5-2003

Competition and Contestability in Central and Eastern European Banking Markets

H. Semih Yildirim
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by H. Semih Yildirim entitled "Competition and Contestability in Central and Eastern European Banking Markets." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

George C. Philippatos, Major Professor

We have read this dissertation and recommend its acceptance:

Ronald E. Shrieves, M. Cary Collins, Hui Chang

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by H. Semih Yildirim entitled "Competition and Contestability in Central and Eastern European Banking Markets". I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements of the degree of Doctor of Philosophy, with a major in Business Administration.

George C. Philippatos

Major Professor

We have read this thesis
and recommend its acceptance:

Ronald E. Shrieves

M. Cary Collins

Hui Chang

Accepted for the Council:

Anne Mayhew
Vice Provost and
Dean of The Graduate Studies

(Original signatures are on file with official students records.)

COMPETITION AND CONTESTABLITY IN CENTRAL AND EASTERN EUROPEAN BANKING MARKETS

A Dissertation

Presented for the

Doctor of Philosophy Degree

The University of Tennessee,

Knoxville, Tennessee

H. Semih Yildirim

May 2003

DEDICATION

This dissertation is gratefully dedicated to my parents for instilling in me the values of hard work, a good attitude and persistence, and for stressing the value of education. Their love, concern and pride in my work were always a major source of strength to me. This dissertation is also dedicated to my beloved wife, Melahat, for always giving me the inspiration to set high goals and the confidence to achieve them. Without her encouragement, support and personal sacrifices I could not have done it.

ACKNOWLEDGEMENTS

I gratefully acknowledge the advice and support of my dissertation committee, George C. Philippatos, Ronald Shrieves, M. Cary Collins, and Hui Chang. Their teaching and encouragement are ultimately responsible for this dissertation. I owe a special debt to George C. Philippatos, whose guidance has stimulated my research in countless ways and whose friendship is yet more valuable. I wish to express my sincere appreciation and thanks to all faculty members, colleagues, and staff in the Finance Department for their academic and professional support and friendship. I thank the University of Tennessee, College of Business Administration, and the SARIF Foundation for financial support.

ABSTRACT

This study attempts to analyze the effects of financial liberalization and deregulation on competitive conditions in the banking industries of fourteen Central and Eastern European (CEE) transition economies using firm-level data for the period 1993-2000. The basis for the evaluation of competitive situation is the extant oligopoly theory in the new industrial organization literature, specifically, the competition model developed by Rosse and Panzar (1977), and Panzar and Rosse (1982,1987). This approach relies on the premise that, in their long-run equilibrium, banks will employ different pricing strategies in response to a change in input costs depending on the market structure in which they operate.

The results of the competition analysis suggest that the banking markets of CEE countries cannot be characterized by the bipolar cases of either perfect competition or monopoly over 1993-2000 except for FYR of Macedonia and Slovakia. That is, banks earned their revenues as if operating under conditions of monopolistic competition in that period. Overall, large banks in transition countries operate in a relatively more competitive environment compared to small banks, or in other words, competition is lower in local markets compared to national and international markets. Finally, the cross-sectional analysis of competitive structure shows initially a decreasing trend between 1993 and 1996 and a subsequent increasing trend in competitive conditions after 1996.

Having determined the degree of competition, this study further examines the relationship between competition, concentration and bank performance. The result of the empirical analysis does not yield any significant relationship between competition and concentration, suggesting the possibility that higher contestability, in part due to the recent technological advances, have resulted in an overall increase in competition, despite high level of market concentration. Furthermore, I find that the average bank deviates substantially from the best-practice frontier. The managerial inefficiencies in CEE banking markets were found to be significant, with average cost efficiency levels of 72

and 76 percent by the "Distribution-free Analysis" (DFA) and the "Stochastic Frontier Analysis" (SFA). These average estimates suggest that an average bank would have incurred 28 to 24 percent less of its actual costs had it matched its performance with the best-practiced bank. The alternative profit efficiency levels are found to be significantly lower relative to cost efficiency. According to SFA, approximately one-third of banks' profits are lost to inefficiency, and almost one-half according to the DFA.

In explaining the cross-sectional determinants of efficiency, the results suggest that higher efficiency levels are associated with larger banks, higher profitability and better capitalization. Banks that heavily rely on core deposits in funding their assets are found to be more efficient. Consistent with most prior research, higher level of problem loans is associated with lower efficiency levels. Regarding the effect of market structure on bank performance, the level of competition is found to increase efficiency while market concentration is negatively linked to efficiency. Finally, foreign banks operating in transition countries are found to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks.

Overall, findings of competition analyses are consistent with previous research on competitive conditions in the banking industries of developed countries that generally report varying degrees of monopolistic competition. The notion that high concentration in CEE banking markets will result in monopoly rents as suggested by SCP paradigm is not supported by empirical results. These results seem to be compatible with contestable markets theory (CMT), if one can assume that incumbent firms set their prices close to the competitive level because of potential competition; otherwise higher prices will attract potential entrants with hit-and-run strategies. These results are also consistent with the expectation that liberalization and deregulation of CEE financial markets have increased the competitive conditions in CEE banking markets.

Recommendations for transition strategies for government efforts in designing and implementing transition program are provided as well as avenues for future research.

TABLE OF CONTENTS

CHAPTER **PAGE**

LIST OF TABLES

TABLE **PAGE**

Chapter 1

Introduction

1.1 Overview

Central and Eastern European (CEE) countries have gone through a significant economic and political transformation during the last decade.[1] As they moved away from state control to a relatively free-market system, these countries launched wide-ranging economic and financial reform programs to stabilize their economies and to establish market forces as performance drivers. These reform programs typically entailed the liberalization of product and financial markets, and restructuring and privatization of state-owned enterprises (SOEs) to open their markets to global competition. Throughout the transition, the strengthening and restructuring of the financial sectors, as well as improving the supervision and regulation of banking and financial services, received a strong emphasis to cope with market forces and sustain economic stability and growth.[2] Privatization of state-owned banks and elimination of the restrictions on domestic and foreign market entries increased the number of commercial banks operating in their previously concentrated and inefficient national markets, and changed the competitive conditions in banking profoundly.

[1] See Scholtens (2000) for a survey of the efforts for developing financial systems in CEE countries during the early transition years (1990-1996).
[2] For the positive role that the financial system and financial institutions play in economic development see, among others, Pagano (1993), King and Levine (1993a,b), Levine (1997), Levine and Zervos (1998), and Rajan and Zingales (1998).

While the command economies of Europe were experiencing this transformation to market economies, their western counterparts were marching toward the goal of European political and economic integration. The establishment of the European Economic and Monetary Union (EMU) as an optimum currency area constituted a giant step towards this latter goal.[3] As the process of achieving full integration among its member countries is evolving, the European Union (EU) is currently working on an eastward enlargement through the inclusion of former socialist countries from Central and Eastern Europe into the union. Indeed, in March 1998 the EU formally launched the process that will make enlargement possible by initiating membership negotiations with ten applicant CEE countries. While the CEE countries expressed their wishes for inclusion into the union, they also acknowledged that membership in the EU implies a long-term commitment to the inevitable process of a complete financial and economic integration.

Such developments are expected to have a substantial influence on the financial and banking systems of member countries, particularly those transition economies of CEE with increasingly tighter links to the EU. Even before this phase, widespread deregulation and liberalization, accompanied by technological development and internationalization have significantly changed the competitive structure of the European financial services industry. After the implementation of the Second Banking Coordination Directive in 1993, banks from the EU countries were allowed to branch

[3] The goal of Economic and Monetary Union (EMU) is set out in the Treaty on European Union, signed at Maastricht in February 1992. Briefly, EMU involves the creation of a single currency, the euro, to replace the national currencies of the EU Member States participating in it. The euro is managed by the European Central Bank.

freely into other EU-member countries.[4] The new legislation, by exposing national banking markets to potential new entrants, and making cross-border acquisitions and mergers practically free of all remaining obstacles, resulted in intensified competition and substantial banking and financial industry restructuring in Europe. These new competitive conditions are likely to entice large European financial institutions that are currently operating at relatively low margins to extend their cross-border operations into the potentially more profitable markets of CEE countries.

Based on the above discussion, I wish to evaluate the effects of recent changes in the competitive structure of the CEE banking markets and to measure the current level of market contestability attained by the recent liberalization and deregulation process. Specifically, I would like to know whether the recent legal and institutional reforms were sufficient to transform the market structure into a more competitive mode or whether there are still some serious obstacles inherited from the prior system that prevent the realization of competition regardless of recent liberalization and deregulation efforts. In the present study, I employ the theory and concepts of the new industrial organization literature for analyzing and measuring the banking competition in fourteen European transition economies. To the best of my knowledge, there are no prior comprehensive empirical analyses of changing competitive conditions in the CEE banking industry. Hence, this study tries to fill this gap and extend previous studies on competition in European banking to the CEE banking markets using the Panzar-Rosse H-statistic [Rosse and Panzar (1977), Panzar and Rosse (1982,1987)].

[4] The Second Banking Coordination Directive defines the basic conditions for the provision of the so-called Single Banking License.

1.2 Policy Implications of the Research

The results of this study will likely have important policy implications since the research focuses on the essential structural and regulatory aspects of banking which enable CEE countries to promote financial stability during the transition period and to create an efficient financial infrastructure focused on accession to the European Union. Since their money and capital markets are still in infancy, the transition countries have primarily bank-based financial systems; banks intermediate large portions of capital flows and household savings, and constitute the primary source of business financing. This situation implies that a potential breakdown in their banking systems can yield contagion effects to all other sectors of their economies. Indeed, these transformation challenges, give rise to some of the following policy questions for the CEE economies: (1) As they open their economies to a greater influence from the western world, how should they manage the transition process by avoiding financial distress and adjust successfully to the expected new competitive environment caused by increased domestic and foreign participation in their local banking markets? (2) How should they design and implement the competitive policies, and appropriate supervisory and regulatory framework? (3) Should they enforce market discipline by promoting foreign competition, rather than adapting defensive policies to protect the existing infant-banking industry from competition? (4) How successful have the transition economies been in implementing the regulatory reforms and industry restructuring to establish more competitive and efficient banking sectors? (5) Should they shift the focus to development of their capital markets, in order to make the final transition from "bank-based" to

"capital market-based" financial systems? These are some of the important policy directions to be developed by CEE countries for the successful development of stable, efficient, properly supervised financial systems for both the transitional economic reforms and their preparations for accession to the European Union.

The aforementioned policy implications, as well as increasing interest in this topic among academics and practitioners alike, motivate my examination of competition and contestability in the CEE transition economies. Given the challenges that the CEE countries face, the conclusions of this study should be timely and helpful for policymakers to better understand how their decisions affect the market conduct and performance of financial institutions under their supervision.

1.3 Summary of the Empirical Findings

The results of the competition analysis suggest that the banking markets of CEE countries cannot be characterized by the bipolar cases of either perfect competition or monopoly over 1993-2000 except for FYR of Macedonia and Slovakia. That is, banks earned their revenues as if operating under conditions of monopolistic competition in that period. Overall, large banks in transition countries operate in a relatively more competitive environment compared to small banks, or in other words, competition is lower in local markets compared to national and international markets. Finally, the cross-sectional analysis of competitive structure shows initially a decreasing trend between 1993 and 1996 and a subsequent increasing trend in competitive conditions after 1996, revealing the impact of liberalization on competitive conditions. These conclusions hold

under a variety of specifications controlling for bank-size, risk and various deposit composition characteristics, and a number of estimation techniques. These results are consistent with previous research on competitive conditions in the banking industries of developed countries that generally report varying degrees of monopolistic competition.

Having determined the degree of competition, this study further examines the relationship between competition, concentration, and bank performance. The result of the empirical analysis does not yield any significant relationship between competition and concentration, suggesting the possibility that higher contestability, in part due to the recent technological advances, have resulted in an overall increase in competition, despite high level of market concentration. Furthermore, I find that the average bank deviates substantially from the best-practice frontier. The managerial inefficiencies in CEE banking markets were found to be significant, with average cost efficiency levels of 72 and 76 percent by DFA and SFA. Overall, these average estimates suggest that an average bank would have incurred 28 to 24 percent less of its actual costs had it matched its performance with the best-practiced bank. The alternative profit efficiency levels are found to be significantly lower relative to cost efficiency. According to SFA, approximately one-third of banks' profits are lost to inefficiency, and almost one-half according to the DFA.

In explaining the cross-sectional determinants of efficiency the results suggest that higher efficiency levels are associated with large banks, higher profitability and equity. Banks that heavily rely on core deposits in funding their assets are found to be more efficient. Consistent with most prior research, higher level of problem loans is associated with lower efficiency levels. Regarding the effect of market structure on bank

performance, the level of competition is found to increase efficiency while market concentration is negatively linked to efficiency. Finally, foreign banks operating in transition countries are found to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks.

Overall, findings of competition analyses are consistent with previous research on competitive conditions in the banking industries of developed countries that generally report varying degrees of monopolistic competition. The notion that high concentration in CEE banking markets will result in monopoly rents as suggested by structure-conduct-performance (SCP) paradigm is not supported by empirical results. These results seem to be compatible with contestable markets theory (CMT), if one can assume that incumbent firms set their prices close to the competitive level because of potential competition; otherwise higher prices will attract potential entrants with hit-and-run strategies. These results are also consistent with the expectation that liberalization and deregulation of CEE financial markets have increased the competitive conditions in CEE banking markets.

1.4 Organization of the Dissertation

The next Chapter sets the stage for the analysis by reviewing briefly the recent history of banking reforms in Central and Eastern Europe. Chapter 3 summarizes the previous studies and methods employed to test competition in the banking literature. Chapter 4 presents the model, the testable hypotheses, and the data used to assess competitive conduct in CEE banking markets. Chapter 5 discusses the empirical results. Finally, Chapter 6 presents the conclusions and outlines suggestions for future research.

Chapter 2

Background on the CEE Banking

This chapter provides information on the banking sectors in Central and Eastern Europe. The Chapter is divided into four sections. First, background on the initial conditions when transition started during the late 1980s is provided in section 2.1. This is followed by the summary of progress made on banking regulation and supervision in section 2.2. Section 2.3 discusses the effects of privatization, foreign entry, and market concentration. Finally, section 2.4 discusses the possible effects of the EMU on CEE banking and the future of banking in transition countries.

2.1 Initial Conditions

Until the social and economic transformation reforms in the late 1980s, a socialist banking system was in effect in CEE countries. At the center of this structure was a monobank that performed the simultaneous roles of central bank and commercial bank. The monobank was in charge of issuing currency, managing the payments system among enterprises, providing savings deposit facilities to households, making loans to enterprises and covering the deficits of the State budget (Catte and Mastropasqua, 1993). In some of these countries, in addition to the monobank, there also existed a Savings Bank and a Foreign Trade Bank. The former functioned as the primary channel in

intermediation of household savings while the latter specialized in foreign exchange transactions of State Owned Enterprises (SOEs) and in managing their foreign debts and assets (Thorne, 1993). These banks, however, had neither expertise nor control over the process of assessing and managing risk and return, and the granting of loans, since lending decisions were then made centrally by the state, which typically allocated funds based on political priorities rather than efficiency and profitability considerations.

The restructuring of the banking system in CEE economies started in the late 1980s after the collapse of their Communist regimes. Hungary and Poland took the lead in establishing independent central banks, followed by the three Baltic States (Estonia, Latvia, and Lithuania) and the Czech and Slovak Republics. The monobank system was transformed into a two-tier banking system by breaking up the monobank into a central bank and a number of commercial banks in each country by new regulatory frameworks.[5] New commercial banks were allowed to engage in a wide range of banking activities, usually specializing in sectors, with increased role in management and credit allocation. Since the new banking system was established based on administrative decisions rather than market forces and without paying much attention to the effective and efficient functioning of the system, the newly created banks were relatively large and inefficient. Furthermore, due to the lack of competitive pressures, the banking sector had little incentive to pursue efficient behavior. These artificially established banks inherited many problems from central planning that plagued the banking system: the capital inadequacy, non-performing loans to SOEs, non-diversified loan portfolios and clientele,

[5] Some of the assets of the Monobank were transferred to newly established commercial banks without cleansing the non-performing loans and many of these banks were technically insolvent from the date of their establishment.

inexperienced management and personnel, underdeveloped branch networks, and other related problems.[6]

During the initial years of transition, restrictions on the establishment of new banks were relaxed and some governments also encouraged the establishment of new banks as a way of enhancing competition. These years were characterized by a growing number of commercial banks and efforts to strengthen the two-tier system. Although the rapid growth of commercial banks brought a certain degree of competition to the banking sectors, many of these new banks soon became financially distressed and were declared insolvent. Governments accelerated the restructuring efforts with the introduction of schemes for revamping their banking systems.[7] While restructuring their banking systems, most of these countries suffered severe banking crises due both to corporate distress and the absence of effective regulatory and legal environments. Ineffective corporate governance and payments discipline intensified the problems. The bank administrators and managerial personnel lacked the knowledge and experience of banking procedures, as well as the technology practiced in market economies; additionally the customers were not accustomed to the new banking practices. Thus, the banking sectors did not have sufficient flexibility to operate adequately or competitively in a market economy. Commercial banks experienced dramatic deteriorations on their balance sheets due to large stocks of non-performing loans and capital inadequacy.[8]

---

[6] Talley et al. (1998) Specifically mention four key market-supporting institutions that are not yet fully developed in the CEE countries: (1) Adequate accounting and auditing, (2) Efficient legal frameworks, (3) Effective corporate governance, and (4) Strong bank supervision.

[7] For example, Hungary has adopted the Anglo-Saxon model of separation between the commercial and investment banking functions, while the Czech Republic, Poland, Bulgaria, and Romania have followed the German-Japanese models of universal banking. (Thorne 1993)

[8] In Hungary and the Czech Republic, banks have been forced to write-off some of their bad loans, while in Poland they have been encouraged to work-out problem loans in their portfolios (Brada and Kutan, 1998).

2.2 Summary of The Progress in Banking Supervision

Despite the problems outlined in the previous section, the CEE governments appeared determined to develop competitive and efficient financial systems based on market forces for the conversion from central planning to market economies and for fulfilling the obligations for future EMU integration. Table 2.1 presents a summary of the progress of banking supervision in selected CEE transition countries by the year 1996 (All tables are located in the appendix). As discussed in Scholtens (2000), the CEE countries followed broadly a similar path in developing their supervisory structure in banking. All countries allow for universal banking but some restrictions exist in Bulgaria and Hungary. Supervision of the banking system is carried on by central banks except for Hungary and Slovenia where some supervisory authorities work jointly with the central bank in conducting this task. The capital requirements for banks range from $0.1 to $15 million in Hungary depending on the type of bank, and this requirement is the highest in the Czech and Slovak Republics, followed by Hungary. As for capital adequacy, all countries seem to comply with the Bank for International Settlements (BIS) recommendation to keep the required minimum risk-weighted capital/assets ratio of 8 percent. Banks are required to make provision for loan losses. Concentration of credit is limited to 15% to 25% of bank capital and participation in the non-banking sector is allowed to a certain extent. Except for Latvia, all countries either have designed deposit insurance systems or are in the process of setting them up to protect depositors from

losses due to bank failures.[9] The last two rows of Table 2.1 demonstrate the progress of reform programs in banking and securities markets. The numbers reveal that, on average, transition countries placed relatively more emphasis on banking market reforms than capital market reforms. This is, of course, one of the weaknesses in the structural reforms that has persisted through the decade of the 1990s, leaving the transition economies with bank-based financial systems.

2.3 Privatization, Foreign Entry, and Concentration

CEE governments initiated large-scale privatization programs that substantially diminished the state ownership in banking during the mid-1990s. The main motive behind privatization of state-owned banks was the desire to enhance competition and efficiency in the banking sector through increased foreign and domestic competition. Banking crises that affected the region during this period have basically accelerated the privatization process and thus, foreign participation. By the end of the decade, the share of foreign ownership in terms of both total assets and capital was exceeding 60 percent, making the CEE banking sector the most open emerging market to foreign participation.

As shown on Table 2.2, among the three most developed CEE countries, Hungary took first place in the internationalization process with approximately 60 percent foreign ownership of banking assets and about 80 percent foreign control in the domestic banking

[9] However the maximum amount of deposits covered by the insurance is not comparable to that of US and European banks. (The Bank Insurance Fund (BIF) in the U.S. insures deposits in commercial banks and savings banks up to a maximum of $100,000 per account, and the comparable figure is $23,000 within the EU).

industry in 1999. Hungary is followed by Poland with about 53 percent of total commercial bank assets controlled by foreign institutions. Also, the Czech republic privatized three of the four large state owned banks after 1998, and by the end of 1999 foreign participation in the banking system reached 47 percent.

Despite large-scale privatization and more liberal public policy towards the elimination of entry barriers, the banking sector remained highly concentrated throughout the sample period. Table 2.3 lists the 3-Bank concentration ratio (CR3) in the sample for the CEE countries from 1993 to 1999. For the pooled sample CR3 went down from 80.5 % in 1993 to 59% in 1997, and subsequently rose to 65% in 1999. Nevertheless, the largest three banks in Estonia, Lithuania, and Yugoslavia held more than 90% of the assets in the banking industry in 1999. Over the sample period, on average, Russia had the lowest CR3 ratio of about 49%, followed by Poland and Hungary with CR3 ratio of about 52 %. Although I do not report the 5-bank concentration ratios here, they are substantially higher than the comparable ratios for the UK and the US. (Cetorelli and Ganbera, 2001, Table 1).

The banks in the region are relatively small in terms of asset size compared to banks in the Western countries. Table 2.4 reports average country balance sheets for all banks for the year 1999. The average asset size for the overall sample is $1.08 billion of which loans constitute from 28 % (in Romania) to 55 % (in Slovakia). According to BankScope world ranking, only 5 CEE banks are listed in the top 1000-bank list. Various average countrywide financial ratios for 1999 are presented in Table 2.5. During the early years of transition, the majority of the banks in the region were burdened by substantial

amounts of non-performing assets. However, after enacting and implementing the new prudential regulations to stabilize the banking system, and bailing out of bad loans by governments, banks experienced a significant balance sheet restructuring and improvements in asset quality. According to various asset quality proxies in 1999, except for the Czech Republic and Bulgaria, banking sectors in CEE countries seem to attain a viable level of asset quality. But I should note that these asset quality ratios are not quite comparable to those in Western European countries where a ratio of non-performing loans to gross loans of more than 5% is considered as a serious problem for a given bank. Table 2.5 shows that more than one-third of the gross loans in the Czech banks turns out to be non-performing in 1999. Despite the banking crises experienced and problems associated with transition, all countries appear to achieve a viable level of capital adequacy, as reflected in their capital to asset ratios, which typically range from 8.6 % (Slovenia) to 29.7 % (FYR of Macedonia).

2.4 Effects of EMU and Future of CEE Banking

The establishment of EMU is expected to have a substantial influence on the financial and banking systems of member countries and on the transition economies of CEE countries with increasingly tighter links to EU. The introduction of the single currency and monetary policy among participating nations in 1999 seems to have accelerated the structural changes by fostering mergers and acquisitions and the integration both intra-countries and across borders through elimination of previous implicit barriers arising from national currencies.

As noted by Yeyati and Struzenegger (2000), "even before EMU, the globalization of financial markets, aided by a gradual process of deregulation, have been fueling a rapid rationalization of European banking systems, with increased competition from within the region and the threat from ever bigger US financial powerhouses forcing European intermediaries to consolidate and extend operations to other previously untapped, markets." An integrated financial system and common monetary policy are expected to accelerate this trend. Prati and Schinasi (1997) note that, after a substantial consolidation and restructuring process triggered by the introduction of the euro, the wholesale market will be dominated by the largest and strongest European Universal banks that are likely to face intense competition from U.S. investment banks and U.K. merchant banks in international operations. The authors further note that although competition in retail banking is not expected to be that strong, elimination of barriers on cross-border provision of banking services and increased public demand in retail services may open retail banking to competition from large European banks and can lead to a further rationalization process.

With regard to banking activities, the most direct and instant effect of the single currency will be on the foreign exchange trading since cost of currency conversions and the risk of cross country positions will eventually vanish. It is estimated that, introduction of euro will cause a 10% to 15% reduction in intra-European foreign exchange activity.[10] The revenue derived from derivatives and currency-hedging activities will also be significantly diminished due to elimination of speculative and/or hedging motives for

[10] This estimate was given by Helmut Schiber, member of the Directorate of the Deutsche Bundesbank in November 1998 at a speech on the Impact of EMU on the banking structure in Europe.

currency. Similarly, equalization of interest rates across member countries will reduce, if not eliminate, interest rate hedging activities by banks and lead to a decline in real rates. Reduced interest margins, however, are likely to increase money and securities market activities of banks to recover lost revenues from foreign exchange trading and investments. Therefore, the introduction of euro will favor the establishment of deep and liquid integrated money and capital markets that will increase competition among the financial institutions.

These new competitive conditions are likely to put more pressure on European banks to extend their cross-border operations into more profitable markets of CEE countries. It is widely acknowledged that, foreign entry to the banking sector influences the behavior of domestic banks by boosting the competitive conditions. A number of strategies should have been implemented to gradually adapt the new conditions and become viable in anticipation of deregulation and increased competition. It is expected that banks will respond to increased competition by extending the scope of professional services beyond traditional markets, generating other revenue sources through offering new services and products, focusing on non-interest income-generating activities, reducing excess capacity through mergers and/or branch closure, and updating their operations through new technology. It is conceivable that, as a result of the elimination of regulatory barriers to foreign entry, the banking industries of CEE countries will gradually move to nearly full internationalization. The establishment of European integration will accelerate this process. The increased competitive pressure from large international banks is likely to foster the rationalization of CEE banking sectors and improve the efficiency levels in the long run; however it may affect negatively market

stability in the short run. Therefore the countries in the region can experience some bank failures in addition to mergers and acquisitions during this rationalization process.

2.5. Summary

Over the last decade the banking markets in the transition economies of Central and Eastern Europe have gradually evolved from the traditional monobank system of the central planning period to a western-style, geographically and sectorally diversified, two-tiered system of today. The governments, with financial and strategic support of international organizations, spent enormous amounts of effort in undertaking comprehensive political and economic reform programs to develop a competitive and efficient banking system, based on market forces, for the transformation from central planning to market economies and for converging toward the criteria for European integration. New financial markets, institutions and channels of intermediation have been established from scratch.

The banking system in CEE countries was highly concentrated and, at least until the late 1980s and early 1990s, was tightly regulated and protected from foreign competition. The governments have recognized the need to carry out a transformation of their banking infrastructure almost simultaneously with political and economic changes. During the course of transition, the CEE countries have shown significant progress in integrating with the developed economies of the EU. Although the rate of transformation to a market economy system varies significantly from one country to another, the specific steps that CEE countries have taken to transform their banking system for the market

economy are broadly similar. The immediate emphasis of banking sectors in the region is to match their counterparts in West Europe by creating efficient, competitive and profitable banks with well-developed infrastructure and wide range of activities. The development in banking industry standards in Hungary, Poland, the Czech Republic, and Estonia are expected to attain Western Standards in the near future. Currently, 10 CEE countries, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia are negotiating their potential accession to the EU. They are trying to increase the transparency of their economic policymaking and financial institutions, by adopting internationally accepted standards that will smooth their transition into the European Union.

Chapter 3

Theory and Literature Review

This chapter provides a brief review of the relevant literature. The chapter is divided into two major sections. Section 3.1 provides the background on financial liberalization and deregulation, and its effects in emerging banking markets. Section 3.2 review major empirical approaches to competitive behavior and summarizes the relevant literature.

3.1 Financial Liberalization and Deregulation Framework

Competition is widely accepted as a positive phenomenon for most industries, and this is also true for banking markets. Moreover, financial liberalization in developing and transition countries is generally considered as the most important way to promote competition. Financial liberalization can be achieved in three different forms: Capital account liberalization entails the elimination of capital controls and restrictions on the convertibility of the national currency. Deregulation of financial markets reduces the role of government in the domestic financial system and removes the government control on lending and borrowing rates, and credit allocation, thereby allowing market forces to function effectively. Internationalization of financial services ensures equal treatment between domestic and foreign financial institutions and eliminates the obstacles for cross-border business activities.

As noted by Casu and Molyneux (2000), European banking systems until mid-1980s were typically characterized by relatively high levels of government controls and restrictions that inhibited competition and maintained a protected banking environment. The main objective of the many governments was to enhance the stability of the banking industry by preserving national ownership of the largest domestic banks. The employed instruments by governments that limited competitive conduct in the banking industry included (i) structural elements such as the functional separations of institutions (e.g. commercial and investment banking), (ii) entry requirements and discriminatory rules regarding foreign banks and investors, (iii) direct restrictions on assets and liabilities (including prudential rules and rules on participations in non-banking firms), (iv) rules related to information disclosure, credit ceilings, limitations on branching and the determination of fees commissions and rates on assets and liabilities (Neven and Roller, 1999).

In order to facilitate the needs of increased international trade of goods and financial services, many banking institutions have become international in recent years. This internationalization trend has helped the liberalization of financial markets around the globe. As a result of significant progress in information technology, financial innovation led the banks to provide a much broader package of services in a more liberalized environment. The banks not only had to compete in their traditional businesses but also faced the increased competitive pressure coming from emerging non-bank institutions. Banking liberalization during the 1980s eliminated the restrictions on the way banks conducted businesses, and thus significantly affected their competitive

conduct. Increased competition among banks and other financial intermediaries reduced profit margins especially for wholesale and corporate banking. It is expected that these competitive pressures arising from financial service liberalization will enhance the cross-border activities within and between EU countries and CEE countries.

The effects of financial liberalization and deregulation were dramatic on the transition economies of Europe. During the early years of transition excessive concentration, preferential treatment by governments, and limited entry significantly impeded the progress of banking industry. As a result of liberalization and deregulation, CEE banking markets experienced substantial structural changes in the form of large-scale privatization and increased foreign participation. The proportion of local bank assets controlled by foreign-owned institutions has significantly increased from 8% in 1994 to 56% in 1999, making their banking systems widely open to foreign participation. This recent increase in foreign ownership in CEE banking markets suggests that the authorities in these countries supported foreign participation as a policy to improve the competition, efficiency, and stability of the banking system.

Although the literature clearly suggests that increased foreign participation as a result of financial liberalization improves competitiveness and efficiency of banking systems, there is no consensus on whether a greater foreign participation enhances financial system stability and capital flow process in emerging countries. The recent growing presence of foreign-owned financial institutions raised a number of important policy issues related to the effects of liberalization on banking system stability. On the one hand, proponents of liberalization suggest that foreign entrants can help countries

build more robust and efficient banking system and provide a better resource allocation by introducing international practices and standards.[11] With respect to deregulation, McKinnon (1973) and Shaw (1973) propose the elimination of market entry restrictions in developing countries that show typically excess demand for credit, and they conjecture that new entry is likely to lower the costs of funds, raising the availability of credit, leading to more investment. Levine (1996, pp.236-237) specifically mentions that liberalizing foreign bank entry may (i) improve access to international capital markets, (ii) improve the quality, pricing and availability of financial services through stimulating competition and contestability, and introducing more modern banking skills, management techniques, and technology in the domestic markets, and (iii) serve to stimulate the development of financial policy and infrastructure by intensifying pressures for governments to improve the legal, regulatory, and supervisory systems.

On the other hand, the internationalization of financial services raised a number of legitimate concerns among researchers and policy makers. Among these concerns are the collapses of domestic financial service firms and of domestic financial systems through capital outflow, the undermining of prudential controls, and the loss of monetary autonomy. Some policymakers and researchers argue that entry by foreign firms can lead to substantial decline in profits, potentially leading to excess risk-taking and financial distress among domestic firms, especially in countries where the financial system is undercapitalized. The experience of severe problems in the banking systems of a number of developing, transition and industrialized countries after deregulation and liberalization

[11] See Levine (1996), Walter and Gray (1983), Gelb and Sagari (1990).

during the last two decade, has led some to blame liberalization as the sources of such problems.[12] Therefore, there is no consensus on the effects of liberalization on financial system development and stability in transition countries. However, prudential supervision by the authorities and increased financial strength of the foreign banks in the local markets are likely to contribute to financial system stability.

The effect of liberalization and deregulation on domestic banking industry has been examined for different countries in numerous studies. Several empirical studies produced some systematic evidence suggesting that liberalizing of foreign entry to the banking sector will enhance the efficiency of domestic banks and provide better resource allocation. McFadden (1994) reports improvements in domestic bank operations after foreign bank participation in Australia. Bhattacharaya (1993) reports individual cases in Pakistan, Turkey, and Korea, where foreign banks helped to access foreign capital accessible to finance domestic projects. Examining 80 countries in the 1988-1995 period, Claessens et al. (2001) find that entry of foreign banks reduces the profitability and the overall expenses of domestic banks. Likewise, Terrell (1986) compares the banking markets in 14 developed countries for 1976 and 1977, and finds lower gross interest margins, lower pre-tax profits, and lower operating costs for eight countries that allow foreign bank entry. After investigating the competitive effects of relaxation of entry barriers to the Uruguayan banking industry Gelfand and Spiller (1984) and Spiller and Favaro (1987) conclude that strategic interactions across banks and across different markets decreased after the regulatory reform. Ribon and Yosha (1999) focus on the

[12] E.g. Argentine and Chile in the early 1980s, the United States savings and loan crises in late 1980s, Estonia 1992-1994, Nordic Countries late 1980s - early 1990s.

Israeli banking industry, finding a significant improvement in competition in the years following financial liberalization.

As mentioned before, the main objective of this study is to evaluate the effects of recent financial liberalization and deregulation on competitive conduct and bank efficiency. In light of the above discussion and empirical evidence provided by prior research, it can be clearly proposed that, by eliminating the restrictions on the way banks conducted businesses, removing substantial entry barriers and exposing national banking markets to potential new entrants, financial liberalization and deregulation have significantly increased the competition and efficiency in CEE countries. The next section discusses several methods employed in previous research to test competition in the banking industry.

3.2 Major Approaches to Competitive Behavior

In the banking literature, there are two major empirical approaches for assessing competition: (a) The structural approach and (b) The non-structural approach. In this section I review several important competition models under both approaches and summarize the empirical findings of the relevant studies.

3.2.1. Structural Models

The "structural approach" to modeling competition embraces the structure-conduct-performance (SCP) paradigm and the efficient structure hypothesis (ESH). The

SCP paradigm assumes that banking firms' market power increases with industrial concentration and thus establishes a direct link from industry structure to competitive conduct. A rise in concentration is regarded as increasing collusive opportunities between banks, and hence would lead to higher prices and profitability.

Efficient structure hypothesis (ESH) advocated by Demsetz (1983) and Peltzman (1977) challenges the SCP paradigm. ESH interprets the positive relationship between profitability and market concentration in a different way. It asserts that the causality between performance and concentration is reverse: some firm-specific factors such as use of latest technology or superior management cause firms become profitable and grow large, leading to market concentration.

3.2.1.1 The Structure-Conduct-Performance (SCP) paradigm

The SCP paradigm, originally developed by Mason (1939) and Bain (1951), posits a one-way casual relationship from industry structure to firm conduct, and from firm conduct to industry performance, therefore try to infer the degree of competition of an industry from its structural features. Market structure usually refers to industry concentration, market shares of firms, the extent of product differentiation, and regulatory or other barriers for new firms to enter the industry. Under the SCP framework, market structure determines firm or industry conduct, and conduct, in turn, determines firm and industry performance, which typically is measured by profits or price-cost margins. In this approach industry performance and concentration are often measured by some form

of profit ratio and by a concentration ratio, say 5-firm concentration ratio, CR5. A typical SCP equation can be written as:

$$\pi_i = \alpha + \beta CR5_i + \Sigma_k \gamma_k X_{ki} + \varepsilon_i, \quad i=1,2,\ldots\ldots,n \tag{3.1}$$

where π_i is usually an accounting measure of profitability X is a vector of exogenous variables that affect profitability or price-cost margin, and i is the index for industry or firm. Positive coefficient on the concentration measure is considered to justify the SCP paradigm, implying that concentrated markets provide the banks with the opportunities to earn monopolistic profits through their ability to offer lower deposit rates and charge higher loan rates.

This model implicitly assumes that in a concentrated industry all firms can easily raise their prices and that their profit rates in the industry can be protected by the entry barriers. Therefore it is more likely to see firms engage in anticompetitive conduct in highly concentrated markets where only few and large firms prevail. It is also assumed that all firms within an industry have the same profit rates, so that the profit rate of the industry can serve as a good measure of industry performance.

The results of the empirical studies examining the linkage between market concentration and market power in the US banking industry are mixed. For example, Berger and Hannan (1989) analyze a cross-section of the U.S. banking markets in 1983-85, by modeling bank deposits as a function of local concentration indices. After controlling for various factors affecting price-setting behavior, the authors find evidence that deposit rates are significantly lower in the most concentrated markets, in favor of

SCP hypothesis. More specifically they report that banks in the most concentrated markets use their market power to extract rents by paying 25 to 100 basis points less on their deposits than banks operating in the least concentrated markets. Hannan and Berger (1991) compare the deposit interest rate with the benchmark money market rate, which is not controlled by banks. They find evidence of market power implied by higher level of deposit rate rigidity in markets with higher HHIs.[13] Hannan and Liang (1993) also present evidence in favor of more market power in concentrated deposits markets. However, Calem and Carlino (1991) find contradictory evidence. They report non-competitive conduct in money market and 3- and 6-month CD markets but deviations from competitive pricing were uncorrelated with market concentration. In a similar work focusing on deposit rate rigidity, Jackson (1997) finds a non-monotonic relation between market concentration and market power demonstrated by increasing price rigidity in both high and low levels of concentration. This U-shaped relationship between market concentration and market power is not consistent with SCP paradigm. Berger (1995) examines the price-concentration relationship, after controlling for efficiency, and finds evidence supporting SCP paradigm in deposit markets, but not in loan markets.

Gilbert (1984) presents a fairly comprehensive review of the related early literature concerning the US retail banking markets over a period from 1964 to 1983, testing the hypothesis of a positive correlation between concentration in the banking

---

[13] HHI stands for Herfindahl-Hirschman index of concentration (HHI), sum of the squared market shares of all firms in the market and range from zero to 10,000. For example, if the market is characterized as monopoly with one bank having a 100percent market share, then HHI equals $(100)^2$ =10,000.

markets and bank performance. The overall evidence is ambiguous. About 50% of the studies confirm the hypothesis, but in any case variation in the market concentration has only a small impact on the performance measure employed. Gilbert strongly criticizes the fact that most of the market structure studies neglect the effect of rate regulation on bank performance, which suppress the true relationship between market structure and performance.

In SCP type of studies a common problem is the definition of market. It is very difficult to identify the true geographic markets, which determines the measured level of concentration and the multi-product structure of banking industry further deepens this problem (Shaffer, 1992). Another criticism for SCP studies is that they cannot distinguish between market power and efficiency as a source of concentration and profitability (Demsetz, 1973; Peltzman, 1977). According to Clarke and Davies (1982), profitability and market structure are actually jointly determined by other factors involving the production technology and demand for the product. After controlling for some aspects of efficiency, Berger (1995) finds that the relation between concentration and profitability significantly declines. Evanoff and Fortier (1988) also find some linkage between profit and concentration for markets characterized by substantial entry barriers, after controlling for efficiency. In summary, these studies do not totally rule out concentration as a contributing factor to monopoly power, but they conclude that it is hard to obtain significant and definitive conclusions from the studies that employ SCP paradigm.

Empirical studies that utilize SCP paradigm to assess the competitive conditions in European banking markets are relatively scarce. Among those are Molyneux and

Thornton (1992), Bourke (1989), Molyneux and Teppet (1993), and Molyneux (1993). Molyneux and Thornton (1992) investigate the determinants of bank performance across 12 European countries between 1986 and 1989, and find a positive and significant, but very small correlation between the 10-bank correlation ratio, CR10 (with respect to total assets), and pretax return on assets. Bourke (1989) uses the three-bank concentration ratio, CR3, and pre-tax profit measures for 12 North-American and European countries with Australia included over a ten year period from 1972 to 1981. His results are closely in agreement with Molyneux and Thornton's findings. According to his findings, banks' interest rate spread increased with the Herfindahl index only in small banking markets with relatively few competitors and high entry barriers. Molyneux and Teppet (1993) examine 5 EFTA countries (Sweden, Norway, Finland, Austria, and Switzerland) and find support for the SCP hypothesis. Finally Molyneux (1993) obtains weak support in favor of the SCP over the efficient structure hypothesis in the major European banking markets.

3.2.1.2 Efficient Structure Hypothesis

This approach contends that a positive relationship between profits and concentration stems not from market power but from the greater efficiency of firms with larger market shares. In other words, more efficient firms gain larger market shares, resulting in higher levels of concentration. According to ESH, highly efficient banks (due to firm specific factors such as technological or managerial skills, etc.) can pursue two

different strategies. They can maximize their profits by maintaining the present levels of prices and firm size or by reducing prices and expanding firm size (Lloyd-Williams et al., 1994). If the efficient banks opt for expansion, they will increase their market share at the expense of other relatively inefficient firms and thus bank efficiency will be the leading force for high market concentration. The efficiency structure hypothesis, therefore, implies that the causal link will be between market share, a measure of firm's efficiency, and profits, but there will be no causal relationship between market concentration and profitability (Denizer, 1997). Following Weiss (1974) and Smirlock (1985) we can formulate a test for ESH by estimating the following profit equation.

$$\pi = \alpha_0 + \alpha_1 CR + \alpha_2 MS + \beta MSCR + \Sigma\delta_i X_i \quad (3.2)$$

where :

π is a profit measure, CR is the concentration measure of the market structure, MS is a market share measure, MSCR is the interaction of market share and concentration, and X is a vector of exogenous variables that account for firm-specific (e.g. risk, size, cost) and market-specific (e.g. commercial, investment) characteristics.

A coefficient combination of $\alpha_1 = 0$ and $\alpha_2 > 0$ implies that larger market shares are associated with more efficient firms and this superior efficiency is the source of rents reflected in higher profitability while also indicating that higher market concentration is not the source of monopoly rents. Conversely, a coefficient combination of $\alpha_1 > 0$ and $\alpha_2 = 0$ implies that it is not market share which creates monopoly rent

reflected in higher profitability but rather market concentration. Thus, SCP hypothesis is verified by $\alpha_1 > 0$ and $\alpha_2 = 0$, and ESH is verified by $\alpha_1 = 0$ and $\alpha_2 > 0$.

Efficient structure hypothesis (ESH) is applied to the banking industry by Smirlock (1985), Smirlock and Brown (1986), Brozen (1982), Evanoff and Fortier (1988), Berger and Humphrey (1991), and Molyneux (1995). Smirlock (1985) finds a positive relationship between market share and profitability, and no linkage between concentration and profitability. He concludes that his results support the efficient structure hypothesis. Brozen (1982) and Evanoff and Fortier (1988) report similar conclusions. However, Smirlock's conclusion is questioned by Shepherd (1986) and Rhoades (1985) for his assumption that market share can be considered as a proxy for efficiency. They maintain that market share represents market power rather than a measure of efficiency.

3.2.2 Non-Structural Models

"Non-structural models" suggest an alternative approach to competitive behavior. These models do not infer the competitive conduct of banks through the analysis of market structure, but rather recognize that banks behave differently depending on the market structure in which they operate. The basic tenet of these models concerning competitive conditions is that there is no clear evidence that the use of market power would be greater in more concentrated industries.

3.2.2.1 Contestable Markets Theory

Under the non-structural framework, the “Contestable Markets Theory” (CMT), developed by Baumol (1982), argues that a concentrated banking industry can behave competitively if the barriers for new entrants to the market are low. The theory argues that the threat of potential entry forces banks with large market shares to price their products competitively under certain conditions.

CMT assumes that firms can enter or leave rapidly any market without losing their capital and that potential competitors have the same cost function as incumbent firms. Baumol emphasizes that incumbent firms are always vulnerable to hit-and-run entry when they try to exercise their potential market power. These features of contestable markets imply that a concentrated banking market can be effectively competitive even if it is dominated by a handful of large banks. Nathan and Neave, (1989) suggest that "if contestability theory is plausible, then widely expressed concerns about the domination of a country's financial system by some type of financial intermediaries may be valid only to the extent that financial markets are not contestable". Therefore, policymakers should be relatively less concerned about the market dominance of some type of financial intermediaries in a country’s financial system, if the financial markets are contestable. Based on these arguments, deregulation and liberalization will make the banking industry more contestable or open to competition. In order to test for contestability, previous research employed the competition model proposed by Rosse and Panzar (1977) and Panzar and Rosse (1982,1987) or the so-called “H statistic”.

3.2.2.2 The Panzar-Rosse Methodology and Empirical Literature

The Panzar-Rosse approach for testing market power relies on the premise that banks will employ different pricing strategies in response to a change in input costs depending on the market structure in which they operate. This conjecture, therefore, implies that whether a bank operates in a competitive market or exercises some monopoly power can be inferred from the analysis of that bank's total revenue as it responds to changing input prices. Unlike the SCP paradigm or EMH, the PR methodology analyzes directly the competitive conduct of banks based on the comparative static properties of the reduced form revenue equations, without employing any structural measures.

In order to measure the competitive structure of the industry and the market power of banks, Panzar and Rosse established a so-called "H statistic"; this is estimated as the sum of the elasticities of the reduced form (equilibrium) revenues with respect to input prices. More specifically, the H statistic measures the percentage change in a bank's equilibrium revenues caused by one percent change in all of the bank's input prices. Panzar and Rosse show that the H statistic can be used to infer competitive structure of the industry in which the bank operates by demonstrating the positive relationship between the H statistic and industry competitiveness. The authors further show that not just the sign of the H statistic is important but its magnitude as well. As noted in Bikker and Haaf (2000, p.4) this approach assumes that (a) banks are operating in their long run equilibrium; (b) the performance of the banks is influenced by the actions of other market participants; (c) cost is linearly homogenous in input prices, so that a one percent increase

in input prices will increase costs by one percent for all output levels; and (d) the price elasticity of demand is greater than unity. By not requiring a locational market definition a priori, PR framework avoids the potential bias caused by the misspecification of market boundaries; hence the H statistic will reflect the average of the bank' s conduct in each market for a bank that operates in more than one market.

In order to assess the industry structure and market power of firms Panzar and Rosse start their analysis with the estimation of reduced form revenue equations. The total revenue is observable even when the price and quantity are not. To obtain the equilibrium output and the equilibrium number of banks, profits are maximized both at the firm and industry level. This implies firstly that the profits of bank i is maximized where marginal revenue equals marginal cost:

$$R'_i (Y_i , n, Z_i) - C'_i (Y_i , W_{i,} T_i) = 0, \qquad (3.7)$$

where R'_i represents marginal revenue of bank i, C'_i is marginal cost, Y_i is the bank output, n is the number of banks, Z_i is the vector of exogenous variables that shift the bank's revenue function, $W_{i,}$ is the vector of input prices, T_i is the vector of exogenous variables that shift the bank's cost function. Furthermore, it also implies that in equilibrium the following equality holds for all the firms in industry:

$$R_i^* (Y^* , n^*, Z^*) - C_i^* (Y^* , W_{,} T) = 0 \quad \forall\ i, \quad i=1,\ldots..,n^* \qquad (3.8)$$

where "*" represents equilibrium values. Under the PR framework the market power is reflected by a change in the equilibrium revenue of a bank (dR_i^*) with respect to a

change in input prices (dw_{ki}.) Panzar and Rosse define a measure of competition, the H-statistic as the sum of the elasticities of the reduced-form revenues with respect to all input prices:[14]

$$H_i = \sum_{k=1}^{m} \frac{\delta R_i^*}{\delta w_{ki}} \frac{w_{ki}}{R_i^*} \tag{3.9}$$

H statistic quantifies the responsiveness of total revenue to a proportional increase in all input prices.

The economic interpretation of the H statistic is as follows. If the market in which banks operate is characterized as monopoly then H statistic is less than or equal to zero. This is due to the economic intuition that a monopolist's revenue will respond in the opposite direction to a change in input prices, as a one percent increase in input prices leads to a one percent increase in marginal and average costs (since they are homogeneous of degree one in input prices), thus reducing equilibrium output and revenue. Panzar and Rosse further show that the H statistic is also negative when the structure is a perfectly colluding oligopoly or a conjectural variations short-run oligopoly.

The H statistic is equal to one when the market structure is characterized as perfectly competitive in long-run equilibrium; under this condition, a proportional shift in all input prices will increase both marginal and average costs by the same proportion, without changing the equilibrium output of banks. In order to survive the competition,

[14] See Panzar and Rosse (1987), Bresnahan (1989, pp.1034-1039) and Vesala (1995) for details of the formal derivation of the H statistic.

banks will be forced to increase prices (e.g. interest rates on loans) until they cover the increased costs. During this adjustment process, the inefficient banks might be acquired by efficient ones or be eventually driven out of the market by competition. The reduction in the number of banks in the industry will increase the demand faced by each incumbent bank, thereby leading to a rise in the output price and revenue by the same amount as costs. Shafer (1982) shows that the H statistic is also unity for a natural monopoly operating in a perfectly contestable market and also for a sales-maximizing firm that is subject to breakeven constraints.

As the third case, Panzar and Rosse distinguish the situation of monopolistic competition, in which, although banks behave like monopolists, the market entry or exit of other banks that offer imperfect rival products makes them always generate precisely zero profits. In this case the H statistic will lie between zero and unity, as revenues will increase less than proportionally to changes in input prices

As mentioned earlier, a critical feature of the H statistic is that the tests must be undertaken on observations that are in long-run equilibrium. The empirical test for equilibrium is suggested by the fact that competitive capital markets will equalize risk-adjusted rates of return across banks, such that in equilibrium, rates of return should not be correlated statistically with input prices. If the markets under examination are not in equilibrium, a decline or increase in factor prices will cause a temporary decline or increase in the rate of return (Molyneux et al. 1994). To test for equilibrium, the H statistic is calculated with the return on assets (or equity) replacing bank revenues as the dependent variable in the regression equation. A finding that $H<0$ would indicate

disequilibrium, whereas H=0 would indicate equilibrium. Different interpretations of the H-statistic are summarized in Table 3.1.

Table 3.2 summarizes the previous studies that have examined the competitive structure of the banking industry in various countries by using H-statistic. Shaffer (1982) applied the PR methodology to a cross-section of banking firms in New York in 1979, and found that competitive conduct of banks cannot be characterized as monopolistic or perfectly competitive in the long run equilibrium. Similarly, Nathan and Neave (1989) also rejected the hypothesis of monopoly and perfect competition for Canadian banks, trust companies and mortgage companies over the period 1982-1984. Molyneux et al. (1994) used the same analysis in a sample of German, UK, French, Italian, and Spanish banks for each year of the period 1986 to 1989. On average, their results suggest monopolistic competition in Germany, France, Spain and the UK, and monopoly in Italy. Vesala (1995) applied a similar model to the Finnish banking industry and found monopolistic competition for 1985-88 and 1991-92, and perfect competition for 1989-90. Molyneux et al. (1996) examined the competitive conduct of Japanese commercial banks and found monopoly for 1986 and monopolistic competition for 1988. Coccorese (1998), Rime (1999), and Hondroyiannis et al. (1999) found monopolistic competition for Italian, Swiss, and Greek banking sectors. In a more recent study, De Bandt and Davis (2000) reported monopolistic competition for large banks and monopoly for small banks for Germany and France, and monopolistic competition for small and large banks in Italy over the period 1992-1996. Bikker and Groeneveld (2000) found monopolistic competition of varying degrees for EU countries for the period of 1989 to 1996. Finally,

in a more comprehensive study, Bikker and Haaf (2000) examined competitive conduct of banks in 23 developed countries over the time period 1988-1999. They reported that, in general, the banking markets of industrialized countries could be characterized by monopolistic competition. However, they could not reject the case of monopoly for the samples of small banks in Australia and Greece, and perfect competition for large banks in several countries.

Chapter 4

Empirical Model, Testable Hypotheses and Database

Based on the discussion in earlier chapters, the objective of this study is to evaluate the effects of recent changes in competitive structure in the CEE banking industry and to show how close is such banking industry to the state of high competition envisioned by recent legal and institutional reforms. The basis for the evaluation of competitive situation is the competition model developed by Rosse and Panzar (1977), and Panzar and Rosse (1982,1987). It should be noted that, although banks can somehow differentiate themselves through specialization in certain areas and through the provision of new services, the PR approach can not capture the degree of competition in each division of banking markets separately; it is basically a means of estimating the overall competitive conduct in a given banking system. In order to apply the PR methodology to the banking industry I follow the previous studies and adopt the "intermediation approach" to bank modeling where the financial intermediation role of a bank is emphasized.[15] It also reflects the realities of banking in the CEE countries, as they attempt to cross the threshold to modern banking.

[15] Two empirical approaches to modeling bank output are the "intermediation" and the "production" approaches. The intermediation approach treats banks as financial intermediaries that create output only in terms of their assets, using their liabilities, labor and capital. Deposits are treated as inputs that are intermediated into banks' outputs (loans and investments) and interest on deposits is a component of total cost, together with labor and capital costs. The production approach, views banks as firms that use capital and labor to produce loans and deposits. Since deposits are considered as output, the interest expense on deposits is not included in the costs. For further discussion of these approaches, see Berger et al. (1987)

4.1 Empirical Model and Testable Hypotheses

I estimate the following bank revenue equation in which revenue is explained by factor prices and other bank-specific variables that affect long-run equilibrium bank revenues for CEE countries for the years 1993 through 2000.

$$\ln(REV_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PL_{it}) + h_3 \ln(PK_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it}) + \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) + \sum_{l=1}^{L} \alpha_l D_l + \varepsilon_{it} \quad (4.1)$$

for t=1,…..,T where T is the number of periods observed, and i=1,….. ,I, where I is the total number of banks and ln is the natural logarithm. The dependent variable (REV) is the ratio of total interest revenue (or total revenue) to total assets. The model posits that banks use three input factors- namely, deposits, labor, and physical capital. Variables PF, PL and PK are the unit prices of these inputs or reasonable proxies: (PF) the ratio of interest expenses to deposits and other liabilities, (PL) the ratio of personnel expenses to total assets, and (PK) the ratio of non-interest expenses to fixed assets.[16] A number of control variables included to account for size, risk, and deposit mix differences are similar to those used in previous studies. These factors are total assets (TA), financial capital (EQTY), net loans (LOAN), and interbank deposits (IBDP). To take the country-

[16] Ideally, the ratio of personnel expense to the number of full time employees would be a better proxy for labor cost. Due to the unavailability of data on the number of employees I cannot employ the ratio of personnel expenses to number of workers as unit price for labor. Using the ratio of personnel expense to total assets as labor cost is a common approach in studies that employ BankScope data. [Molyneux et al. (1994), Bikker and Groeneveld (1999), De Bandt and Davis (2000)]

specific characteristics into account, country dummy variables were also added in the pooled sample estimations.

The 3-input factor model with total interest revenue (INTREV) as the dependent variable will be referred to as Model 1a and the model with total revenue (TOTREV) as the dependent variable will be referred to as Model 1b. The definitions of the dependent and explanatory variables for the model as well as their descriptive statistics for the overall sample are presented in Table 4.1. The same descriptive statistics for individual countries are provided in Table 4.2. Under the PR framework, the H statistic is equal to the sum of the elasticities of the interest revenue with respect to the three input prices:

$$\mathbf{H = h_1 + h_2 + h_3} \tag{4.2}$$

For almost all the banks in Bulgaria and Yugoslavia and for several banks in other CEE countries, BankScope data do not provide personnel expense figures as a separate cost item. To rectify this problem a second model is specified, as shown in equation (4.3), where the sum of personnel expense and capital expense variables are combined into the total overhead expense variable.

$$\begin{aligned}\mathbf{\ln (REV_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PO_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it})} \\ \mathbf{+ \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) +} \sum_{l=1}^{L} \alpha_l D_l \mathbf{+ \varepsilon_{it}}\end{aligned} \tag{4.3}$$

where PO is the ratio of overhead expenses to total assets and other variables are the same as those in equation (4.1). This 2-input factor model with total interest revenue (INTREV) as the dependent variable will be referred to as Model 2a and the model with total revenue (TOTREV) as the dependent variable will be referred to as Model 2b. The H-statistic by Model 2 is thus given by the sum of the two input elasticities:[17]

$$\mathbf{H = h_1 + h_2} \tag{4.4}$$

The conventional wisdom about the banking market structure of CEE countries is that banks are relatively large and industries are very concentrated. Monopolistic competition is therefore a priori the most plausible structure for the banking industry since it "recognizes the existence of product differentiation and is consistent with the observation that banks tend to differ with respect to various product quality variables and advertising, although their core business is fairly homogenous" (Bikker and Haaf, 2000, p.5). The testable hypothesis for monopolistic competition is then, given in (4.5).

$$\mathbf{0 < H = h_1 + h_2 + h_3 < 1,} \tag{4.5}$$

where $H \leq 0$ is monopoly and $H=1$ is perfect competition.

[17] This new specification helped us to recoup a substantial amount of observations lost due to the unavailability of complete data for personnel expense variable in two countries.

As noted earlier, one critical assumption of the PR approach is that banks operate in their long-run equilibrium phases, thus implying that their returns should not be statistically correlated with input prices. For the long-run equilibrium test, I follow the extant literature by running the original regression equation with return on average assets (ratio of net income to average total assets) being the new dependent variable, as shown in Equation (4.6). A value of H = 0 would indicate an equilibrium in the banking markets under investigation.[18]

$$\ln(ROA_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PL_{it}) + h_3 \ln(PK_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it}) + \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) + \sum_{l=1}^{L} \alpha_l D_l + \varepsilon_{it} \quad (4.6)$$

Although previous studies generally report cross sectional results, this study employed both cross-section and time series analyses in empirical estimation of Equations 4.1 and 4.3. The regression models are first estimated by the ordinary least squares (OLS) method on the pooled sample of banks and years, implicitly assuming that standard errors are independently distributed across banks and over time. One advantage of having panel data is that it allows controlling for heterogeneity bias, or the confounding effects of omitted variables that are stable over time. Considering the time-series dimension of the data, I also used both fixed and random effects estimators, correcting for the effect of any combination of time-invariant variables that have been

[18] Shaffer (1985) notes that if the sample is not in equilibrium, it is true that H<0 no longer verify monopoly, but it is still true that H>0 disproves monopoly or conjectural variation short-run oligopoly.

omitted, knowingly or not, from the regression model. The fixed-effect estimation entails specifying a different intercept term for each bank in the sample as well as time dummies for each year. The fixed-effect model without time dummies will be referred to as Model Fixed-One and the fixed-effect model with time dummies will be referred to as Model Fixed-Two. I also specified a random-effects model that allows for the intercept term to vary across banks, but it presumes that this variance arises from a firm-specific random error. The random-effects models without and with time dummies will be referred to as Model Random-one and Model Random-two, respectively.

4.2 Discussion of the Variables

Prior studies on market structure have developed different specifications in order to apply the PR methodology to the banking industry. For example, Molyneux et al. (1994) and Bikker and Groeneveld (2000) have used the log ratio of interest revenue to total assets as the dependent variable, while Shaffer (1982), Nathan and Neave (1989), Vesala (1995), Coccorese (1998), and De Band and Davis (2000) have used the logarithm of interest revenues for the same purpose.

In this study two different dependent variables are specified: INTREV as the ratio of total interest revenue to total assets in Models 1a and 2a, and TOTREV as the ratio of total (gross) operating revenue to total assets in Models 1b and 2b. The first specification in which the dependent variable is only the interest part of the total revenue is consistent with the approach that financial intermediation constitutes the core business in CEE

commercial banking. Although interest revenues still constitute the principal source of banks' earnings, recent studies on banking activities report an increasing share of non-interest income from fee-based products and services and off balance sheet credit substitutes in total revenues. Given the increased level of competition in financial markets, this can be explained partly by the desire of financial services firms to expand their revenue generating sources without altering their risk and thus their capital structures, materially. For this reason, it will be appropriate to include total revenues in an alternative model as the dependent variable.

Other control variables are included in the Model to account for differences in bank-specific risk, size, and deposit structure of banks, and they are similar to those utilized in previous studies. To take the country-specific characteristics into account, country dummy variables were also added in the pooled sample estimations. The two different risk variables employed are the log ratio of equity to total assets (EQTY) and the log ratio of loans to total assets (LOAN). The size variable, log of total assets (TA), is used as a proxy for economies or diseconomies of scale, given the wide range of bank asset sizes in CEE banking systems. The ratio of Interbank deposits to customer and short-term funding (IBDP) accounts for differences in the deposit mix.

Loans generally represent the biggest portion of earning assets and also convey information about bank's risk preference. I expect a positive coefficient for the LOAN variable since more interest revenue is generated with increasing levels of loans. Equity to asset ratio is included to capture the effect of different risk levels among banks, with better capitalization ratios indicating lower risk levels. Lower capitalization ratios may

imply a more aggressive approach in lending with expectation of higher revenues. Therefore, the expected sign on the coefficient for capital ratio is negative. The size variable (TA) accounts for cost differences related to banks size and also controls for greater portfolio and loan diversification associated with larger banks. An important implication of asset diversification is less risk and hence a lower required rate of return. I do not know the ex-ante effect of size differentials in assets among banks on revenue generating process, and therefore I do not have any expectation on the sign of the coefficient for the size variable. The Interbank deposit ratio (IBDP) variable is included in the analysis because interbank deposits imply higher interest costs relative to customer deposits and thus constitute a more expensive source of funds than other deposits. I expect the coefficient on this variable to be negative.

4.3 Database and Sample Selection

The banks in the sample comprise a fairly large portion of banking industry in Central and Eastern Europe over the period of 1993-2000. Annual balance sheet and income statement data for the banks were taken from the BankScope data set provided by Fitch-IBCA, a London-based bank rating company. IBCA reports annual financial data in four different formats: Global-Summary, Global-Detailed, Spreadsheet, and Raw Data. The global formats allow for cross-country comparisons and have the same line item information. However, it is most likely to be acknowledged that each country has its own reporting requirements and language for banking terms. Because of this, the data set has a country-specific "spreadsheet" format that is more detailed than the global formats and

will have line items that are specific to that particular country. Finally, the data set has the raw data format, which is the most detailed report available. It contains the exact numbers that the bank files. Since the banks followed and reported by BankScope represent a large proportion of banks in each country, this sample represents fairly the average bank in the region. I should, however, note that there are always discrepancies and inconsistencies in international data, and this is particularly true for the transition countries of Europe.

In order to be able to perform reliable econometric analyses on bank competition the first requirement is to have sufficiently large sample of healthy banks for which financial data needed for the model variables are available. Some of the previous studies discussed in the literature review section focused their analyses to a single country, namely the USA, Canada and several other economically developed European countries, thanks to the availability of sufficiently large databases. The number of banks in transition countries is relatively small and the quality of financial reporting for these newly established institutions may not be at par. Nevertheless, the available data are utilized in various possible dimensions, after a rather rigorous sample selection process.

The countries included are the Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Latvia, Lithuania, FYR of Macedonia, Poland, Romania, Slovenia, the Slovak Republic, the Russian Federation, and Yugoslavia. The initial sample consisted of 2364 observations on 562 financial institutions. To be included in the final sample, banks had to be classified as commercial banks or cooperative banks in the BankScope data set and they must have all the model variables available for a given year. Bank holding companies, investment banks and securities houses, saving banks, real estate and

mortgage banks, non-banking credit institutions, and other specialized governmental credit institutions are excluded from the initial sample to make the data more comparable across countries. 96 % of the firms in the sample are consisted of commercial banks, and the remaining 4 % were cooperative banks. Due to the log linear specification in the estimated model, observations that have negative value on any of the explanatory variables are also dropped from the sample. The selection process yielded a unbalanced panel with 2113 observations belonging to 325 banks over the period 1993-2000. Table 4.3 lists the number of banks in the sample by country and years. Not all the banks were in continuous operation over the entire period due to failures, mergers, and de novo entry. Table 4.4 presents the descriptive statistics of bank characteristics under investigation for each country for 1999. All data are reported in US$ as the reference currency and corrected for inflation. Differences in the average banks size are substantial. The average Czech bank has more assets ($2.08 billion in 1999) than does the average bank in other CEE countries, followed by Polish and Hungarian banks. However, the average Polish bank has generated more loans than the average bank in other countries, followed by Czech and Estonian banks. On average, banks in the Czech Republic and Poland have the highest equity capital on their balance sheets, followed by Hungarian banks.

Chapter 5

Empirical Results

This chapter provides the results of the empirical estimation of the various models specified and discussed in chapter 4. The chapter is divided into three sections. Section 5.1 provides the results of the equilibrium tests. Section 5.2 presents the results of the competitive structure tests for CEE region and individual countries, respectively. Finally, relationship between competition, concentration, and bank performance is examined in Section 5.3.

5.1. Equilibrium Test

The equilibrium test is performed by running the regression model in Equation (4.6) in which return on assets (or return on equity) is employed as dependent variable. As suggested by Molyneux et al. (1994) we can verify the equilibrium by showing that factor prices are not correlated with bank returns. Under this specification H=0 suggests an equilibrium in the data. The results of the long-run equilibrium tests for individual years and sample period for the pooled data are presented in Table 5.1. The Wald test is used to test the H=0 hypothesis. The models were estimated using OLS where the standard errors were calculated using White's (1980) correction for heteroscedasticity. The regression coefficients of the unit price of funds, labor, and capital have mixed signs. The F-statistic for testing hypothesis H=0 indicates that the null hypothesis can only be

rejected for the year 1997 at any conventional significance levels. The results reveal the existence of long-run equilibrium of the data for the majority of regressions, thus, implying that the Panzar and Rosse methodology can be used constructively to estimate market power. [19]

5.2 Competitive Structure Tests

Compared to previous studies on bank competition that generally report cross-sectional results for a single country, this study has analyzed the available data in several dimensions. The econometric model with 4 different specifications was run on a pooled data set of the fourteen CEE countries to obtain a general picture of the competitive structure of economies in transition over the period of 1993-2000. Tables 5.2 and 5.3 report the results of these estimations. For the overall sample, the Model-1a and Model-2a were also estimated for three different time horizons-1993-2000, 1993-1996, and 1997-2000.[20] Panel A of Table 5.4 lists the results over these three time horizons. In order to account for geographical scope of banking services, I also defined two sub-markets based on asset size, (large and small banks with total assets above and below the median asset size in the sample) and estimated their H-statistics. Estimation results for large and small banks are presented in Panel B of Table 5.4. I also looked at the trend of

[19] The same analyses are also performed with return on equity is being the dependent variable. The results are qualitatively the same, suggesting the long-run equilibrium in data.

[20] The 1993-1996 period corresponds to the initial years of transition that were characterized by non-performing loans of state-owned banks and bank failures due mainly to the problems of adjusting to the new system and worsened economic conditions. The 1997-2000 period is characterized by the completion of debt consolidation, recapitalization of banks, and privatization of major banks along with adoption of restrictive monetary policies to stabilize the economic systems and attain positive GDP growth.

changes in competitive conditions by running the regressions on cross-sectional data for each year. These results are reported in Panel C. Finally, I computed the competition index for individual countries over the sample period. These estimates are sumarized in Table 5.5. The detailed lists of parameter estimates for each country are provided in Tables 5.6 - 5.19.

When using time series data in regressions, one must always check to make sure that all the assumptions of the classical linear regression model are satisfied. The presence of autocorrelation in the error terms of an OLS regression is a frequent problem in the analysis of time series data. In the preliminary analyses, the results of the Durbin-Watson autocorrelation tests suggested the existence of first order positive autocorrelation. The models are adjusted accordingly to correct for first order serial correlation.

5.2.1 Estimation for the Overall Sample

In this section, the econometric model is applied to a pooled sample of CEE banks to evaluate the competitive structure, assuming that banking markets of individual countries in the region possess similar characteristics and therefore the region can be considered as a single market. Tables 5.2 and 5.3 report the results of the regression analyses for the period 1993-2000.

Although the coefficients on the bank specific factors are of secondary interest to competitive analysis, they are reported for the overall sample along with H statistics in Tables 5.2 and 5.3. Other than random-effects models, the regression models estimated

all had R-squared values of 0.90 or higher and plausible parameter estimates. Note that, the sign on the size coefficient (LNTA) is generally positive and significant for most of the cases, suggesting that size differentials in assets among banks lead to higher interest revenues for the larger banks. The positive sign on the coefficient for the loans-to-assets variable (LNLOAN) implies higher interest revenue per dollar of assets for banks with a higher proportion of loans on their portfolio. This is, of course, consistent with the expectations that higher level of loans will generate higher interest income. The risk coefficient, LNEQTY, is significant and has the expected negative sign, indicating that banks with low proportion of equity capital (riskier banks) are able to generate higher income per dollar of their assets. Another significant variable with negative coefficient is the deposit mix (IBDP), and it suggests that banks, which obtain a higher proportion of their funds from retail (deposit) markets, are able to generate higher interest revenues per dollar of their assets compared to those banks that rely heavily on purchased funds. This is consistent with the notion that higher shares of "core deposits" in total funds imply the degree of retail operations where banks confront relatively less competition.

The signs on the coefficients for the price of funds proxy (LNPF) and the price of labor proxy (LNPL) are always highly statistically significant and positive in all cases, as expected. The price of funds input provides the highest contribution the explanation of bank revenues (thus to H-statistic), followed by price of labor. The coefficient of price of capital proxy is also positive and significant in most of the cases, and provides the least contribution to the H-statistic. In general, both models yield similar results and the explanatory power of the models is satisfactory. The country dummies also contribute significantly to the explanation of dependent variable.

As for the competitive structure tests, the following results are observed. For the OLS estimations, models with interest revenue as the dependent variable generally yield higher H-statistics, and for fixed and random effects estimations, models with total revenue as the dependent variable yield higher H-statistics. Furthermore, competition coefficients found by fixed and random effects estimations are relatively lower than that of OLS estimation. For the overall sample (Tables 5.2 and 5.3), the mean levels of H values range from 0.46 (Model Fixed-one) to 0.58 (Model 1a) depending on the model specification and are significantly different from both zero and unity. This leads to the rejection of monopoly hypothesis, the conjectural variations short-run oligopoly hypothesis, and the hypothesis of perfect competition. These findings indicate that banks in this region have actually operated under monopolistic competition between 1993 and 2000, as expected. Such findings of monopolistic competition have been also substantiated previously by Bikker and Groeneveld (2000) for the banks in 15 European Union countries.

According to Table 5.4, the estimates of market power coefficient over the three periods 1993-2000, 1993-1996, and 1997-2000 are found to be 0.58, 0.54, and 0.59 respectively, and they are statistically significantly different from the bipolar cases of unity and zero. For both Models, the estimates for the periods 1993-96 and 1997-2000 indicate a slight increase in H-values, as expected from the structural economic reforms over the sample period. For individual years, these estimates range between 0.40 and 0.69 for Model 1a and between 0.36 and 0.69 for Model 2a. They are also statistically significantly different from unity and zero. Similar to above conclusions, these results imply that competitive conduct of banks in this region cannot be characterized as purely

monopolistic or perfectly competitive between 1993 and 2000. The cross-section estimates for each year indicate initially a decreasing trend between 1993 and 1996 and a subsequent increasing trend in competitive conditions after 1996, although the competitive conduct must still be characterized as monopolistic competition.

According to both models in Panel B of Table 5.4, the H-statistics for large banks are higher than those for smaller banks. Since H-statistic might be interpreted as a continuous measure of competitive conduct (that is higher H values refer to higher competition), we can say that large banks in transition countries operate in a relatively more competitive environment compared to small banks, or, in other words, competition is lower in local markets compared to national and international markets. This results are not surprising, since I expect that larger banks with international operations would confront higher competitive pressures from other Universal European banks.

Overall, the results are consistent with the expectation that liberalization and deregulation of financial markets during the process of transition from command-based to market-based systems have increased the competitive conditions in CEE banking markets. This conjecture becomes noticeable especially after 1996 when transition countries had gone through a substantial privatization, experienced significant foreign bank participation in their markets due to a relatively more liberal financial structure, and adopted new regulations in order to comply with European banking standards before joining the European Union. This is, indeed the period when most of the structural reforms in the banking sectors had been fully absorbed and accommodated by the CEE countries.

5.2.2 Estimation for the Individual Countries

Observing the structural differences suggested by significant country dummies estimated in the full sample analysis calls for the evaluation of competitive conditions at the country level. Furthermore, extending the competition analysis into national markets of CEE will also enable us to examine the relationship between competition, concentration, and performance. For these reasons, I extend the competitive analyses performed in the previous section to individual banking markets in the sample.

Table 5.5 summarizes the calculated market power coefficients of the separate analyses for each country over the sample period, with two different model specifications. In the majority of cases, the H-statistic is positive and significantly different from zero and unity. According to Model 1a, over the period 1993-2000, Latvia has the highest competitive index (0.75) and Slovakia has the lowest (0.09). The models fail to reject the hypothesis H=0 for Slovakia and FYR of Macedonia at the 95 percent confidence level.[21] Therefore, I conclude that for the period 1993-2000 the banking markets of Slovakia and FYR of Macedonia can be characterized as monopolistic (or cases of perfectly colluding oligopoly or conjectural variations short-run oligopoly).

According to the above findings, I reject the monopoly and perfect competition hypotheses for individual countries (except for FYR of Macedonia and Slovakia) and conclude that banks in these countries seem to earn their revenues as if under the conditions of monopolistic competition. These results are also consistent with the

[21] Model 1b rejects the hypothesis H=0 for Slovakia but not for FYR of Macedonia.

expectation that liberalization and deregulation of CEE financial markets have increased the competitive conditions in CEE banking markets.

5.3. Competition, Concentration, and Bank Performance

Although results reported in the previous section suggest a high degree of competitiveness in CEE banking markets, they do not convey any information regarding the impact of concentration in competitive conduct and the effects of competition on bank performance. From the public policy perspective, it would be extremely beneficial to understand whether concentration impedes competitive pricing and whether high competition automatically translates into higher efficiency. In the following sections I examine the relationship between the degree of competition (measured by H statistic as computed in this section) and the level of concentration (measured by 3-bank concentration ratio-CR3). I also investigate the effect of concentration and competition on bank performance measures such as cost and profit efficiency.

5.3.1 Competition and Concentration

As discussed in Section 3, the literature offers two competing hypotheses regarding the effect of concentration on the pricing behavior of banks. On the one hand, the structure-conduct-performance (SCP) hypothesis suggests that banks operating in more concentrated markets can use their market power to extract high rents from their customers. The efficient structure hypothesis (ESH) on the other hand, suggests that

concentration might increase the overall efficiency of the banking markets if concentration is due to efficiency, or if more efficient banks grow at the expense of less efficient banks. If this be the case, banks in concentrated markets would price their services competitively at least up to a certain point.

Table 5-20 presents average CR3 concentration index and the H statistics from Model-1a for individual countries over the sample period 1993-2000. Figure 1 shows a scatter of CR3 and H Statistics for each country and also provides an estimated linear regression line through these data points. Although the slightly downward sloping regression line suggests that higher concentration is associated with lower degree of competition, the negative slope of the regression line with a t-value of –0.71 is not statistically significant at any conventional significance levels. Therefore these result of the empirical analysis yields no significant relationship between concentration and collusive behavior.

The results suggest that the highly concentrated banking markets of transition economies do not seem to lead to anti-competitive conduct as suggested by the traditional SCP hypothesis since the competitive analyses in the previous section consistently reject the existence of collusive behavior and the linear regression in this section does not yield a significant relationship between concentration and competition. These results seem to be compatible with contestable markets theory (CMT), if we can assume that incumbent firms set their prices close to the competitive level because of potential competition; otherwise higher prices will attract potential entrants with hit-and-run strategies.

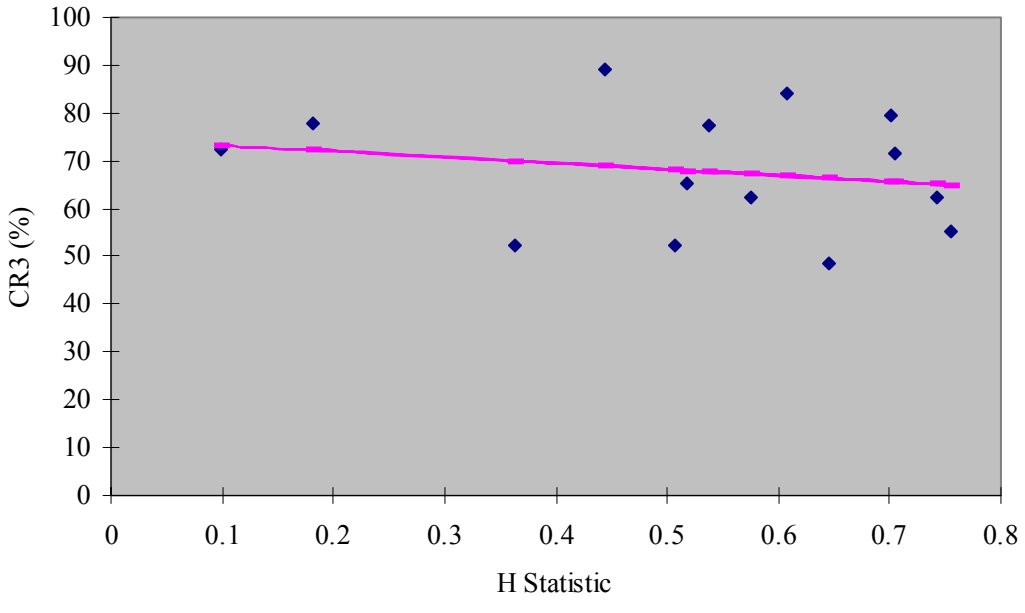

Figure 1
Relationship Between Concentration and Competition

5.3.2. Competition and Bank Performance

In this section I investigate the relationship between competition and bank performance in CEE banking markets. For this reason, I use cost and profit efficiency measures as performance indicators. The efficiency analysis comprises two stages. In the first stage, I employ the standard translog specification to obtain efficiency estimates for individual banks in the sample. Since the production technologies of banks are unknown a priori, I estimate the efficiency measure as the deviation from the efficient frontier

where best-practice firms operate. In this approach, a frontier is established from the estimated cost or profit function of banks in the data while the inefficiencies or deviations from the frontier are represented by the error terms. In the second stage, I explore the relationship between bank efficiency and market structure variables such as competition level and market concentration after accounting for certain bank-specific factors.

I evaluate the performance of CEE banks using two different optimization concepts—cost minimization and alternative profit maximization. In this respect efficiency refers to the degree of managerial success on using inputs and outputs in a manner that will minimize costs and maximize profits. I employ two different efficiency estimation techniques, namely "Stochastic Frontier Analysis" (SFA) and the "Distribution-free Analysis" (DFA). These optimization concepts and estimation techniques are explained in detail in Yildirim and Philippatos (2002b). I also briefly explain the derivation of cost and profit frontiers and the multi-product translog functional form to estimate efficiency measures in Tables 5.21-5.23 in the appendix.

5.3.2.1.Cost and Profit Efficiency Measures

The mean cost and profit efficiencies obtained from the frontiers that were estimated by two different methods, i.e. SFA and DFA, are presented in Tables 5.24 and 5.25. I report the results in four different truncation points (0, 1, 5, and 10%).

Note that, the level of efficiency changes significantly with the level of truncation applied. For example, the average cost efficiency measured by the DFA for the overall sample changes from 40% to 66% when only 1% of extreme values are replaced by the

value of truncation point. The inefficiency level increases to 73% with 5% truncation. This might be due to persistent random factors that do not factor out completely over the sample period as assumed by the DFA approach. Following the prior literature, I will focus my analysis on the efficiency measures obtained by 5% truncation level.

According to the SFA results at 5% truncation point, the average cost efficiency level for CEE countries under examination is 76%. This result suggests that, on average, about one-fourth of the bank resources are wasted during the provision of banking services in transition economies. The results of the analysis are comparable to that of previous studies of developed banking markets where operating inefficiencies are typically in the vicinity of 20% to 30%. According to these results Poland and Slovenia appear to be the most efficient countries while the Russian Federation and the three Baltic States (Lithuania, Latvia, and Estonia) are the least efficient.

The cost efficiency levels estimated by the DFA at 5 % truncation are slightly lower than those estimated by the SFA. The overall efficiency measure is 0.72 for the entire sample. The 72% efficiency measure means that the average bank needs 28% more resources to produce the same output as the average efficient bank. Based on the DFA results, Poland has the highest average efficiency level (81%) and Lithuania has the lowest (63%). Given the relatively well-developed nature of the Polish banking industry this result does not come as a surprise. This result might partly be attributed to the increased foreign participation with more efficient operating techniques in Poland. The highly concentrated structure of the banking markets and the lack of competition might be the reasons for such low scores of efficiency in the Baltic States. For example, the Estonian banking market is highly concentrated and the three largest domestic banks

controlled more than 95% of total assets at the end of June 2000. The efficiency scores of other countries range between 66% and 80%, implying that an average bank in these countries can reduce its operating costs by 34% to 20% if it can adjust its operations according to the bank at the frontier. Overall, the results imply that, banks in transition economies can significantly reduce their production costs if they can utilize their productive inputs more efficiently.

The results of the alternative profit efficiency estimation are presented in Table 5.25. Here too, the levels of efficiency measures significantly vary with the level of truncation chosen. As in many previous researches, the alternative profit estimates are lower than those of cost efficiency (Berger and Mester (1997) for US banks; Maudos et al. (2002) for 10 EU member countries). According to the SFA, approximately one-third of banks' profits are lost to inefficiency, and almost one-half according to the DFA. Estonia, Latvia, and FYR of Macedonia have the highest average profit efficiency level (69%) while Romania has the lowest (43%).

5.3.2.2. Explaining the Determianants of Efficiency

Having documented the efficiency scores of each national banking industry, the next step is to determine whether the efficiency levels can be explained by market structure factors such as competition and concentration. For this purpose, I provide an explanatory analysis through examining the cross-sectional determinants of bank-specific efficiency by regressing these measures against a number of financial and structural variables.

Several bank- and industry-specific factors may influence the efficiency of a particular bank. Some of these factors may be neither inputs nor outputs in the production process, but rather circumstances faced by a particular bank. The variables consist of two groups-the first representing the nature of the market and regulatory structure in effect over the period examined and the second encompassing the firm-specific attributes.

There are several ways by which market structure can affect the performance of financial intermediaries. Recent theoretic work in the economics of information postulates that under the setting of asymmetric information and uncertainty, competitive pressures serve as the most effective instrument in fostering productive efficiency (Hart, 1983). Competition motivates management to operate closely to their production frontier and also, under the agency framework, provides the principals with relevant information for monitoring effectively the agent's activities. Incumbent banks in an industry characterized by entry barriers are subject to a lesser degree of market discipline since the degree of competition they face will be relatively low. Therefore, I hypothesize that increased competition will improve bank efficiency. In order to account for the effect of the degree of competition (COMP), I use the Panzar and Rosse H-statistic as computed in the previous section.

It is widely acknowledged that due to the lack of potential competition, banks in concentrated markets can exercise market power to earn monopoly profits and enjoy the luxury of operating in inefficient levels. The ICR3 variable, which represents the market share of the largest three banks in the industry, is used to capture the effect of market concentration on bank efficiency. As already discussed in Chapter 3, the two competing theories that explain the linkage between market concentration and firm performance are

the SCP paradigm and ESH. SCP paradigm asserts that concentration is the result of market power and conjectures a negative relation between concentration and efficiency. The ESH, in contrast, argues that efficient firms grow large at the expense of inefficient firms, and therefore anticipates a higher efficiency in concentrated markets. Hence, I do not have a strong ex-ante expectation on the sign of the concentration coefficient.

The GDP variable represents the growth rate in state domestic product and is used as a proxy for local economic conditions. Favorable economic conditions will affect positively the demand and supply of banking services, and will possibly improve bank efficiency. To distinguish between foreign and domestic banks I included the FOREIGN dummy variable. I expect to find higher efficiency measures for foreign-owned banks compared to domestically owned private or state banks. Similarly SPEC variable is used to distinguish between commercial and cooperative banks and accounts for the effect of bank specialization. I also specified the LISTED dummy variable to account for any systematic differences in efficiency levels of the publicly traded banks and private banks.

The other bank-specific variables included in the regressions are: size (LNTA=log of total assets measured in thousands of US dollar); performance (ROA= net income as a fraction of total assets); capitalization (EQTY= book value of stockholders' equity as a fraction of total assets); risk (LOANS/TA= total loans over total assets, LLR/TL= Loan loss reserves as a fraction of gross loans); funding (CSTF=customer and short term funding over total funds; IBDP/TOTDEP= interbank deposits over total deposits) and off-balance sheet activity (OBSI/TA=off-balance sheet items over total assets) variables.

The second stage regressions were estimated using OLS, where the standard errors were calculated using White's (1980) correction for heteroscedasticity. Table 5.26 reports the definition of regression variables and the results of the estimation. Overall, most of the coefficients are significant.

Among the market structure variables, the degree of competition has a positive influence on cost efficiency and a negative one on profit efficiency. These results suggest that the banks operating in more competitive and contestable markets are under more pressure to control their costs and cannot earn higher profits by exercising their potential market power. Consistent with this result, the negative and highly statistically significant relationship between industry concentration ratio and profit efficiency implies that profitability is not the result of concentration or market power. The GDP variable is positive indicating that favorable economic conditions improve bank efficiency. Foreign banks operating in transition countries appear to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks. The dummy variable representing bank specialization is significant only in the cost efficiency case indicating that commercial banks are less cost efficient relative to cooperative banks. Public trading dummy (LISTED) did not yield any significant relationship in both cost and profit efficiency models.

As for the firm-specific variables, the coefficient on the size variable is positive and statistically significant at the 1 % level, indicating that, on average, larger banks attain a higher level of cost efficiency in their operations. This might be the result of the relaxation of asset restrictions in the banking system that allowed the banks to grow and venture into different banking business practices, and to accrue some economies of scale

and scope. Profit efficiency on the other hand does not seem to be linked to asset size at any conventional significance levels. The coefficient on the performance variable, ROA, is positive and significant, suggesting that greater cost and profit efficiency is linked to higher profitability. The level of equity capital is positively related with efficiency in both models. This finding is consistent with the results of the previous research that usually report higher cost and profit efficiency levels for well-capitalized banks. Banks with higher ratio of loans to assets are found to be more cost efficient. A negative and statistically significant LLR/TL coefficient indicates that a higher level of problem loans is associated with lower cost and profit efficiency levels. This result might suggest that efficient banks are very effective in evaluating credit risk (Berger and DeYoung, 1997). Efficient banks also appear to have higher customer and short tem funds in total funding and low interbank deposit ratios. Finally, banks with higher level of off-balance sheet activities are found to be significantly more cost and profit efficient.

Chapter 6

Summary and Conclusions

This study examines the competitive conditions in fourteen Central and Eastern European countries' banking industry while explicitly controlling for the bank specific factors such as risk, size, and deposit mix for the period 1993-2000. Furthermore, this study also examines the relationship between the degree of competition and concentration, and their effects on bank performance for the sample period. For the transition countries of Central and Eastern Europe, this period corresponds to an era characterized by substantial reform programs to restructure their planned economies into market-based economies, and to liberalize and deregulate sufficiently their financial systems in order to integrate economically with the advanced western world.

The basis for the evaluation of competitive situation is the extant oligopoly theory in the new industrial organization literature, specifically, the competition model developed by Rosse and Panzar (1977). This approach relies on the premise that, in their long-run equilibrium, banks will employ different pricing strategies in response to a change in input costs depending on the market structure in which they operate. The results of the equilibrium tests reveal the existence of long-run equilibrium of the data for the majority of regressions, thus, implying that the Rosse and Panzar methodology can be used constructively to estimate market power.

6.1 Summary of the Empirical Findings and Limitations of the Research

The results of the competition analysis suggest that the banking markets of CEE countries cannot be characterized by the bipolar cases of either perfect competition or monopoly over 1993-2000 except for FYR of Macedonia and Slovakia. That is, banks earned their revenues as if operating under conditions of monopolistic competition in that period. Overall, large banks in transition countries operate in a relatively more competitive environment compared to small banks, or in other words, competition is lower in local markets compared to national and international markets. Finally, the cross-sectional analysis of competitive structure shows initially a decreasing trend between 1993 and 1996 and a subsequent increasing trend in competitive conditions after 1996, revealing the inevitable impact of liberalization on competitive conditions. As an overall conclusion, for the region and individual countries under investigation, the banking market structure can be characterized as monopolistic competition. This conclusion holds under a variety of specifications controlling for bank-size, risk and various deposit composition characteristics, and a number of estimation techniques.

Although the coefficients of control variables in competition analysis are of secondary interest, I think they are worth mentioning since they might be helpful in understanding the effects of bank-specific factors in revenue generating process in CEE banking markets. Specifically, I find that size differentials in assets among CEE banks lead to higher interest revenues for the larger banks. Higher interest revenue per dollar of assets for banks is associated with a higher proportion of loans on their portfolio. Results also suggest that banks, which obtain a higher proportion of their funds from retail

markets, are able to generate higher interest revenues per dollar of their assets. Finally, riskier banks are found to be able to generate higher income per dollar of their assets.

In this research I also investigate the relationship between competition and concentration, and their effects on bank performance. The simple linear regression between competition and concentration does not yield any significant relationship, suggesting the possibility that higher contestability, in part due to the recent technological advances, have resulted in an overall increase in competition, despite high level of market concentration.

Regarding the bank performance, I find that the average bank deviates substantially from the best-practice frontier. The managerial inefficiencies in CEE banking markets were found to be significant, with average cost efficiency levels of 72 and 76 percent by DFA and SFA. Overall, these average estimates suggest that an average bank would have incurred 28 to 24 percent less of its actual costs had it matched its performance with the best-practiced bank. According to the results Poland and Slovenia appear to be the most cost efficient countries while the Russian Federation and the three Baltic States (Lithuania, Latvia, and Estonia) are the least efficient. The alternative profit efficiency levels are found to be significantly lower relative to cost efficiency. According to SFA, approximately one-third of banks' profits are lost to inefficiency, and almost one-half according to the DFA. Among the countries under examination Estonia, Latvia, and Macedonia have the highest average profit efficiency level (69%) while Romania has the lowest (43%).

The results of the second-stage regression analyses of bank performance suggest that higher efficiency levels are associated with larger banks, higher profitability and

better capitalization. Banks that heavily rely on core deposits in funding their assets are found to be more efficient. Consistent with most prior research, a higher level of problem loans is associated with lower efficiency levels. Regarding the effect of market structure on bank performance, the level of competition is found to increase efficiency while market concentration is negatively linked to efficiency. Favorable economic conditions seem to improve bank performance as reflected by a positive relation between GDP growth and efficiency. Finally, foreign banks operating in transition countries are found to be more cost efficient but less profit efficient relative to domestically owned private banks and state-owned banks.

Overall, findings of competition analyses are consistent with previous research on competitive conditions in the banking industries of developed countries that generally report varying degrees of monopolistic competition. The notion that high concentration in CEE banking markets will result in monopoly rents as suggested by SCP paradigm is not supported by empirical results. These results seem to be compatible with contestable markets theory (CMT), if one can assume that incumbent firms set their prices close to the competitive level because of potential competition; otherwise higher prices will attract potential entrants with hit-and-run strategies. These results are also consistent with the expectation that liberalization and deregulation of CEE financial markets have increased the competitive conditions in CEE banking markets. However, I should also note that the period under investigation corresponds to the early years of the ongoing transition from central planning when these countries were lacking many market-supportive institutions essential for efficient financial markets. Therefore, the results of this study should be interpreted with the necessary scholarly scrutiny.

6.2 Policy Implications of the Results

In summarizing the specific results of this study, I would also like to make the following remarks regarding the policy questions raised in the introductory section. First of all, CEE countries deserve to be given special attention and enough credit for their achievements in building market-oriented banking systems from almost scratch in such a short time period. Despite the considerable disparities among their progress of achievement, in less than a decade they have passed the threshold point of other market economies that made them part of the free world—a progress that took several decades to achieve for the developed western countries.

Broadly speaking, they were rather successful in certain areas of structural reforms such as effective design and implementation of the privatization process, competitive policies, and prudential regulatory framework. With regard to privatization and foreign bank participation, in many of these countries the private sector currently holds more than 70 percent of the assets in banking—a figure which is quite comparable to that of many western economies- and more than half of the assets in the CEE banking industry are owned by foreign institutions. The results of the current study suggests that CEE banks increased their competitiveness to a certain degree with large scale privatization and foreign participation in their banking systems. It is expected that CEE banks will continue to respond to increased competition by extending the scope of professional services beyond traditional markets, generating other revenue sources by offering new services and products, focusing on non-interest income-generating

activities, reducing excess capacity through mergers and/or branch closures, and upgrading their operations through new technology.

Building strong institutions and effective governance was, and will be, the key element throughout the ongoing transition process, which requires market-oriented financial structures. Therefore, it is essential to establish a prudentially regulated entry policy and careful supervision for both domestic and foreign participation in managing the transition process by avoiding financial distress which is likely to be caused by competitive pressures. Due to their liberal licencing policies, CEE countries experienced a rapid growth of new commerical banks during the early years of transition. Since the markets to be served were initially limited, near exponential growth of commercial banks caused detrimental effects on banks' financial positions. As the free market system unfolded, the positive role the foreign banks played became more significant. The entry of foreign banks had a crucial impact on the modernization of domestic banking systems through the introduction of modern banking practices, and product and service innovation. Regarding the openness and expansion of the banking markets, the results suggest that CEE economies should keep their markets open to well-established European banks rather than adopting strictly selective policies if they want to seize the maximum benefit from best-practices of sound financial institutions and to increase the competitiveness and efficiency in their banking markets. Indeed, under the Association Agreements between EU and candidates, openness to foreign participation is also a necessary condition to meet the criteria dictated by the Second Banking Directive that enable any EU member bank freely operate in other member countries' banking markets.

With respect to developing their capital markets and making the transition from "bank-based" to "capital market-based" financial systems I can draw the following inferences:

(a) As the empirical results indicate, the CEE economies have brought their "bank-based" financial systems to the relatively high state of contestability that is somewhat comparable to that of the small economies of western Europe.

(b) All regulatory reforms and restructuring achieved nearly the desired results and made banking more competitive. Any further improvements can only come from focusing attention to improving the tentative status of capital markets in the CEE countries.

(c) As conditions in CEE capital markets improve, it is expected that commercial banks will engage in "investment banking" activities for IPOs and SEOs, thus enhancing non-interest income sources. And this fee income will, in turn, further enhance "market contestability" as measured by the PR H-statistic.

6.3 Avenues For the Future Research

The growth of research and knowledge about the process of political, social, and economic transition from command economies to market economy has been substantial over the recent years. I believe that this infant area will continue to receive a great deal of attention, particularly because a number of interesting questions have been suggested by the examination of competitive structure. For example, It would be interesting for future research to inquire: How did banks react to the European unification in anticipation of increased competition? Which banking activities in the region are likely to

be affected because of the EMU? What organizational rearrangement banks have experienced in response to changing competitive conditions? Another interesting topic might be answering the question whether efficiency gains derived from increased competition are passed onto bank customers as reduced costs or improved product and service quality? Finally, previous research reports substantial evidence of a positive relationship between the level of development of the financial markets and economic growth. (See, among others, McKinnon (1973), Shaw (1973), and more recently Pagano (1993), King and Levine (1993), and Levine and Zervos (1998)). Keeping up with the current research, the next avenue would be to examine whether the findings of these authors hold for the transition economies of Central and Eastern Europe.

LIST OF REFERENCES

Bain, J. S., 1951. "Relation of profit rate to industry concentration", *Quarterly journal of economics*, 65 pp. 293-324

Baumol, W., 1982. "Constable markets: An uprising in the theory of industry structure", *American Economic Review* , 72, pp. 1-15

Berger, A.N. and Hannan, T.H., 1989. "The price-concentration relationship in banking." *Review of Economics and Statistics* 71, pp. 291–299.

Berger, A.N. and D.B. Humphrey, 1991. "The Dominance of Inefficiencies over Scale and Product Mix Economies in Banking", *Journal of Monetary Economics* 28(1):117-148.

Berger, A. N., 1995. "The Profit-Structure Relationship in Banking - Tests of Market Power and Efficient-Structure Hypothesis," *Journal of Money, Credit and Banking* 27, pp. 404-431.

Berger, A.N. and R. DeYoung, 1997, "Problem Loans and Cost Efficiency in Commercial Banks", Journal of Banking & Finance 21, 1997, p.849-870.

Berger, A.N. and L.J. Mester. 1997. "Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions?" Journal of Banking and Finance 21: 895-947.

Bhattacharaya, J., 1993. "The role of foreign banks in developing countries: A survey of evidence". Cornell University, mimeo.

Bikker, J.A. and J.M. Groeneveld, 2000. "Competition and Concentration in the EU Banking Industry", *Kredit und Kapital* 33, pp. 62-98.

Bikker, J.A., Haaf, K., 2000. "Competition, concentration and their relationship: An empirical analysis of the banking industry", Research Series Supervision No. 30, De Nederlandsche Bank, Amsterdam.

Bourke, P., 1989. "Concentration and other determinants of bank profitability in Europe, North America and Australia*", Journal of banking and finance*, 13, 65-78

Brada, J. C., and Ali M. Kutan, 1998. "The end of moderate inflation in three transition economies", Federal Reserve Bank of St. Louis Working paper 99-003A

Brozen, Yale. 1982. "Concentration, Mergers and Public Policy" New York: MacMillan.

Calem, P. and Carlino, G., 1991. "The concentration/conduct relationship in bank deposit markets", *The Review of Economics and Statistics*, 73, 2, 268-276

Casu, B. and P. Molyneux, 2000. "A Comparative Study of Efficiency in European Banking", working paper, February 2000

Catte, P. and C. Mastropasqua, 1993. "Financial Structure and reforms in Central and Eastern Europe in the 1980s.", *Journal of Banking and Finance*, 17 (1993) 785-817

Claessens, S., A. Demirguc-Kunt, and H. Huizinga, 2001. "How does foreign bank entry affect the domestic bank market?" *Journal Of Banking And Finance* Vol. 25 (5) pp. 891-911.

Clarke, R., and S.W. Davies., 1982. "Market Structure and Price-Cost Margins". *Economica* 49: 277-87.

Coccorese, P., 1998. "Assessing the Competitive Conditions in the Italian Banking System: Some empirical evidence", *BNL Quarterly Review*, no.205, pp. 171-199

De Bandt, O., Davis, E.P., 2000. "Competition, contestability and market structure in European banking sectors on the eve of EMU", *Journal of Banking and Finance*, 24, 1045-1066

Demsetz, H., 1973. "Information and efficiency: Another viewpoint". *Journal of Law and Economics* 10: 1-22.

Denizer, Cevdet, 1997. "The Effects of Financial Liberalization and New Bank Entry on Market Structure and Competition in Turkey", World Bank Research paper

Denizer, Cevdet, 1998. "Foreign Entry in Turkey's Banking Sector, 1980-1997", IFC/The World Bank Paper prepared for WTO-World Bank Conference on Liberalization and Internationalization of Financial Services Geneva, May 1999

European Central Bank, 1999. "Possible Effects Of EMU On The Banking Systems In The Medium To Long Term".

Evanoff, D.D., and D.L. Fortier, 1988. "Re-evaluation of the Structure: Conduct Performance Paradigm in Banking". *Journal of Financial Services Research* 1: 272-94.

Gelb, A., and S. Sagari, 1990. "Banking, in P. Messerlin and K. Sanvant, eds., The Uruguay Round: Services in the World Economy", Washington, D.C.: The World Bank and UN Center on Transnational Corporations.

Gelfand, M. And Spiller, P., 1987, "Entry Barriers And Multiproduct Oligopolies", *International Journal Of Industrial Organization*, 5, 101-113.

Gilbert, R. Alton. 1984. "Bank Market Structure and Competition: A Survey" *Journal of Money,Credit, and Banking* (November 1984), pp. 617-44.

Hannan, T. and A. Berger, 1991. “The Rigidity of Prices: Evidence from the Banking Industry”, *American Economic Review*, 81, 938-945.

Hannan, T. and J.N. Liang, 1993. “Inferring Market Power from Time-Series Data”, *International Journal of Industrial Organization*, 11, 205-218.

Hart, O. S., 1983. “The Market Mechanism As an Incentive Scheme," Bell Journal of Economics l4 (Autumn l983) 366-382

Hondroyiannis G., and E. Papapetrou, 1996. “International banking activity in Greece: The recent Experience”, *Journal of Economics and Business*, 48:207-215

Jackson, W. III. 1997. “Market Structure and the Speed of Adjustment: Evidence of Non-Monotonicity”, *Review of Industrial Organization*, 12, 37-57.

King, R. and Levine, R., 1993a. “Finance and growth: Schumpeter might be right.” *Quarterly Journal of Economics* 108, pp. 707–737.

King, R. and Levine, R., 1993b. “Finance entrepreneurship and growth: Theory and evidence”. *Journal of Monetary Economics* 32, pp. 513–542.

Levine, Ross, 1996. “Foreign banks, financial development, and economic growth”, in Claude E. Barfied, ed., *International Financial Markets.* Washington, D.C., AEI Press

Levine, R., 1997. “Financial development and economic growth: Views and agenda. “ *Journal of Economic Literature* 35, pp. 688–726.

Levine Ross and Sara Zervos, 1988. “Stock Markets, Banks, and Economic Growth,” *American Economic Review*, vol 88, no 3, 537-558

Lloyd-Williams, D.M., P. Molyneux, And J. Thornton, 1991. "Competition And Contestability In The Japanese Commercial Banking Market", Institute Of European Finance, Research Papers In Banking And Finance, No 16, Bangor

Lloyd-Williams, D.M., Molyneux, P., and Thorton, J., 1994. "Market Structure and Performance in Spanish Banking", *Journal of Banking and Finance*, vol. 18, 433-43.

Mason, Edwards S., 1939. “Price And Production Policies Of Large-Scale Enterprise”, *American Economic Review*, 29, Pp.61-74

Maudos J., J. Pastor, F. Perez, and J. Quesada, 2002, “Cost and Profit Efficiency in European Banks”, Journal of International Financial Markets, Institutions, and Money 12, (2002) 33-58

McFadden, Catherine, 1994. “Foreign banks in Australia”, The World Bank, mimeo.

McKinnon, Ronald I. 1973. “Money and Capital in Economic Development”. Washington DC: The Brookings Institution.

Molyneux, P., and J. Thornton., 1992. "Determinants of European bank Profitability: A Note." *Journal of Banking and Finance* 16: 1173-1178.

Molyneux, P., 1993. "Concentration And Rivalry In European Banking, IEF Research Papers, RP 93/1.

Molyneux, P., 1995. "Cooperation and rivalry in banking markets", Chapter 1 in Research in International Business and Finance. Vol.12. J.Doukas and L.Lang (eds), pp. 3-23.

Molyneux, P., Lloyd-Williams, D.M., Thornton, J., 1994. “Competitive conditions in European banking”. *Journal of Banking and Finance* 18, 445-459.

Molyneux P., J. Thornton and Lloyd-Williams, D.M. 1996. ‘Competition and Market Contestability in the Japanese Commercial Banking Market’, *Journal of Economics and Business* 1996, 48, pp. 33-45

Molyneux, Phil and J.L. Teppet, 1993. “Structure - Conduct - Performance in EFTA Banking Markets”, Bank- en Financiewezen 3, 133-137.

Nathan, A., Neave, E., 1989. “Competition And Contestability In Canada's Financial System:Empirical Results”. *Canadian Journal Of Economics* 22, 576-594.

Neven Damien, and Lars-Hendrick Roller, 1995. “An aggregate structural model of competition in the European banking industry”, *International Journal of Industrial organization*, 17, (1999) 1059 -1074.

Pagano, M., 1993. “Financial markets and growth: An overview”. *European Economic Review* 37, pp. 613–623.

Panzar, J.C. and Rosse, J.N., 1982. "Structure, Conduct and Comparative Statistics" *Bell Laboratories Economic discussion paper* No. 248.

Panzar, J.C., Rosse, J.N., 1987. “Testing for Monopoly equilibrium”. *Journal of Industrial Economics* 35, 443-456.

Panzar, J. and Willig, R., 1977. "Free Entry and the Sustainability of Natural Monopoly," *Bell Journal of Economics*, Vol. 8(1), Spring 1977, pp. 1-22.

Peltzman, S., 1977. "The Gains and Losses from Industrial Concentration" *Journal of Law and Economics* 20, 229-263.

Prati, A., Schinasi, G., 1997. "EMU and international capital markets: structural implications and risks". In: Masson, P., Krueger, Th., Turtleboom, B. (Eds.) , EMU and the International Monetary System.17-48, IMF.

Rajan, R. and L. Zingales, 1998. "Financial dependence and Growth", *American Economic review*, Vol. 88, June 1998, pp.559586.

Rhoades, S. A., 1985. "Market Share as a Source of Market Power: Implications and Some Evidence", *Journal of Economics and Business* 37, 343-363.

Ribon, S. and O. Yosha, 1999. "Financial Liberalization and Competition in Banking: An Empirical Investigation", Tel Aviv University, Working Paper no. 23-99.

Rime, B., 1999. "Mesure de degré de concurrence dans le système bancaire Suisse à l'aide du modèle de Panzar et Rosse", Revue Suisse d'Economie Politique et de Statistique 135 (1), pp. 21-40.

Rosse, J.N., and J.C. Panzar, 1977. "Chamberlin vs Robinson: An Empirical Study for Monopoly Rents", *Bell Laboratories Economic Discussion Paper.*

Scholtens, 2000. "Financial regulation and financial system architecture in Central Europe", *Journal Of Banking And Finance* (24)4 (2000) pp. 525-553

Shaffer, S.,1982. "Competition Conduct And Demand Elasticity." *Economic Letters* 10, Pp.167-171

Shaffer, S., 1992. "Competitiveness in Banking," in The New Palgrave Dictionary of Money and Finance, Peter Newman, Murray Milgate, and John Eatwell, eds., Stockton Press, 1992, Volume 1, pp. 414-16.

Shaw, E. S., 1973. "Financial Deepening in Economic Development". New York: Oxford University Press.

Shepherd, W. G. , 1986. "Tobin's q and the structure performance relationship: Comment". *American Economic Review* 76 (December), 1211-1213

Smirlock, M.,1985. "Evidence on the (Non) Relationship Between Concentration and Profitability in Banking." *Journal of Money, Credit and Banking*, Vol. 17, pp. 69-83.

Smirlock, M. and D. Brown, 1986. "Collusion, Efficiency and Pricing Behavior: Evidence From the Banking Industry." Economic Inquiry, Vol. 24, pp. 85-96.

Spiller, P. And E. Favaro, 1984, “The Effects Of Entry Regulation On Oligopolistic Interactions: The Uruguayan Banking Sector”, *The Rand Journal Of Economics*, 9, 305-327.

Talley S., M. M. Giugale, and R. Polastri , 1998. “Capital Inflow Reversals, Banking Stability, and Prudential Regulation in Central and Eastern Europe”, World Bank Working paper Series 2023

Terrell, H. S., 1986. “The role of foreign banks in domestic banking markets”, in H. Cheng, ed., *Financial Policy and Reform in Pacific-Rim Countrie*s, Lexington: Lexington Books.

Thorne Alfredo, 1993. "Eastern Europe's Experience With Banking Reform, Is There A Role For Banks In The Transition?" *Journal of Banking and Finance*, 17, 959-1000

Vesala, J., 1995. “Testing Competition In Banking: Behavioral Evidence From Finland”, Bank Of Finland Studies, E:1, Helsinki.

Walter, I., and H. P. Gray, 1983. “Protectionism, and international banking, sectoral efficiency, competitive structure and national policy”, *Journal of Banking and Finance* 7, 597-609.

Weiss, L. W., 1974. “The Concentration-Profits Relationship and Antitrust”, in: H. J. Goldschmid, H. M. Mann and J. F. Weston (eds.), Industrial Concentration: The New Learning, Boston: Little, Brown and Company.

White, H., 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrics*, 48, 817 -838.

Yeyati E. L., F. Sturzenegger, 2000. “Implications of the euro for Latin America's financial and banking systems”, *Emerging Markets Review* (1)1 (2000) pp.53-81

Yildirim, H. S., and G. C. Philippatos, 2002b, “Efficiency of Banks: Recent Evidence from the Transition Economies of Europe”, Working paper.

APPENDIX

Table 2.1 Banking Supervision in Central and Eastern Europe

	BUL	CRO	CZR	EST	HUN	LAT	LIT	POL	ROM	SLK	SLV
Supervisor[a]	CB	CB	CB	CB	SA+CB	CB	CB	CB	CB	CB	SA+CB
Capital Requirement ($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 capital of non-bank equity	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 equity	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 set up	N.A.
Reserves/ Provisions for bad debts	1.25% loans; according to risk categories	Provisions for different risk categories	1% loans; Provisions for different risk categories	Yes	1.25 % loans; Provisions for different risk categories	According to risk categories	Yes	1% loans; Provisions for different risk categories	2% loans	1% 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

Source: Scholtens (2000) p. 543
[a]CB=Central Bank; SA=Supervisory Authority (other than central bank).

Table 2.2 Foreign Bank Ownership in Selected CEE Countries[1]

	Total Assets	Foreign Control[2]	Total Assets	Foreign Participation	Foreign Control[2]	Foreign Control[3]
	Dec-94	Dec-94	Dec-98	Dec-99	Dec-99	Dec-99
	(Billion US$)	(%)	(Billion US$)	(%)	(%)	(%)
Czech Republic	46.6	5.8	63.4	47.3	49.3	50.7
Hungary	26.8	19.8	32.6	59.5	56.6	80.4
Poland	39.4	2.1	91.1	36.3	52.8	52.8

Source : IMF staff estimates based on data from Fitch IBCA's BankScope Database

[1]Ownership data reflect changes up to December 1999 while balance sheet data are the most recent available in FITCH IBCA's BankScope

[2] Ratio of assets of banks where foreigners own more than 50 percent of total equity to total bank assets

[3] Same as footnote 2 but at 40 percent level

Table- 2.3 3-Bank Concentration Ratios for CEE Banking industry (1993-1999)

	1993	1994	1995	1996	1997	1998	1999	1993-1999
Bulgaria	93.4	84.0	67.4	77.4	60.3	59.5	58.9	71.6
Croatia	72.5	70.1	66.9	58.9	51.6	56.9	58.4	62.2
Czech Republic	77	71.2	63.8	63	62.3	57.6	61.5	65.2
Estonia	77.0	71.2	63.8	72.5	72.6	98.9	98.9	79.3
Hungary	66.7	52.7	54.6	52.8	46.1	48.1	46.1	52.4
Latvia	81.1	58.7	49.3	44.5	44.5	54.8	52.6	55.1
Lithuania	100	98	97.5	88.2	71.7	75.3	92.8	89.1
FYR of Macedonia	100.0	58.7	56.2	83.8	84.6	80.0	81.6	77.8
Poland	60.6	58.7	56.2	54.4	45.9	45.2	44.3	52.2
Romania	99.3	93.8	88.4	74.8	64	57.6	64.7	77.5
Russian Federation	64.8	47.1	48.7	52.9	27.3	63.3	36.5	48.7
Slovakia	91.6	86.8	78.3	68.9	62.5	54.6	62.7	72.2
Slovenia	62.5	74.4	66.9	56.7	57.6	59.8	59.6	62.5
Yugoslavia		90.5	82.7	76.6	75.5	86.0	93.0	84.0
Average	80.5	72.6	67.2	66.1	59.0	64.1	65.1	

Source: Author's calculations based on BankScope data set

Table 2.4 Balance Sheets for CEE Banks (1999)

The value of each item is calculated as a fraction of the book value of total assets and then averaged across all banks reporting balance sheets in the country.

	BUL	CRO	CZR	EST	HUN	LAT	LIT	MAC	POL	ROM	RUS	SLVK	SLVN	YUG
ASSETS														
Loans	33.7	51.8	34.0	51.9	49.0	51.8	39.9	41.4	48.0	27.7	45.1	54.7	46.2	33.4
Other Earning Assets	53.8	36.3	52.3	30.1	39.5	22.4	42.6	35.7	43.4	54.9	31.2	37.0	44.5	42.0
Total Earning Assets	87.5	88.1	86.3	82.0	88.6	74.1	82.5	77.2	91.5	82.6	76.3	91.6	90.7	75.5
Fixed Assets	4.9	6.4	4.6	7.9	2.7	10.8	5.4	7.1	2.4	11.6	4.8	3.9	4.0	5.5
Non-Earning Assets	7.6	5.7	9.1	10.1	8.8	15.0	12.1	15.7	6.1	5.8	19.0	4.5	5.2	19.0
Total Assets	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LIABILITIES														
Cust. & ST Funding	76.3	62.1	79.4	64.0	78.3	70.5	75.9	64.3	77.9	75.1	73.3	81.2	86.2	50.9
Other Funding	0.1	13.2	5.8	19.5	7.3	6.9	8.2	1.1	0.5	0.2	1.8	3.5	2.4	16.1
Other (Non-Int. bearing)	4.1	3.6	5.6	4.4	4.0	3.9	2.9	4.8	5.5	3.7	6.2	4.5	2.9	8.9
Loan Loss Reserves	.	2.6	0.8	.	.	.	.	.	0.1	.	.	0.2	.	.
Other Reserves	1.4	1.1	2.0	1.3	1.5	.	.	.	0.5	.	0.0	.	.	.
Equity	19.4	20.9	12.3	11.9	10.1	19.6	12.9	29.7	15.9	21.1	18.9	10.8	8.6	24.1
Total Liabilities & Equity	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Off Balance Sheet Items	11.5	14.8	25.1	27.9	53.3	8.1	5.6	16.5	0.8	8.1	38.4	25.0	33.3	14.3
Loan Loss Reserves	6.5	7.6	6.4	3.3	1.3	3.2	2.7	7.2	2.2	2.0	5.1	3.4	5.9	7.6
Liquid Assets	52.2	20.5	32.7	3.0	9.0	24.7	8.1	40.0	9.4	49.9	39.0	12.9	40.2	40.3

Source: Authors' calculation based on BankScope Data

Table 2.5 Selected Financial Ratios for CEE Banks (1999)

Ratios	BUL	CRO	CZR	EST	HUN	LAT	LIT	MAC	POL	ROM	RUS	SLVK	SLVN	YUG
Asset Quality														
Loan Loss Reserve / Gross Loans	13.2	12.7	15.1	6.3	3.1	6.7	6.0	14.0	4.0	6.5	11.2	9.2	5.4	24.2
Loan Loss Prov / Net Int Rev	26.8	58.3	53.7	43.1	20.4	66.6	23.2	42.1	15.9	12.3	26.6	102.1	28.3	103.0
Loan Loss Res / Non Perf Loans	66.6	84.5	47.0	57.4	101.2	83.4	77.3	313.1	64.5	77.1	249.0	164.0	73.4	194.2
Non Perf Loans / Gross Loans	28.6	16.8	35.0	10.2	7.9	7.8	9.1	5.6	7.0	9.2	8.1	7.9	9.2	8.2
Capital														
Total Capital Ratio	43.6	25.6	24.3	14.8	13.2	20.4	21.5	29.6	19.7	43.8	39.0	16.5	15.8	34.3
Equity / Total Assets	19.4	20.9	12.3	11.9	10.1	12.9	19.6	29.7	15.9	21.1	18.9	8.6	10.8	24.1
Equity / Net Loans	108.8	43.2	47.5	23.2	20.8	39.2	39.5	88.8	33.9	96.3	54.8	21.8	20.4	121.3
Equity / Cust & ST Funding	29.6	44.2	11.7	18.6	14.1	20.8	31.8	49.9	32.4	37.2	40.7	10.5	13.5	56.4
Cap Funds / Tot Assets	17.8	21.3	9.8	.	14.1	.	.	27.6	14.6	22.4	19.7	9.5	13.5	23.5
Operations														
Net Interest Margin	5.5	6.2	2.3	5.2	4.2	5.4	5.8	8.0	5.2	13.4	7.2	2.9	3.6	6.8
Net Int Rev / Avg Assets	4.8	5.4	2.0	4.2	3.6	4.5	4.3	5.9	4.7	10.6	5.0	2.6	3.3	5.0
Non Int Exp / Avg Assets	7.9	8.1	4.3	8.5	5.4	9.1	7.5	9.7	5.1	12.1	11.6	3.2	5.1	10.4
Return on Average Assets (ROAA)	1.0	0.9	-1.1	0.4	0.3	-0.6	0.6	2.7	1.0	0.9	4.8	1.2	0.9	0.7
Return on Average Equity (ROAE)	7.8	11.6	-14.4	1.7	1.9	2.3	6.7	7.9	2.1	4.9	27.7	15.9	7.8	3.8
Cost to Income Ratio	75.5	71.4	67.8	81.1	83.7	95.8	80.5	57.7	54.2	106.0	68.0	74.1	73.2	64.3
Liquidity														
Interbank Ratio	472.9	385.7	155.7	230.6	185.4	309.9	160.6	327.4	124.0	382.4	184.6	181.6	117.8	139.9
Net Loans / Total Assets	33.7	51.8	34.0	51.9	49.0	39.9	51.8	41.4	48.0	27.7	45.1	46.2	54.7	33.4
Net Loans / Customer & ST Fund.	47.1	91.0	44.4	84.1	64.3	58.6	75.1	66.2	67.2	37.9	71.2	53.8	67.8	70.8
Net Loans / Tot Dep & Bor	42.7	76.0	45.7	.	61.9	.	.	67.5	68.0	35.9	71.4	53.4	67.2	66.8
Liquid Assets / Cust & ST Fund.	70.2	36.6	42.1	4.6	11.9	11.2	37.4	63.9	11.8	68.5	55.3	47.0	16.0	83.1

Source: Author's calculation based on BankScope Data

Table 3.1 Interpretation of H-statistic

Estimated H	Competitive Environment Test	Equilibrium Test
$H \leq 0$	Monopoly equilibrium Perfectly colluding oligopoly Conjectural variations short-run oligopoly	$H < 0$ Disequilibrium $H=0$ Equilibrium
$0<H<1$	Monopolistic competition free entry equilibrium.	
$H=1$	Perfect competition Natural monopoly in a perfectly contestable market Sales maximizing firm subject to breakeven constraint.	

Source: Molyneux et al. (1994)

Table 3.2 Summary of Literature on Measuring Bank Competition Using P-R Methodology

Authors	Period	Countries Considered	Results
Nathan and Neave (1989)	1982-1984	Canada	1982:Perfect Competition 1983-1984:Monopolistic Competition
Shaffer (1982)	1979	New York	Monopolistic competition
Molyneux et al. (1994)	1986-1989	France, Germany, Italy, Spain, United Kingdom	Monopoly for Italy Monopolistic competition for France, Germany, Spain, UK
Vesala (1995)	1985-1992	Finland	Monopolistic competition for all but two years
Molyneux et al (1996)	1986-1988	Japan	1986:Monopoly 1988: Monopolistic competition
Coccorese (1998)	1988-1996	Italy	Monopolistic competition
De Bandt and Davis(1999)	1992-1996	France, Germany, Italy	Large banks: monopolistic competition in all countries; Small banks: monopolistic competition in Italy, monopoly in France and Germany
Rime (1999)	1987-1994	Switzerland	Monopolistic competition
Hondroyiannis et al. (1999)	1993-95	Greece	Monopolistic competition
Bikker and Groeneveld (2000)	1989-1996	15 EU countries	Monopolistic competition
Bikker and Haaf (2000)	1988-1998	23 Industrialized countries	Whole sample: Monopolistic competition Large banks: Monopolistic competition in general, several exceptions of perfect competition Monopoly for small banks in Australia and Greece

Source: Bikker and Haaf (2000) (Updated)

Table 4.1 Definitions and Descriptive Statistics of Regression Variables
(Variables other than ratios are in 1000s of US Dollars)

Variable Name	Specification	Mean	Std. Dev	Min	Max
Interest Revenue (INTREV)	Ratio of total interest revenue to total assets	0.13	0.10	0.0031	0.95
Total Revenue (TOTREV)	Ratio of total operating revenue to total assets	0.19	0.19	0.000	1.94
Price of Funds (PF)	Ratio of interest expenses to deposits and other liabilities	0.10	0.11	0.0002	0.92
Price of labor (PL)	Ratio of personnel expenses to total assets	0.02	0.02	0.0003	0.27
Price of physical capital (PK)	Ratio of non-interest expenses to fixed assets	0.05	0.13	0.0000	2.24
Total Assets (TA)	Total assets	836780	1954800	71.8100	19554211
Fixed Assets (FA)	Fixed assets	34107.88	89327.36	1.0000	1699595
Equity (EQTY)	Ratio of equity capital to total assets	0.16	0.15	0.000	0.95
Deposit Mix (IBDP)	Ratio of interbank deposits to customer and short-term funding	0.27	0.26	0	1
Loans (LOAN)	Ratio of net loans to total assets	0.41	0.18	0	1

Table 4.2 Descriptive Statistics of Regression Variables for Individual Countries[1].						
STATE	**Variable Name**	**N**	**Mean**	**Std Dev**	**Minimum**	**Maximum**
Czech	Interest Revenue (INTREV)	180	0.0872523	0.0387806	0.0121169	0.3456362
	Total Revenue (TOTREV)	180	0.1084006	0.0450301	0.0313545	0.3593143
	Price of Funds (PF)	180	0.0745252	0.0514919	0.0092871	0.5101137
	Price of Labor (PL)	180	0.0097212	0.0089039	0.0006124	0.0791636
	Price of Physical capital (PK)	180	0.0116052	0.01916	0.0000115	0.1383548
	Total Assets (TA)	180	2248104.3	3804472.4	30965.87	16538782.4
	Fixed Assets (FA)	180	80228.53	160444.1	409.91	699107.27
	Equity (EQTY)	180	0.0820106	0.0887462	-0.2274004	0.9503332
	Deposits Mix (IBDP)	180	0.4500421	0.2594344	1.48E-06	1
	Loans (LOAN)	180	0.4049209	0.1877677	0.0028867	0.8543697
Estonia	Interest Revenue (INTREV)	43	0.0772435	0.0242754	0.0440143	0.1752777
	Total Revenue (TOTREV)	43	0.1145683	0.0295589	0.065604	0.2103322
	Price of Funds (PF)	43	0.0389225	0.0141227	0.0137543	0.0865698
	Price of Labor (PL)	43	0.0260872	0.0140452	0.0062184	0.0633943
	Price of Physical capital (PK)	43	0.0416489	0.0242465	0.0048976	0.1370147
	Total Assets (TA)	43	401116.65	618478.94	3905.46	2710822.96
	Fixed Assets (FA)	43	21722.6	26381.64	192.93	103504.85
	Equity (EQTY)	43	0.113748	0.0655945	0.0466183	0.3604732
	Deposits Mix (IBDP)	43	0.210588	0.2195405	0.000364617	0.9681782
	Loans (LOAN)	43	0.4714493	0.1121781	0.2498261	0.6432901
Croatia	Interest Revenue (INTREV)	253	0.1136278	0.1247465	0.0051355	0.946884
	Total Revenue (TOTREV)	253	0.1592201	0.1550068	0.0372168	1.2073771
	Price of Funds (PF)	253	0.082303	0.1256797	0.0086976	0.9158111
	Price of Labor (PL)	246	0.0282295	0.0236198	0.0023343	0.2213674
	Price of Physical capital (PK)	253	0.0410138	0.0423551	0.0026744	0.3046759
	Total Assets (TA)	253	378877.73	763617.52	3916.55	4593289.62
	Fixed Assets (FA)	253	18786.84	43803.31	1	304233.69
	Equity (EQTY)	253	0.2127244	0.1555226	-0.1322112	0.9034268
	Deposits Mix (IBDP)	253	0.123215	0.164297	9.44E-06	0.9603943
	Loans (LOAN)	253	0.4463331	0.1592683	0.002518	0.8039897
Hungary	Interest Revenue (INTREV)	178	0.1262331	0.0466762	0.0334232	0.3152874
	Total Revenue (TOTREV)	178	0.160738	0.0633444	0.0594789	0.564222
	Price of Funds (PF)	178	0.1017652	0.0453743	0.0287929	0.277722
	Price of Labor (PL)	134	0.0175173	0.0106274	0.004498	0.066903
	Price of Physical capital (PK)	178	0.0383959	0.0328632	0.0042578	0.191895
	Total Assets (TA)	178	917838.06	1433259.07	24722.79	7985715.1
	Fixed Assets (FA)	178	39644.8	65893.17	148.96	360285.37
	Equity (EQTY)	178	0.1075873	0.0632982	-0.0671982	0.4286402
	Deposits Mix (IBDP)	178	0.3937845	0.243259	0.0000355	1
	Loans (LOAN)	178	0.438878	0.1713573	0.0629758	0.9597378

Table 4.2 Continued						
Lithuania	Interest Revenue (INTREV)	50	0.0861744	0.06025	0.0247352	0.3668564
	Total Revenue (TOTREV)	50	0.1252135	0.0700556	0.0209035	0.4152205
	Price of Funds (PF)	50	0.0558487	0.0545462	0.0090093	0.3297422
	Price of Labor (PL)	50	0.0343934	0.0137351	0.0117187	0.0751374
	Price of Physical capital (PK)	50	0.0329902	0.0149267	0.0070923	0.0891314
	Total Assets (TA)	50	234819.1	312735.45	9250	1386300
	Fixed Assets (FA)	50	18770.34	20860.62	974.73	72829.97
	Equity (EQTY)	50	0.1441787	0.1529374	-0.2746703	0.6184972
	Deposits Mix (IBDP)	50	0.2559591	0.2629081	0.0018468	1
	Loans (LOAN)	50	0.4712993	0.1234593	0.2301136	0.7919621
Latvia	Interest Revenue (INTREV)	127	0.0839826	0.0501614	0.0132157	0.2631581
	Total Revenue (TOTREV)	127	0.1340679	0.074658	-0.1106195	0.4146343
	Price of Funds (PF)	127	0.0438054	0.0488988	0.0085959	0.4112756
	Price of Labor (PL)	123	0.0277186	0.0300312	0.0022727	0.2708695
	Price of Physical capital (PK)	127	0.0544938	0.0534948	0.0073349	0.4085546
	Total Assets (TA)	127	115462.06	153125.54	1135.75	871125.61
	Fixed Assets (FA)	127	5747.81	7412.84	78.1	41598.69
	Equity (EQTY)	127	0.1306896	0.1321981	-0.4454277	0.8058534
	Deposits Mix (IBDP)	127	0.1822829	0.2174208	5.38E-08	0.9850747
	Loans (LOAN)	127	0.2949127	0.1988333	0.0034464	0.7636362
FYRM	Interest Revenue (INTREV)	48	0.1151924	0.0969766	0.0468826	0.6593867
	Total Revenue (TOTREV)	48	0.2583094	0.1469019	0.0927476	0.7967519
	Price of Funds (PF)	48	0.0679158	0.0991528	0.0052463	0.6747251
	Price of Labor (PL)	44	0.026046	0.0110989	0.010658	0.0679137
	Price of Physical capital (PK)	48	0.0461822	0.0330094	0.0119945	0.1431506
	Total Assets (TA)	48	101201.45	158195.52	6806.79	766772.59
	Fixed Assets (FA)	48	6050.84	7348.95	71.98	26996.07
	Equity (EQTY)	48	0.3358402	0.1639442	0.0520947	0.7412361
	Deposits Mix (IBDP)	48	0.1848892	0.144928	0.000150148	0.6583428
	Loans (LOAN)	48	0.3958752	0.1808295	0.0677198	0.8001533
Poland	Interest Revenue (INTREV)	279	0.1348259	0.0433996	0.0121596	0.3098252
	Total Revenue (TOTREV)	279	0.1635668	0.0475196	0.0173058	0.3435805
	Price of Funds (PF)	279	0.1121441	0.0570257	0.0083516	0.6707073
	Price of Labor (PL)	262	0.0214215	0.0107542	0.000701015	0.0834782
	Price of Physical capital (PK)	279	0.0095676	0.0162228	0.000029973	0.1037736
	Total Assets (TA)	279	1610945.03	2903889.26	9370.31	16669836.7
	Fixed Assets (FA)	279	49917.93	91726.86	208.66	481766.38
	Equity (EQTY)	279	0.1392519	0.1532416	-0.5714686	0.8193429
	Deposits Mix (IBDP)	279	0.301876	0.2625695	0.000025331	0.9890712
	Loans (LOAN)	279	0.4286273	0.1649377	9.72E-07	0.8998628

Table 4.2 Continued						
Romania	Interest Revenue (INTREV)	98	0.2519724	0.1312942	0.0232988	0.5653682
	Total Revenue (TOTREV)	98	0.3074089	0.1465702	0.0285104	0.8593636
	Price of Funds (PF)	98	0.2047187	0.133105	0.0156849	0.6739235
	Price of Labor (PL)	84	0.0394325	0.0280681	0.0055413	0.2189461
	Price of Physical capital (PK)	98	0.046507	0.0340661	0.0019603	0.1932107
	Total Assets (TA)	98	543425.5	981493.84	1405.65	4514151.28
	Fixed Assets (FA)	98	51937.95	92352.87	330.86	375138.04
	Equity (EQTY)	98	0.2023852	0.1533112	-0.290123	0.7529236
	Deposits Mix (IBDP)	98	0.2110239	0.2053267	0.000043	0.8161653
	Loans (LOAN)	98	0.3421001	0.187991	0.0004621	0.848106
Russian Fed	Interest Revenue (INTREV)	426	0.1592358	0.1185664	0.0031092	0.7954628
	Total Revenue (TOTREV)	424	0.2482925	0.1685821	-0.0675274	1.5386667
	Price of Funds (PF)	426	0.1429765	0.1399552	0.0002090	0.8716599
	Price of Labor (PL)	389	0.0272449	0.0271349	0.0002572	0.2358073
	Price of Physical capital (PK)	426	0.0614611	0.0542262	0.0004742	0.4475762
	Total Assets (TA)	426	536075.74	1424713.27	71.81	19554211.7
	Fixed Assets (FA)	426	25634.89	116143.67	5.6	1699595.17
	Equity (EQTY)	426	0.1782576	0.1769323	-1.6074231	0.7843552
	Deposits Mix (IBDP)	426	0.2729378	0.245072	4.88E-10	1
	Loans (LOAN)	426	0.4014255	0.1929195	2.35E-07	1.1885805
Slovenia	Interest Revenue (INTREV)	131	0.0856682	0.0328689	0.0089709	0.2162309
	Total Revenue (TOTREV)	131	0.1177629	0.0373638	0.0155458	0.2591529
	Price of Funds (PF)	131	0.056242	0.025412	0.0198127	0.1501834
	Price of Labor (PL)	112	0.0193732	0.0067511	0.0054632	0.0406883
	Price of Physical capital (PK)	131	0.0298204	0.0191213	0.0084395	0.1025533
	Total Assets (TA)	131	564062.58	933643.62	17592.51	5244063.28
	Fixed Assets (FA)	131	24513.68	41533.17	187.32	212196.03
	Equity (EQTY)	131	0.1366259	0.0691497	-0.0529941	0.4991095
	Deposits Mix (IBDP)	131	0.1556617	0.1657697	3.24E-06	1
	Loans (LOAN)	131	0.5066049	0.1444886	0.0048384	0.8256065
Slovakia	Interest Revenue (INTREV)	115	0.0954714	0.0403634	0.0054802	0.2133931
	Total Revenue (TOTREV)	115	0.1207537	0.0529285	0.0098642	0.361596
	Price of Funds (PF)	115	0.0848358	0.0473843	0.0089491	0.4192693
	Price of Labor (PL)	104	0.0095978	0.0056388	0.0023456	0.0475863
	Price of Physical capital (PK)	115	0.0284286	0.0404368	0.0022518	0.320461
	Total Assets (TA)	115	991733.12	1420788.34	15000	5430180.26
	Fixed Assets (FA)	115	44158.24	70313.22	902.96	289971.82
	Equity (EQTY)	115	0.1069959	0.1092515	-0.1949587	0.62
	Deposits Mix (IBDP)	115	0.3640954	0.2477856	0.0185828	1
	Loans (LOAN)	115	0.4438722	0.1643603	0.0005811	0.8084502

Table 4.2 Continued						
Yugoslavia	Interest Revenue (INTREV)	73	0.1018005	0.100024	0.0050578	0.5649241
	Total Revenue (TOTREV)	71	0.1939182	0.1580105	0.0037303	0.7605396
	Price of Funds (PF)	73	0.0483621	0.0409877	0.0033989	0.2075782
	Price of Labor (PL)	0	.	.	.	.
	Price of Physical capital (PK)	73	0.0675853	0.0878039	0.0081322	0.6306913
	Total Assets (TA)	73	1242423.4	2139503.84	2154.4	12760732.6
	Fixed Assets (FA)	73	47485.82	76207.41	1	351048.71
	Equity (EQTY)	73	0.1808678	0.1624707	0.0087453	0.8390387
	Deposits Mix (IBDP)	73	0.3462069	0.37644	5.59E-10	1
	Loans (LOAN)	73	0.3426281	0.1785243	0.0430416	1
Bulgaria	Interest Revenue (INTREV)	117	0.1328481	0.1224951	0.0044486	0.6856187
	Total Revenue (TOTREV)	117	0.3344675	0.5729553	0	4.9417681
	Price of Funds (PF)	117	0.1327697	0.169766	0.0030746	0.864
	Price of Labor (PL)	0	.	.	.	.
	Price of Physical capital (PK)	117	0.1727451	0.495705	0.000468275	4.2424964
	Total Assets (TA)	117	428927.17	1314979.27	7337.84	13061162.1
	Fixed Assets (FA)	117	11991.98	17522.81	1.52	90685.27
	Equity (EQTY)	117	0.1823892	0.1431709	-0.0468227	0.6449889
	Deposits Mix (IBDP)	117	0.2356406	0.2695131	2.39E-06	1
	Loans (LOAN)	117	0.3565919	0.1673489	0.0249323	0.7770796
[1](Variables other than ratios are in 1000s of US dollars)						

Table 4.3 Number of Banks by Country and Year (1993-2000)

	1993	1994	1995	1996	1997	1998	1999	2000
Czech Republic	17	22	26	28	28	25	23	19
Estonia	1	2	8	10	10	4	4	4
Croatia	21	27	30	35	41	37	35	30
Hungary	18	21	26	27	28	26	30	28
Lithuania	2	3	5	7	10	9	9	8
Latvia	5	12	17	17	24	21	20	18
FYR of Macedonia	2	4	7	8	8	9	10	6
Poland	21	31	35	42	44	42	43	35
Romania	3	5	6	7	11	26	27	17
Russian Federation	22	44	67	67	69	56	80	52
Slovenia	7	10	16	17	25	20	20	20
Slovakia	7	10	14	19	21	20	18	14
Yugoslavia		5	11	13	14	10	10	10
Bulgaria	7	9	13	15	16	19	19	19
Sample period	133	205	281	312	349	324	348	280

Table 4.4 Descriptive Statistics of Banks in Sample by Country Average for 1999

Country	N	Assets	Deposits	Other Funding	Equity	Loans	Investment Securities
Czech Rep.	23	2080406.6	1624421.6	133993.74	181037.25	824995.62	1022069.07
Estonia	4	853797.76	596246.13	77872.34	117707.83	497291.66	247507.28
Croatia	35	371027.14	239724.81	47188.73	55213.97	197176.16	165395.22
Hungary	30	955514.74	747333.03	47471.45	82570.47	407301.88	458503.72
Lithuania	9	283078.5	233102.49	8186.64	29750.64	146475.77	71032.55
Latvia	20	153242.88	132194.78	1500.94	14950.45	69846.75	62257.78
FYR of Macedonia	10	97645.31	63878.15	496.53	16536.54	41953.39	47531.04
Poland	43	1912469.2	1630925.3	7222.85	172547.94	967080.4	779226.86
Romania	27	318874	252160.32	3128.1	48889.57	97394.2	170034.02
Russian Federation	80	535235.56	378220.24	14861.45	69694.85	228825.34	226358.92
Slovenia	20	687551.78	560575.39	24718.57	70852.66	377501.9	274026.27
Slovakia	18	846286.35	738380.42	11147.26	46441.51	484277.61	356381.25

All quantity variables are in thousands of US dollars and corrected for inflation.
Total number of banks N = 319 for 1999.

Table 5.1 Equilibrium Test for CEE Banking Market for Individual Years and the Period 1993-2000

	1993		1994		1995		1996		1997		1998		1999		2000		1993-2000	
Indep. Var.	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**	**Coeff.**	**t**
PF	-0.0097	-1.03	0.0004	0.14	-0.0106	-1.3	-0.0060	-1.4	-0.0236	-6.34 ***	0.0192	2.67 ***	0.0009	0.29	-0.0002	-0.07	-0.0113	-1.19
PL	0.0004	0.06	0.0006	-0.14	-0.0205	-1.97 *	-0.0034	-0.7	-0.0024	-0.67	-0.0284	-3.91 ***	-0.0011	-0.25	-0.0038	-1.27	-0.0138	-1.14
PK	0.0008	0.19	0.0009	0.34	0.0024	0.35	0.0002	0.1	0.0008	0.38	-0.0055	-1.24	-0.0006	-0.23	-0.0027	-1.47	0.0074	0.97
LNTA	0.0014	0.32	0.0032	1.31	0.0078	1.21	0.0083	2.7 ***	0.0043	2.29 **	0.0055	1.31	0.0059	2.52 **	0.0050	3.12 ***	-0.8339	-120.9 ***
LNEQTY	0.0241	2.6 **	0.0149	3.13 ***	0.0176	1.42	0.0199	3.2 ***	0.0108	2.62 ***	0.0200	2.58 **	0.0053	1.45	0.0163	4.41 ***	0.1241	9.36 ***
LNLOAN	-0.0017	-0.21	0.0033	0.81	-0.0226	-1.98 **	0.0004	0.1	0.0070	1.93 *	0.0174	3.02 ***	0.0009	0.17	-0.0043	-1.28	-0.0194	-1.78 **
LNIBDP	0.0040	1.97 *	-0.0018	-1.12	-0.0040	-1.26	-0.0016	-0.9	0.0019	1.29	0.0000	-0.02	-0.0007	-0.39	0.0004	0.4	-0.0025	-0.61
Czech Rep	0.0205	0.32	-0.0036	-0.12	-0.2166	-2.69 ***	-0.1108	-2.6 **	-0.1026	-3.6 ***	-0.1300	-1.96 *	-0.0881	-2.28 **	-0.0441	-1.64	8.8809	89.26 ***
Estonia	0.0796	1.12	-0.0028	-0.08	-0.1693	-2.23 **	-0.0649	-1.7 *	-0.0875	-3.09 ***	-0.1149	-1.66 *	-0.0625	-1.54	-0.0419	-1.55	9.0943	91.14 ***
Croatia	0.0678	1.35	-0.0163	-0.57	-0.2158	-2.93 ***	-0.0897	-2.4 **	-0.0962	-3.7 ***	-0.0756	-1.32	-0.0551	-1.7 *	-0.0408	-1.75 *	8.9272	101.9 ***
Hungary	0.0083	0.13	0.0028	0.09	-0.1682	-2.17 **	-0.0815	-2.1 **	-0.0783	-2.86 ***	-0.0909	-1.45	-0.0658	-1.85 *	-0.0363	-1.47	8.9919	95.14 ***
Lithuania	0.0961	1.46	-0.0321	-0.86	-0.1588	-1.78 *	-0.1482	-3.5 ***	-0.1201	-4.49 ***	-0.0461	-0.76	-0.0597	-1.76 *	-0.0423	-1.78 *	9.0477	94.98 ***
Latvia	0.0516	0.81	-0.0037	-0.13	-0.3030	-4.33 ***	-0.0716	-1.9 *	-0.0778	-2.82 ***	-0.0740	-1.28	-0.0657	-1.97 *	-0.0265	-1.11	9.0880	100.3 ***
Macedonia	0.0407	0.6	0.0452	1.4	-0.1621	-2.12 **	-0.0572	-1.5	-0.0482	-1.8 *	-0.0426	-0.71	-0.0351	-1.02	-0.0219	-0.87	9.0245	96.11 ***
Poland	0.0539	0.96	0.0201	0.67	-0.1731	-2.29 **	-0.0832	-2.1 **	-0.0644	-2.41 **	-0.0788	-1.3	-0.0582	-1.65	-0.0443	-1.83 *	9.1154	97.98 ***
Romania	0.0858	1.36	0.0266	0.84	-0.1100	-1.29	-0.0820	-2 **	0.0090	0.35	-0.0512	-0.91	-0.0614	-1.9 *	-0.0351	-1.58	9.1521	100.6 ***
Russia	0.0949	1.54	0.0543	1.82 *	-0.1342	-1.84 *	-0.0283	-0.8	-0.0706	-2.75 ***	-0.1270	-2.43 **	-0.0395	-1.26	-0.0338	-1.47	9.1208	104.8 ***
Slovenia	0.0652	1.09	0.0126	0.4	-0.1852	-2.38 **	-0.0836	-2.1 **	-0.0916	-3.39 ***	-0.0633	-1.02	-0.0580	-1.63	-0.0327	-1.34	8.9460	94.22 ***
Slovakia	0.0381	0.59	-0.0095	-0.31	-0.2044	-2.52 **	-0.0887	-2.2 **	-0.0887	-3.13 ***	-0.0849	-1.31	-0.0547	-1.48	-0.0336	-1.31	8.8803	89.97 ***
Adjusted R2	0.27		0.39		0.1316		0.31		0.36		0.17		0.1089		0.2295		0.9636	
H - Statistic	-0.008		0.001		-0.029		-0.009		-0.0252		-0.015		-0.0008		-0.0067		-0.018	
F-value for H=0	0.490	(0.48)	0.020	(0.87)	3.290	(0.17)	1.540	(0.21)	20.900	(0.001)	1.650	(0.2)	0.020	(0.89)	2.23	(0.13)	1.10	(0.29)
# of observations	110		161		220		231		285		252		273		218		1729	

Estimated regression model: $\ln(ROA_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PL_{it}) + h_3 \ln(PK_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it}) + \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) + \Sigma_{l=1} \alpha_l D_l + \varepsilon_{it}$
for t=1,…..,T where T is the number of periods observed, and i=1,….. ,I, where I is the total number of banks and ln is the natural logarithm. The dependent variable is the logarithm of the return on asset ratio. Variables PF, PL and PK are the unit prices of three inputs: (PF) the ratio of interest expenses to deposits and other liabilities, (PL) the ratio of personnel expenses to deposits and loans, and (PK) the ratio of non-interest expenses to fixed assets. Bank specific factors included in the model are total assets (TA), financial capital (EQTY), loans to total assets (LOAN), and interbank deposits to total assets (IBDP). The model is estimated by running Least-squares regressions on the pooled sample of fourteen CEE countries. The models are adjusted to correct for first order serial correlation. The standard errors were calculated using White's (1980) correction for heteroscedasticity. T-statistics are given in italics next to the parameter estimates. For t-values ***,**, and * indicate 1, 5, and 10 percent significance levels, respectively. The H statistic is equal to the sum of the elasticities of the interest revenue with respect to three input prices: $H = h_1 + h_2 + h_3$. The Wald test is used to test the H=0 hypothesis and follows an F-distribution. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.

Table 5.2 Regression Results of Competitive Conditions for CEE banks: Panel data covering the period 1993-2000								
	Model 1a (INTR)		Model 1b	(TOTREV)	Model 2a (INTR)		Model 2b (TOTREV)	
Independent Variable	**Est. Coeff.**	**t**	**Est. Coeff.**	**t**	**Est. Coeff.**	**t**	**Est. Coeff.**	**t**
PF	0.3515	*27.5* ***	0.2805	*27.48* ***	0.4093	*37.66* ***	0.3291	*31.63* ***
PL	0.2038	*14.6* ***	0.1938	*14.57* ***				
PK (PO in Models 2a,2b)	0.0301	*3.42* ***	0.0301	*3.42* ***	0.1465	*3.45* ***	0.2184	*9.31* ***
LNTA	0.0150	*1.9* *	0.0150	*1.9* *	0.0122	*1.55* **	0.0450	*5.59* ***
LNEQTY	-0.070	*-4.66* ***	-0.070	*-4.66* ***	-0.0550	*-3.60* ***	-0.0267	*-1.72* *
LNLOAN	0.1547	*12.3* ***	0.1547	*12.26* ***	0.1543	*11.82* ***	0.1118	*8.41* ***
LNIBDP	-0.0097	*-2.05* **	-0.0097	*-2.05* **	-0.0122	*-2.67* ***	-0.0127	*-2.62* ***
Czech Republic	-0.8958	*-7.83* ***	-0.8958	*-7.83* ***	-1.2318	*-11.65* ***	-0.6244	*-5.80* ***
Estonia	-1.0640	*-9.26* ***	-1.0640	*-9.26* ***	-1.1673	*-10.18* ***	-0.5103	*-4.37* ***
Croatia	-0.9762	*-9.69* ***	-0.9762	*-9.69* ***	-1.1309	*-11.85* ***	-0.5097	*-5.24* ***
Hungary	-0.8612	*-7.94* ***	-0.8612	*-7.94* ***	-1.0927	*-10.75* ***	-0.5485	*-5.30* ***
Lithuania	-1.2261	*-11.2* ***	-1.2261	*-11.21* ***	-1.3246	*-12.14* ***	-0.6181	*-5.56* ***
Latvia	-0.9420	*-9.14* ***	-0.9420	*-9.14* ***	-1.1036	*-11.23* ***	-0.4058	*-4.05* ***
Macedonia	-0.7026	*-6.49* ***	-0.7026	*-6.49* ***	-0.8932	*-8.53* ***	0.1018	*0.96*
Poland	-0.7139	*-6.69* ***	-0.7139	*-6.69* ***	-0.9195	*-9.22* ***	-0.2948	*-2.90* ***
Romania	-0.3511	*-3.37* ***	-0.3511	*-3.37* ***	-0.5987	*-5.96* ***	-0.0652	*-0.64*
Russia	-0.7304	*-7.31* ***	-0.7304	*-7.31* ***	-1.0235	*-10.98* ***	-0.2580	*-2.71* ***
Slovenia	-1.0369	*-9.52* ***	-1.0369	*-9.52* ***	-1.2355	*-11.97* ***	-0.623	*-5.93* ***
Slovakia	-0.9814	*-8.66* ***	-0.9814	*-8.66* ***	-1.3131	*-12.51* ***	-0.7231	*-6.76* ***
Yugoslavia					-1.2180	*-10.63* ***	-0.3056	*-2.61* ***
Bulgaria					-1.0625	*-10.6* ***	-0.2153	*-2.10* **
H - Statistic	0.586		0.5046		0.5558		0.5475	
[a]F-value on Wald test for H=0	758.31*		687.77*		1010.5*		945.85*	
[b]F-value on Wald test for H=1	570.05*		883.26*		1843.09*		1818.5*	
Adjusted R2	0.968		0.9636		0.9624		0.9455	
# of observations	1769		1764		2113		2105	

Estimated regression model: $\ln(REV_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PL_{it}) + h_3 \ln(PK_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it}) + \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) + \Sigma_{l=1} \alpha_l D_l + \varepsilon_{it}$
for t=1,…..,T where T is the number of periods observed, and i=1,….. ,I, where I is the total number of banks and ln is the natural logarithm. The dependent variable is the logarithm of the total interest revenue (or total operating revenue) scaled by total assets. Variables PF, PL and PK are the unit prices of three inputs: (PF) the ratio of interest expenses to deposits and other liabilities, (PL) the ratio of personnel expenses to deposits and loans, and (PK) the ratio of non-interest expenses to fixed assets. Bank specific factors included in the model are total assets (TA), financial capital (EQTY), loans to total assets (LOAN), and interbank deposits to total assets (IBDP). The model is estimated by running Least-squares regressions on the pooled sample of fourteen CEE countries. The models are adjusted to correct for first order serial correlation. The standard errors were calculated using White's (1980) correction for heteroscedasticity. T-statistics are given in italics next to the parameter estimates. For t-values ***,**, and * indicate 1,5 , and 10 percent significance levels, respectively. The H statistic is equal to the sum of the elasticities of the interest revenue with respect to three input prices: $H = h_1 + h_2 + h_3$. The Wald test is used to test the H=0 and H=1 hypothesis. [a]F statistic for testing hypothesis H=0 (* means significantly different from 1 at the 5% level). [b]F statistic for testing hypothesis H=1 (* means significantly different from 0 at the 5% level).

Table 5.3 Empirical Results from Model 1a 1993-2000 (Fixed and Random effects)								
	Model 1a-fixed one		Model 1a-fixed two		Model 1a random one		Model 1a random two	
Independent Variable	**INTR**	**t**	**INTR**	**t**	**INTR**	**t**	**INTR**	**t**
PF	0.2731	22.99 ***	0.2619	22.84 ***	0.2781	26.22 ***	0.2622	25.71 ***
PL	0.1584	7.11 ***	0.2127	9.61 ***	0.1701	9.27 ***	0.2082	10.76 ***
PK	0.0323	2.61 ***	0.0124	1.03	0.0324	3.03 ***	0.0133	1.24
LNTA	0.0204	0.78	0.1110	3.93 ***	-0.0084	-0.40	0.0996	4.11 ***
LNEQTY	-0.0111	-0.45	-0.029	-1.22	-0.0203	-0.92	-0.0299	-1.4
LNLOAN	0.1389	8.17 ***	0.1484	9.07 ***	0.1384	9.41 ***	0.1494	10.3 ***
LNIBDP	-0.0153	-2.46 **	-0.0143	-2.4 **	-0.0136	-2.53 **	-0.0138	-2.62 ***
Czech Republic					-0.6853	-2.52 **	-2.0058	-2.69 ***
Estonia					-0.8581	-2.95 ***	-2.0031	-2.44 ***
Croatia					-0.8218	-3.24 ***	-1.9678	-2.73 ***
Hungary					-0.6596	-2.39 ***	-1.9147	-2.51 ***
Lithuania					-1.0358	-3.65 ***	-2.1203	-2.62 ***
Latvia					-0.7894	-3.03 ***	-1.7902	-2.4 **
Macedonia					-0.6158	-2.04 **	-1.6385	-1.91 *
Poland					-0.4782	-1.82 *	-1.7904	-2.47 **
Romania					-0.1580	-0.59	-1.2236	-1.61 **
Russia					-0.5527	-2.23 **	-1.6636	-2.39 **
Slovenia					-0.8344	-2.95 ***	-2.0654	-2.63 ***
Slovakia					-0.8283	-2.96 ***	-2.0625	-2.66 ***
H	0.464		0.487		0.481		0.484	
[a]F-value on Wald test for H=0	319.45*		376.23*		471.8*		478.44*	
[b]F-value on Wald test for H=1	426.3*		416.82*		550.40*		543.81*	
Adjusted R2	0.9827		0.9842		0.7887		0.3637	
# of observations	1369		1374		1740		1740	

Estimated regression model: $\ln(REV_{it}) = h_1 \ln(PF_{it}) + h_2 \ln(PL_{it}) + h_3 \ln(PK_{it}) + \beta_1 \ln(TA_{it}) + \beta_2 \ln(EQTY_{it}) + \beta_3 \ln(LOAN_{it}) + \beta_4 \ln(IBDP_{it}) + \Sigma_{l=1} \alpha_l D_l + \varepsilon_{it}$
for t=1,…..,T where T is the number of periods observed, and i=1,….. ,I, where I is the total number of banks and ln is the natural logarithm. The dependent variable is the logarithm of the total interest revenue (or total operating revenue) scaled by total assets. Variables PF, PL and PK are the unit prices of three inputs: (PF) the ratio of interest expenses to deposits and other liabilities, (PL) the ratio of personnel expenses to deposits and loans, and (PK) the ratio of non-interest expenses to fixed assets. Bank specific factors included in the model are total assets (TA), financial capital (EQTY), loans to total assets (LOAN), and interbank deposits to total assets (IBDP). Specifications tested on the pooled sample of fourteen CEE countries are fixed and random effects models with and without year dummies. T-statistics are given in italics next to the parameter estimates. For t-values ***,**, and * indicate 1,5 , and 10 percent significance levels, respectively. The H statistic is equal to the sum of the elasticities of the interest revenue with respect to three input prices: $H = h_1 + h_2 + h_3$. The Wald test is used to test the H=0 and H=1 hypothesis. [a]F statistic for testing hypothesis H=0 (* means significantly different from 1 at the 5% level). [b]F statistic for testing hypothesis H=1 (* means significantly different from 0 at the 5% level).

Table 5.4 H Statistics for Years and Size Groups[1]						
	Model 1a (INTREV)			Model 2a (INTREV)		
	H	F	DOF	H	F	DOF
Panel A						
1993-2000	0.5865	758.31a*	1769	0.5558	1010.5a*	2113
		570.5b*			1843.09b*	
1993-1996	0.5400	268.73a*	741	0.5214	419.87a*	909
		211.28b*			415.19b*	
1997-2000	0.5917	478.35a*	1028	0.5517	659.90a*	1204
		471.60b*			600.54b*	
Panel B						
Large Banks	0.7248	934.42a*	907	0.7131	1722.06a*	1056
		134.66b*			278.54b*	
Small Banks	0.5647	357.84a*	862	0.4580	353.07a*	1057
		212.5b*			494.29b*	
Panel C						
1993	0.6548	83.29a*	110	0.6939	122.49a*	122
		23.14b*			26.10b*	
1994	0.4982	76.60a*	161	0.6127	219.59a*	185
		77.68b*			87.73b*	
1995	0.4354	47.911a*	220	0.4643	84.85a*	268
		80.53b*			112.96b*	
1996	0.4085	42.56a*	250	0.3627	53.58a*	294
		89.23b*			165.0b*	
1997	0.5404	128.4a*	285	0.5323	189.4a*	337
		93.1b*			146.22b*	
1998	0.6952	321.38a*	252	0.6545	316.39a*	303
		47.24b*			67.18b*	
1999	0.5542	82.18a*	273	0.5636	86.66a*	332
		178.5b*			223.66b*	
2000	0.5740	104.39a*	218	0.5534	128.21a*	272
		12853b*			135.09b*	

[1] Note: See table 5.1 for the definition of estimated regression model.
DOF: Degrees of freedom.
The H statistic is equal to the sum of the elasticities of the interest revenue with respect to three input prices: $H = h_1 + h_2 + h_3$.
The Wald test is used to test the H=0 and H=1 hypothesis. [a]F statistic for testing hypothesis H=0 (* means significantly different from 1 at the 5% level). [b]F statistic for testing hypothesis H=1 (* means significantly different from 0 at the 5% level).
Large and small banks are determined by total assets above and below the median asset size in the sample.

Table 5.5 H-Statistics for Individual Countries 1993-2000[1]

	Model – 1a (INTREV)					Model – 1b (TOTREV)				
Country	H-statistic	F-Value for H=0	F-Value for H=1	N	Adj. R-Square	H-Statistic	F-Value for H=0	F-Value for H=1	N	Adj. R-Square
The Czech Rep.	0.5171	144	125.59	160	0.73	0.4294	72.35	127.86	160	0.56
Estonia	0.7018	22.16	8.23	27	0.85	0.3438	16.04	6.73	27	0.75
Croatia	0.7419	134.85	16.33	235	0.77	0.6984	165.52	30.89	235	0.81
Hungary	0.3629	51.44	158.58	132	0.67	0.4095	62.88	130.86	132	0.67
Lithuania	0.4449	7.14	13.11	31	0.83	0.3744	7.17	20.03	31	0.82
Latvia	0.7552	63.48	5.67	104	0.65	0.6194	47.58	17.95	103	0.59
FYR of Macedonia	0.1809	1.27*	39.06	34	0.86	0.3868	3.95*	13.63	34	0.69
Poland	0.5074	221.43	337.6	243	0.7	0.4968	367.13	442.07	243	0.76
Romania	0.5381	137.27	93.36	66	0.89	0.5184	178.16	51.41	66	0.91
The Russian Fed.	0.6449	226.87	68.73	361	0.68	0.5570	255.36	161.42	357	0.69
Slovenia	0.5760	41.45	22.45	96	0.89	0.52751	14.56	11.68	96	0.59
Slovakia	0.0987	0.09 *	30.15	88	0.38	0.6364	31.27	10.21	88	0.6
Yugoslavia[2]	0.7055	37.69	6.31	56	0.8207	0.6762	38.93	7.97	54	0.847
Bulgaria[2]	0.6076	139.99	54.01	79	0.7968	0.6693	110.16	29.89	77	0.8448

[1]Note: See table 5.1 for the definition of estimated regression model
[2] For Yugoslavia and Bulgaria the estimated models are Model-2a and Model-2B.
The Wald test is used to test H= 0 and H=1 hypotheses.
* Means can not reject the hypothesis H=0 at 5% significant level (Monopoly)

Table 5.6 Empirical Results for the Czech Republic

		Model 1a				Model 1b	
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-1.80290	*-6.7*	*		-1.56280	*-4.99*	*
PF	0.40960	*14.08*	*		0.29850	*8.71*	*
PL	0.10360	*3.67*	*		0.11650	*3.54*	*
PK	0.00396	*0.25*			0.01440	*0.77*	
LNTA	0.04820	*3.06*	*		0.03250	*1.79*	
LNEQTY	-0.02660	*-0.94*			-0.01090	*-0.33*	
LNLOAN	0.03870	*1.6*			0.03120	*1.11*	
LNIBDP	-0.00978	*-0.86*			-0.00463	*-0.35*	
1993	0.27020	*3.52*	*		0.22930	*2.53*	
1994	0.26200	*3.44*	*		0.22290	*2.49*	**
1995	0.25650	*3.47*	*		0.22830	*2.63*	*
1996	0.20180	*2.62*	*		0.26250	*2.9*	*
1997	0.20180	*2.55*	*		0.28320	*3.05*	*
1998	0.33130	*4.47*	*		0.32580	*3.73*	*
1999	0.16310	*2.46*	**		0.20550	*2.6*	*
H	0.51716				0.42940		
H=0	144	(0.001)			72.35	(0.001)	
H=1	125.59	(0.001)			127.86	(0.001)	
N	160				160		
Adj. R-Square	0.73				0.56		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.7 Empirical Results for Estonia

		Model 1a				Model 1b	
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.59890	*-1.36*			-1.52860	*-3.23*	*
PF	0.53150	*4.7*	*		-0.03930	*-0.29*	*
PL	0.20780	*2.87*	*		0.34810	*4.7*	*
PK	-0.03750	*-0.77*			0.03500	*0.65*	
LNTA	0.03920	*1.1*			0.02140	*0.54*	
LNEQTY	-0.03240	*-0.52*			-0.10530	*-1.39*	
LNLOAN	0.36700	*2.48*	**		0.06170	*0.34*	
LNIBDP	-0.02790	*-1.34*			-0.01350	*-0.48*	
1993	0.53940	*2.28*	**		0.59340	*2.1*	**
1994	0.55970	*2.98*	*		0.26290	*1.17*	
1995	0.32230	*3.34*	*		0.06120	*0.52*	
1996	0.23840	*2.77*	*		0.04370	*0.42*	
1997	0.12900	*1.51*			0.01790	*0.18*	
1998	0.07310	*0.78*			-0.12290	*-1.06*	
1999	0.04560	*0.56*			0.14630	*1.33*	
H	0.70180				0.34380		
H=0	22.16	(0.001)			16.04	(0.001)	
H=1	8.23	(0.018)			6.73	(0.0231)	
N	27				27		
Adj. R-Square	0.85				0.75		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.8 Empirical Results for Croatia

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.13550	*-0.49*			0.48430	*1.97*	**
PF	0.45220	*11.41*	*		0.40850	*12.18*	*
PL	0.27420	*6.5*	*		0.27150	*7.45*	*
PK	0.01550	*0.55*			0.01840	*0.77*	
LNTA	0.01280	*0.5*			-0.00913	*-0.4*	
LNEQTY	-0.00304	*-0.07*			0.05510	*1.45*	
LNLOAN	0.06880	*1.5*			0.10730	*2.7*	*
LNIBDP	0.01540	*1.52*			0.02740	*3.17*	*
1993	0.50920	*4.17*	*		0.55750	*5.46*	*
1994	-0.27440	*-3.18*	*		-0.10580	*-1.46*	
1995	-0.00579	*-0.07*			0.06430	*0.93*	
1996	-0.01040	*-0.13*			0.07100	*1.09*	
1997	-0.04390	*-0.58*			-0.02270	*-0.36*	
1998	0.02690	*0.35*			0.03240	*0.51*	
1999	0.04430	*0.65*			0.00819	*0.15*	
H	0.7419				0.6983		
H=0	134.85	(0.001)			165.52	(0.001)	
H=1	16.33	(0.001)			30.89	(0.001)	
N	235				235		
Adj. R-Square	0.77				0.81		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column.
The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.9 Empirical Results for Hungary

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.13550	*-0.49*			0.48430	*1.97*	**
PF	0.45220	*11.41*	*		0.40850	*12.18*	*
PL	0.27420	*6.5*	*		0.27150	*7.45*	*
PK	0.01550	*0.55*			0.01840	*0.77*	
LNTA	0.01280	*0.5*			-0.00913	*-0.4*	
LNEQTY	-0.00304	*-0.07*			0.05510	*1.45*	
LNLOAN	0.06880	*1.5*			0.10730	*2.7*	*
LNIBDP	0.01540	*1.52*			0.02740	*3.17*	*
1993	0.50920	*4.17*	*		0.55750	*5.46*	*
1994	-0.27440	*-3.18*	*		-0.10580	*-1.46*	
1995	-0.00579	*-0.07*			0.06430	*0.93*	
1996	-0.01040	*-0.13*			0.07100	*1.09*	
1997	-0.04390	*-0.58*			-0.02270	*-0.36*	
1998	0.02690	*0.35*			0.03240	*0.51*	
1999	0.04430	*0.65*			0.00819	*0.15*	
H	0.7419				0.6983		
H=0	134.85	(0.001)			165.52	(0.001)	
H=1	16.33	(0.001)			30.89	(0.001)	
N	235				235		
Adj. R-Square	0.77				0.81		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.10 Empirical Results for Lithuania

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-1.78550	*-3.1*	**		-0.99080	*-2.17*	**
PF	0.07230	*2.55*	**		0.03590	*1.38*	
PL	0.36110	*2.44*	**		0.48180	*4.03*	*
PK	0.01150	*0.12*			-0.14330	*-1.76*	
LNTA	0.08540	*1.88*			0.06730	*1.82*	
LNEQTY	-0.03400	*-0.55*			-0.03350	*-0.59*	
LNLOAN	0.50030	*3.35*	*		0.48180	*3.85*	*
LNIBDP	0.02820	*0.44*			0.03160	*0.59*	
1993	1.15700	*4.07*	*		1.40070	*5.42*	*
1994	0.73680	*2.76*	*		0.56250	*2.33*	**
1995	0.06540	*0.3*			-0.00920	*-0.05*	
1996	-0.15960	*-1.01*			-0.23980	*-1.66*	
1997	-0.11740	*-0.97*			-0.16180	*-1.48*	
1998	-0.13660	*-1.12*			-0.14470	*-1.31*	
1999	-0.09890	*-0.87*			-0.15480	*-1.41*	
H	0.4449				0.3744		
H=0	7.14	(0.011)			7.17	(0.0113)	
H=1	13.11	(0.001)			20.03	(0.001)	
N	31				31		
Adj. R-Square	0.83				0.82		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.11 Empirical Results for Latvia

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-1.09930	*-2.42*	**		-1.44850	*-3.21*	*
PF	0.38820	*5.69*	*		0.31720	*4.86*	*
PL	0.24550	*4.63*	*		0.17410	*3.44*	*
PK	0.12150	*2.54*	**		0.12810	*2.72*	*
LNTA	0.06830	*1.7*			0.09960	*2.49*	*
LNEQTY	0.03120	*0.48*			0.12370	*1.99*	**
LNLOAN	0.05150	*1*			-0.05420	*-1.08*	
LNIBDP	-0.00339	*-0.31*			-0.00557	*-0.53*	
1993	0.52190	*2.54*	**		0.81110	*4.22*	*
1994	0.26250	*1.7*	**		0.40580	*2.78*	*
1995	0.28840	*2.15*	*		0.41070	*3.22*	*
1996	0.21760	*1.7*	**		0.33450	*2.75*	*
1997	0.01960	*0.17*			0.24590	*2.25*	**
1998	0.17240	*1.45*			-0.05540	*-0.49*	
1999	-0.00203	*-0.02*			0.06070	*0.62*	
H	0.7552				0.6194		
H=0	63.48	(0.001)			47.58	(0.001)	
H=1	5.67	(0.0192)			17.95	(0.001)	
N	104				103		
Adj. R-Square	0.65				0.59		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.12 Empirical Results for FYR of Macedonia

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-2.76620	*-3.76*	*		2.06460	*2.01*	**
PF	0.11890	*2.01*	**		-0.08680	*-1.05*	
PL	0.02960	*0.27*			0.53430	*3.56*	*
PK	0.03240	*0.66*			-0.06070	*-0.87*	
LNTA	0.08420	*1.49*			-0.24720	*-3.16*	*
LNEQTY	-0.00993	*-0.09*			-0.45940	*-2.84*	*
LNLOAN	0.44420	*4.92*	*		0.17830	*1.39*	
LNIBDP	-0.11050	*-4.26*	*		-0.05810	*-1.58*	
1993	0.40830	*1.64*	*		0.89310	*2.48*	*
1994	0.71720	*3.68*	*		0.48890	*1.75*	
1995	0.36570	*2.41*	**		0.23100	*1.07*	
1996	0.29930	*2.16*	**		0.23530	*1.2*	
1997	0.07150	*0.52*			0.53000	*2.72*	*
1998	-0.07650	*-0.58*			0.19060	*1.01*	
1999	0.00769	*0.06*			0.04880	*0.28*	
H	0.18091				0.38685		
H=0	1.27	(0.2672)			3.95	(0.0549)	
H=1	39.06	(0.001)			13.63	(0.001)	
N	34				34		
Adj. R-Square	0.86				0.69		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.13 Empirical Results for Poland

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.68130	*-3.68*	*		-0.54620	*-4.19*	*
PF	0.36890	*13.63*	*		0.38090	*18.36*	*
PL	0.13500	*4.83*	*		0.09670	*4.47*	*
PK	0.00356	*0.41*			0.01920	*2.83*	*
LNTA	-0.01830	*-1.33*			-0.00434	*-0.47*	
LNEQTY	-0.04080	*-1.43*			0.00044	*0.02*	
LNLOAN	0.07110	*4.74*	*		0.08550	*7.41*	*
LNIBDP	-0.01660	*-1.5*			-0.01860	*-2.23*	**
1993	0.09390	*1.72*			0.15210	*3.32*	*
1994	0.19590	*3.76*	*		0.20770	*4.92*	*
1995	0.10260	*2.05*	**		0.08720	*2.17*	**
1996	0.09970	*2.12*	**		0.04010	*1.06*	
1997	0.07010	*1.6*			0.02680	*0.74*	
1998	0.06460	*1.54*			0.01890	*0.53*	
1999	-0.08920	*-2.44*	**		-0.04880	*-1.45*	
H	0.50746				0.49680		
H=0	221.43	(0.001)			367.13	(0.001)	
H=1	337.6	(0.001)			442.07	(0.001)	
N	243				243		
Adj. R-Square	0.7				0.76		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.14 Empirical Results for Romania

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.36400	*-1.16*			0.07630	*0.28*	
PF	0.33320	*12.81*	*		0.29510	*12.16*	*
PL	0.14190	*2.22*	**		0.12550	*4.16*	*
PK	0.06300	*1.7*			0.09780	*3.11*	**
LNTA	0.06640	*2.54*	**		0.06950	*3.05*	*
LNEQTY	0.03490	*0.68*			0.06260	*1.41*	
LNLOAN	0.05790	*1.95*	**		0.09840	*3.88*	*
LNIBDP	-0.00605	*-0.43*			0.01740	*1.47*	
1993	0.24900	*1.61*			0.09990	*0.77*	
1994	0.03490	*0.26*			-0.11580	*-1.02*	
1995	0.03390	*0.25*			0.07220	*0.64*	
1996	-0.08800	*-0.71*			-0.12280	*-1.19*	
1997	0.10700	*1.07*			0.17080	*2.06*	
1998	0.07950	*0.97*			0.04120	*0.62*	
1999	0.02850	*0.39*			-0.00031	*-0.01*	
H	0.53810				0.51840		
H=0	137.27	(0.001)			178.16	(0.001)	
H=1	93.36	(0.001)			51.41	(0.001)	
N	66				66		
Adj. R-Square	0.89				0.91		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.15 Empirical Results for the Russian Federation

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.03900	*-0.16*			0.63300	*3.37*	*
PF	0.43560	*14.04*	*		0.32870	*13.22*	*
PL	0.18830	*8.36*	*		0.15630	*8.81*	*
PK	0.02110	*1*			0.07210	*4.3*	*
LNTA	-0.01910	*-1.05*			-0.07510	*-5.36*	*
LNEQTY	-0.00442	*-0.13*			0.05370	*1.98*	**
LNLOAN	0.17750	*4.86*	*		0.01160	*0.39*	
LNIBDP	-0.01080	*-1.19*			-0.01280	*-1.56*	
1993	0.30430	*2.46*	*		0.14780	*1.46*	
1994	0.39270	*3.58*	*		0.25820	*2.91*	*
1995	0.30860	*3.21*	*		0.39260	*5.01*	*
1996	0.26210	*3.03*	*		0.41560	*5.86*	*
1997	0.11500	*1.46*			0.18930	*2.92*	*
1998	-0.16040	*-1.89*	**		-0.18520	*-2.61*	*
1999	-0.05390	*-0.78*			0.10720	*1.84*	
H	0.64499				0.55708		
H=0	226.87	(0.001)			255.36	(0.001)	
H=1	68.73	(0.001)			161.42	(0.001)	
N	361				357		
Adj. R-Square	0.68				0.69		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.16 Empirical Results for Slovenia

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-2.58850	*-6.66*	*		-1.15320	*-2.03*	**
PF	0.42780	*7.09*	*		0.31050	*3.47*	*
PL	0.06340	*1.1*			0.16520	*1.93*	**
PK	0.08490	*3.64*	*		0.05180	*1.48*	
LNTA	0.14290	*6.14*	*		0.08250	*2.42*	*
LNEQTY	0.01660	*0.3*			0.13000	*1.63*	
LNLOAN	0.35660	*12.9*	*		0.24000	*5.28*	*
LNIBDP	-0.01110	*-1.31*			0.03790	*2.93*	*
1993	0.58190	*6.56*	*		0.18670	*1.33*	
1994	0.22380	*2.96*	*		0.23660	*1.97*	**
1995	0.01800	*0.33*			0.06630	*0.75*	
1996	0.12710	*2.3*	**		0.10080	*1.14*	
1997	0.10370	*1.99*	**		0.07880	*0.94*	
1998	-0.00078	*-0.02*			0.01960	*0.24*	
1999	-0.07630	*-1.86*			-0.05770	*-0.81*	
H	0.57607				0.52751		
H=0	41.45	(0.001)			14.56	(0.001)	
H=1	22.45	(0.001)			11.68	(0.001)	
N	96				96		
Adj. R-Square	0.89				0.59		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.17 Empirical Results for Slovakia

	Model 1a				Model 1b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-3.96880	*-4.13*	*		-1.50030	*-2.16*	**
PF	0.09380	*2.44*	*		0.04550	*1.72*	*
PL	0.01070	*0.08*			0.35540	*3.85*	*
PK	-0.00565	*-0.07*			0.23560	*4.09*	*
LNTA	0.15770	*2.43*	*		0.10210	*2.14*	**
LNEQTY	-0.01170	*-0.18*			-0.00537	*-0.12*	
LNLOAN	0.15100	*2.18*	**		0.27180	*5.74*	*
LNIBDP	0.03780	*0.67*			-0.07140	*-1.75*	
1993	0.00449	*0.02*			0.22390	*1.2*	
1994	-0.09160	*-0.36*			-0.04420	*-0.25*	
1995	-0.39660	*-1.72*			-0.23700	*-1.49*	
1996	-0.35820	*-1.62*			-0.08900	*-0.58*	
1997	-0.05120	*-0.24*			0.16950	*1.16*	
1998	0.09070	*0.42*			0.24470	*1.67*	
1999	0.04010	*0.2*			0.07520	*0.58*	
H	0.098796				0.63642		
H=0	0.09	(0.7625)			31.27	(0.001)	
H=1	30.15	(0.001)			10.21	(0.001)	
N	88				88		
Adj. R-Square	0.38				0.6		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.18 Empirical Results for Yugoslavia

	Model 2a				Model 2b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.2426	*-0.43*			0.7118	*1.27*	
PF	0.5251	*5.49*	*		0.2291	*2.45*	**
PO	0.1804	*2.03*	**		0.4118	*5.62*	*
LNTA	0.2738	*2.95*	*		0.5421	*5.89*	*
LNEQTY	0.0915	*0.85*			-0.1586	*-1.44*	
LNLOAN	-0.005719	*-0.42*			-0.008045	*-0.52*	
LNIBDP	0.2266	*0.81*			0.9798	*3.59*	*
1993	0.401	*1.98*			0.4738	*2.38*	**
1994	0.8638	*4.32*	*		0.3141	*1.64*	
1995	0.6152	*3.29*	*		0.0946	*0.53*	
1996	0.2688	*1.37*			0.1464	*0.78*	
1997	0.2647	*1.37*			-0.1247	*-0.68*	
1998	-0.2426	*-0.43*			0.7118	*1.27*	
1999	0.5251	*5.49*	*		0.2291	*2.45*	
H	0.70552				0.6762		
H=0	37.69	(0.001)			38.93	(0.001)	
H=1	6.31	(0.015)			7.97	(0.0011)	
N	56				54		
Adj. R-Square	0.8207				0.847		**

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.19 Empirical Results for Bulgaria

	Model 2a				Model 2b		
Variable	Estimate	t-values			Estimate	t-values	
Intercept	-0.662	*-1.97*	**		0.2121	*0.58*	
PF	0.5185	*10.7*	*		0.1737	*3*	*
PO	0.0892	*1.97*	**		0.4956	*8.83*	*
LNTA	-0.0296	*-0.63*			-0.0357	*-0.61*	
LNEQTY	0.0394	*0.55*			-0.0853	*-1.04*	
LNLOAN	0.0263	*1.49*			0.006463	*0.31*	
LNIBDP	0.4999	*1.1*			2.8328	*4.86*	*
1993	-0.1335	*-0.44*			1.5641	*4.06*	*
1994	-0.3977	*-2.18*	**		0.6153	*2.48*	**
1995	-0.2979	*-2.05*	**		1.1497	*6.39*	*
1996	-0.1433	*-1.05*			0.743	*4.35*	*
1997	-0.2714	*-2.48*	**		-0.2315	*-1.63*	
1998	-0.0867	*-0.84*			-0.0465	*-0.31*	
1999	-0.662	*-1.97*	**		0.2121	*0.58*	
H	0.6076				0.6693		
H=0	139.99	(0.001)			110.16	(0.001)	
H=1	54.01	(0.001)			29.89	(0.001)	
N	79				77		
Adj. R-Square	0.7968				0.8448		

Note: See table 5.2 for the definition of estimated regression model.
The Wald test is used to test H= 0 and H=1 hypotheses and F-values for the two hypotheses are provided in the second column. The values in parenthesis for the Wald tests are the levels of significance where the null hypothesis can be rejected.
*, ** represent significance levels at 1% and 5% respectively.

Table 5.20 3-Bank Concentration Ratios and Competition Index (1993-2000)

Country	CR3	H Statistic
The Czech Rep.	65.2	0.5171
Estonia	79.3	0.7018
Croatia	62.2	0.7419
Hungary	52.4	0.3629
Lithuania	89.1	0.4449
Latvia	55.1	0.7552
FYR of Macedonia	77.8	0.1809
Poland	52.2	0.5074
Romania	77.5	0.5381
The Russian Fed.	48.7	0.6449
Slovenia	62.5	0.576
Slovakia	72.2	0.0987
Yugoslavia	71.6	0.7055
Bulgaria	84	0.6076

Table 5.21 Derivation of the Cost Frontier

Cost efficiency scores measure the performance of a banking firm relative to the best-practice bank that produces the same output bundle under the same exogenous conditions. The cost frontier is derived by estimating the following cost function:

C =C (y,w,z,u,e)

where, C measures total costs for bank, including both operating and financial costs;
y is a vector of outputs; w is a vector of input prices;
z represents the quantities of fixed bank parameters (bank capital, fixed assets, off-balance sheet items, etc.);
u is the inefficiency term that captures the difference between the efficient level of cost for given output levels and input prices and the actual level of cost; and
e is the random error term.

Assuming the inefficiency and random error term are multiplicatively separable from the rest of the parameters, the cost function can be expressed in logarithmic form as:

ln C= f(y,w,z) + ln u + ln e

where f denotes a functional form. After estimating a particular cost function, the cost efficiency for bank i is measured as the ratio between the minimum cost (C_{min}) necessary to produce that bank's output and the actual cost (C_i):

$$COSTEFF_i = \frac{C_{\min}}{C_i} = \frac{\exp[f(y,w,z)]x\exp(\ln u_{\min})}{\exp[f(y,w,z)]x\exp(\ln u_i)} = \frac{u_{\min}}{u_i}$$

where u_{min} is the minimum u_i across all banks in the sample.

Under this formulation, an efficiency score, say 0.90, implies that the bank would have incurred 90 percent of its actual costs had it operated in the cost frontier.

Table 5.22 Derivation of the Alternative Profit Frontier

Profit efficiency measures how close a bank is to attaining the maximum possible profit as a best-practice firm on the frontier for given levels of input and output prices (quantities) and other exogenous market variables.

Previous literature offers two different specifications for the profit maximization objective, namely "standard" and "alternative" (non-standard) profit functions. The standard profit function assumes that output markets are perfectly competitive so that banks are price-takers in both output and input markets while alternative profit specification assumes that banks can have some power in determining output prices. Thus, standard profit function is specified as a function of input and output prices, whereas alternative profit function is specified as a function of input prices and output quantities.

The alternative profit specification employs the same set of exogenous variables as the cost function in Table 5.21 with the only difference that profit replaces total cost as the dependant variable in the frontier regression. Therefore, the alternative profit frontier is given by

P = P (y,w,z u, e)

where P is the variable profits of the firm, which includes all the interest and fee income earned less total costs, C, used in the cost function. The profit function can be written in log terms:

ln (P+θ) = f(y,w,z) + ln e - ln u

where θ is a constant added to every bank's profit to make it positive so that the natural log can be taken.

$$PROFEFF_i = \frac{P_i}{P_{\max}} = \frac{\exp[f(y,w,z)]x\exp(\ln u_i) - \theta}{\exp[f(y,w,z)]x\exp(\ln u_{\max}) - \theta}$$

Profit efficiency is measured by the ratio between the actual profit of a bank and the maximum possible profit that is achievable by the most efficient bank.
where u_{max} is the maximum u_i across all banks in the sample. For example, profit efficiency score of a bank, say, of 80% means that the bank is losing about 20% of its potential profits to managerial failure in choosing optimum input quantities and output prices.

Table 5.23 The Multi-product Translog Functional Form

The multi-product translog functional form is employed to estimate the cost and alternative profit frontiers and derive the efficiency measures. The cost frontier function is represented by:

$$\begin{aligned}\ln(C/w_3 z) = \quad & \alpha_0 + \sum_{l=1}^{2} \alpha_l \ln(w_i/w_3) + 0.5 \sum_{l=1}^{2} \sum_{h=1}^{2} \omega_{lh} \ln(w_l/w_3) \ln(w_i/w_3) \\ & + \sum_{k=1}^{3} \beta_k \ln(y_k/z) + 0.5 \sum_{k=1}^{3} \sum_{j=1}^{3} \beta_{kj} \ln(y_k/z) \ln(y_j/z) \\ & + \sum_{k=1}^{3} \sum_{l=1}^{2} \delta_{lk} \ln(y_k/z) \ln(w_l/w_3) + \varphi_1 \ln Z + 0.5\varphi_2 (\ln Z)^2 \\ & + \sum_{k=1}^{3} \tau_k \ln(y_k/z) \ln Z + \sum_{l=1}^{2} \varsigma_l \ln(w_l/w_3) \ln Z + \ln e_{ti} + \ln u_{it}\end{aligned}$$

where w_i and y_i are input prices and output amounts and z is the equity capital. The dependent variable, total cost, is the sum of interest expenses, personnel expenses and other operating expenses. I impose the regular restrictions of symmetry and linear homogeneity for input prices in estimating the parameters as the following:

$$\beta_{kj} = \beta_{jk}, \quad \omega_{lh} = \omega_{hl} \; ; \quad \sum_{l=1}^{3} \alpha_l = 1, \quad \sum_{h=1}^{3} \omega_{lh} = 0 \, , \quad \sum_{l=1}^{3} \delta_{lk} = 0.$$

In this study, banks are modeled as multi-product firms that produce 3 outputs (loans, investments, and deposits) and employ 3 inputs (borrowed funds, labor, and physical capital). The price of borrowed funds (W1) is estimated as interest expenses divided by customer and short term funding plus other funding. The price of labor (W2) is defined as the ratio of personnel expenses to total assets. The price of physical capital (W3) is measured as the ratio of other operating expense to fixed assets.

Cost and input prices are normalized by the price of capital before taking logarithms to impose linear input price homogeneity. Since I do not decompose the efficiency measure into technical and allocative components, the cost functions are not estimated using the input share equations.

The alternative profit frontier estimation employs essentially the same specification in cost equation with some minor changes. For the profit frontier estimation the dependent variable $\ln (C / w_3 z)$ is replaced with $\ln (P/w_3 z)$ and the inefficiency term is -u.

Cost, profit and output variables are normalized by equity capital (Z). This normalization controls for heteroscedasticity, scale biases, and other estimation biases in addition to providing a more economic meaning since the dependant variable in profit function essentially becomes ROE, a common measure of performance.

Table 5.24 Cost Efficiency Measures

	Stochastic Frontier Approach (SFA)				Distribution Free Approach (DFA)			
Country	**SFA(0)**	**SFA(1)**	**SFA(5)**	**SFA(10)**	**DFA(0)**	**DFA(1)**	**DFA(5)**	**DFA(10)**
Czech Republic	0.715	0.772	0.778	0.810	0.391	0.653	0.717	0.777
Estonia	0.690	0.734	0.738	0.779	0.371	0.619	0.677	0.731
Croatia	0.755	0.799	0.803	0.834	0.442	0.722	0.776	0.819
Hungary	0.717	0.775	0.777	0.812	0.411	0.666	0.732	0.791
Lithuania	0.591	0.695	0.702	0.755	0.345	0.575	0.633	0.692
Latvia	0.651	0.716	0.728	0.774	0.376	0.627	0.691	0.747
FYR Macedonia	0.741	0.781	0.787	0.820	0.424	0.707	0.776	0.838
Poland	0.774	0.813	0.832	0.854	0.439	0.732	0.816	0.863
Romania	0.725	0.777	0.776	0.800	0.411	0.686	0.750	0.805
Russian Fed.	0.621	0.686	0.712	0.762	0.360	0.604	0.667	0.726
Slovenia	0.738	0.792	0.813	0.857	0.456	0.762	0.803	0.842
Slovakia	0.668	0.748	0.760	0.804	0.377	0.631	0.698	0.762
Overall	0.700	0.758	0.767	0.804	0.398	0.663	0.727	0.781

Table 5.25 Profit Efficiency Measures

	Stochastic Frontier Approach (SFA)				Distribution Free Approach (DFA)			
Country	**SFA(0)**	**SFA(1)**	**SFA(5)**	**SFA(10)**	**DFA(0)**	**DFA(1)**	**DFA(5)**	**DFA(10)**
Czech Republic	0.633	0.665	0.685	0.705	0.322	0.413	0.422	0.526
Estonia	0.619	0.659	0.696	0.708	0.338	0.379	0.437	0.535
Croatia	0.539	0.589	0.640	0.655	0.291	0.441	0.568	0.691
Hungary	0.427	0.497	0.570	0.587	0.262	0.426	0.556	0.670
Lithuania	0.595	0.638	0.676	0.689	0.346	0.370	0.475	0.578
Latvia	0.631	0.665	0.697	0.709	0.393	0.339	0.443	0.544
FYR Macedonia	0.633	0.663	0.696	0.708	0.376	0.347	0.448	0.553
Poland	0.550	0.599	0.654	0.663	0.306	0.423	0.545	0.665
Romania	0.355	0.438	0.532	0.555	0.296	0.479	0.595	0.657
Russian Fed.	0.460	0.524	0.592	0.606	0.267	0.537	0.561	0.602
Slovenia	0.565	0.615	0.665	0.675	0.310	0.403	0.518	0.630
Slovakia	0.627	0.659	0.682	0.700	0.368	0.348	0.449	0.550
Overall	0.553	0.601	0.649	0.663	0.323	0.409	0.501	0.600

Table 5.26 Regression Analysis of Potential Correlates of Efficiency

Variable		Cost Efficiency		Profit Efficiency	
		Coefficient	**t-Statistic**	**Coefficient**	**t-Statistic**
Intercept		0.83290	15.79*	0.8333	11.62
COMP	Degree of Competition by Panzar and Rosse H-statistic	0.0395	2.12**	-0.1308	-4.37*
ICR3	Market share of largest 3 banks in the industry	-0.00010	-0.43	-0.00261	-8.16*
LNTA	Logarithm of Total Assets	0.01010	4.31*	0.002345	0.74
ROA	Return on Average Assets	0.00149	3.08*	0.00154	4.34*
EQTY	Shareholder's Equity /Total Assets	0.10100	4.15*	0.0458	1.38
LOANS	Total Loans / total assets	0.04950	2.93*	0.0245	1.06
LLR/TL	Loan Loss Reserves/Gross Loans	-0.00237	-3.82*	-0.00533	-6.33*
CSTF	Customer and ST funding/total funds	0.06090	2.09**	-0.0265	-0.67
IBDP	Interbank Deposits/Total Deposits	-0.02450	-4.80*	-0.0115	-1.66***
OBSI	Off-balance sheet items/total assets	0.01100	1.70***	0.0205	2.33**
GDPGROWTH	Growth rate in state real domestic product	0.00366	5.16*	-0.0117	-12.15*
SPEC	Dummy variable that equals 1 if bank is a commercial bank, 0 otherwise	-0.06230	-4.90*	0.0164	0.95
FOREIGN	Dummy variable that equals 1 if more than 50% of the bank assets are owned by foreign banks; 0 otherwise	0.03130	3.96*	-0.0669	-6.22*
LISTED	Dummy variable that equals 1 if bank is publicly traded, 0 otherwise	-0.00388	-0.44	0.008102	0.68
Adjusted R^2	0.23				

*,**,*** represent significance at the 1%, 5%, and 10% levels respectively

VITA

H. Semih Yildirim was born in May 1971 in Turkey. He attended the schools of his hometown where he graduated from Unye High School in the spring of 1989. He began his post-secondary education at Marmara University, Istanbul and received his Bachelor of Art degree in Business Administration with concentration in accounting and finance in May 1993. He received a Master of Business Administration degree from Rochester Institute of Technology, Rochester, New York In May 1998. The following August he entered the Department of Finance at the University of Tennessee, Knoxville in order to pursue doctoral studies. He completed his degree in May 2003.