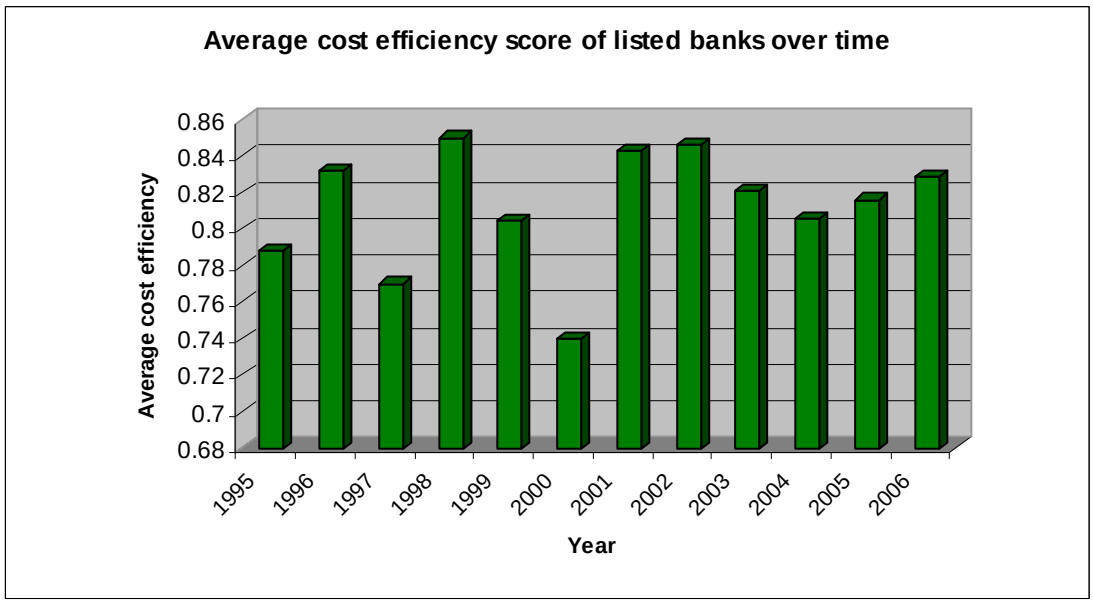


Figure 7

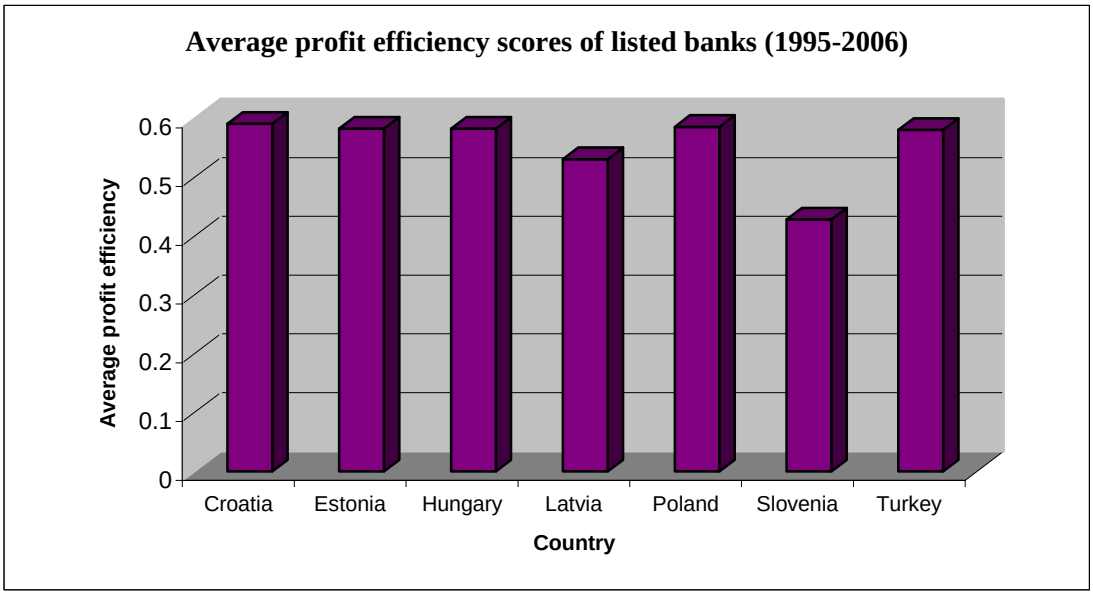


Figure 8

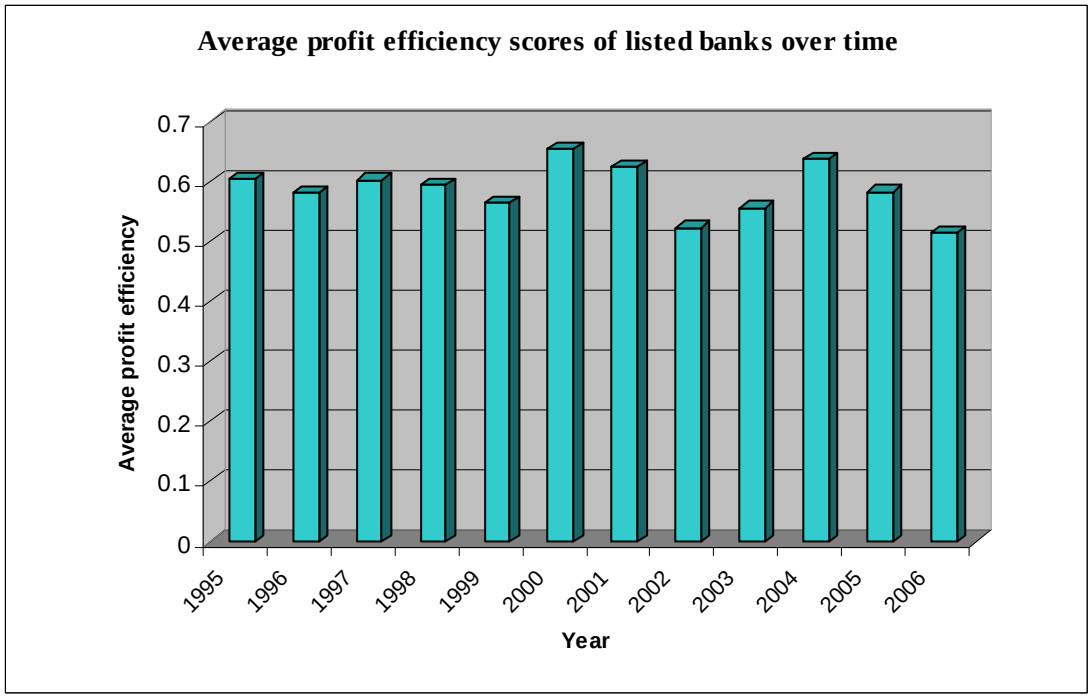
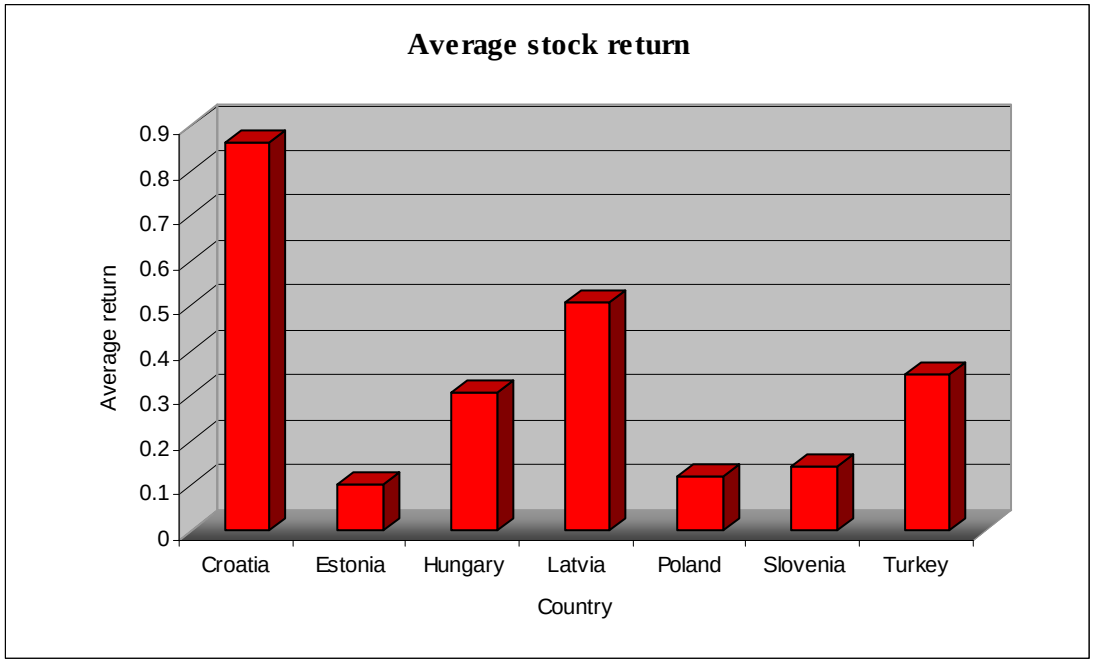


Figure 9


Average stock return
Average return
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Croatia
Estonia
Hungary
Latvia
Poland
Slovenia
Turkey
Country

VITA

Gülin Vardar was born in Izmir on March 4, 1980. She received her B.S. degree in City and Regional Planning from Middle East Technical University in June 2002. She graduated from Izmir University of Economics in 2005 from the Department of Business Administration, in a major field of finance. She started her PhD in the Department of Business Administration in a major field of finance in Izmir University of Economics in 2005. At the same time, she started to work as a research assistant at the Department of International Trade and Finance. Since 2008, she has been working as an instructor in the Department of International Trade and Finance at Izmir University of Economics. She teaches business finance and financial mathematics courses. Her research is focused on stock markets and banking. Her academic papers have been published in peer-reviewed journals such as *Economic Modelling, İktisat, İşletme ve Finans, Review of Middle East Economics and Finance and European Journal of Economics, Finance and Administrative Sciences*.