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RELATIONSHIP BETWEEN MARKET STRUCTURE AND BANK PERFORMANCE: EMPIRICAL EVIDENCE FOR CENTRAL AND EASTERN EUROPE[1]

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Abstract

This study aims to assess the role of market structure in the pricing behaviour and profitability of Central and Eastern European banks. In order to determine the most important variables related to the banks' pricing behaviour and profitability, we create a simple Cournot model. Then using these exogenous variables we build non-formal equations for testing the SCP (structure-conduct-performance) and the RMP (relative market power) hypotheses. Using the data of individual banks of eight Central and Eastern European countries in the period of 1998-2001 the tests reject the SCP hypothesis, but confirm the RMP hypothesis. In addition, we show that other factors, such as costs, risks, reserve ratio as well as the depth of bank intermediation also play an important role in banks' performance.

Keywords: bank performance, market structure, market power

JEL Classification: D43, G21, L13

1 Introduction

The banking systems and financial markets in Central-Eastern Europe underwent fundamental changes in the past decade. Privatisation, financial reforms, liberalisation of capital flows and the establishment of the framework for an efficient regulatory environment in CEE countries facilitated the stability of the banking system and the establishment of a sound financial infrastructure. With macroeconomic stability, vigorous economic growth and increasingly tight financial integration with the EU, the financial system gradually strengthened. The upcoming accession to the EU and related legal harmonisation have further amplified this process.

Changes in the operating environment also exerted a substantial impact on the structure of banking markets and the degree of competition. Due to the initially liberal entry rules and promising profit prospects, the number of banks rose significantly until the middle of the 90s, with mainly foreign banks entering the market. However, due to the tightening of prudential regulations, mergers and acquisitions as well as the liquidation of insolvent banks, the number of banks began to decrease in the second half of the 90s.

At the same time, with the dominance of private (foreign) ownership and stable financial systems in place, banks' performance and pricing behaviour have become increasingly market-based. Thus, competition may constitute a major determinant of bank performance in CEE countries today, contrary to the earlier period of transition when prevailing state ownership and high risks associated with macroeconomic instability significantly distorted the pricing decisions of commercial banks.

In order to assess the role of competition in bank performance empirically, we take the structural approach to measuring competition. The structural approach relies on the structural features of the market, and links competition to concentration (or the distribution of market shares), while non-structural methods directly quantify the conduct of market participants to measure the degree of competition.[2] As our main interest is not to determine the degree of competition, but to explore to what extent competition influences bank performance, only the structural methods can be regarded as relevant.[3]

Extensive empirical research has investigated the role of market structure in explaining banks' performance in developed countries, mainly in the U.S. and European banking markets. For the CEE countries, to our knowledge, only a few

[2] There are two major schools of thought in methodology to assess competition among banks: the structural approach and the non-structural approach. For a description of non-structural methods, see Bikker and Haaf (2002a). For the banking industry, empirical application of the Panzar-Rosse method can be found e.g. in Molyneux et al. (1994), Bikker and Groeneveld (1998), De Bandt and Davis (1999), Hempell (2002), Gelos and Roldos (2002); for CEE countries Drakos and Konstantinou (2002) and Philippatos and Yildirim (2002). Empirical investigations based on the Bresnahan model include studies by Shaffer (1993), Swank (1995), Berg and Kim (1998), Toolsema (2002) and Bikker (2003).

[3] It should also be noted, that structural variables are not necessarily viewed as good measures of competition. So far, only a few studies have investigated the relationship between market structure and non-structural measures of competition for a larger sample of countries. The results of Bikker and Haaf (2002b) supported the traditional view that concentration is inversely related to the degree of competition, whereas Claessens and Laeven (2003) found no evidence of a negative relationship.

studies have been devoted to measuring the degree of competition or exploring the issue of whether the structural features of the banking market are related to bank performance.[4] In order to fill the gap caused by the paucity of such studies, our research focuses on examining the relationship between competition and bank performance in the region, while also trying to capture the effect of other factors influencing pricing and profitability.

This study is structured as follows: In Section 2 we describe the structural methods of measuring competition and provide a comprehensive overview of the related hypotheses and empirical literature. In Section 3, a Cournot model describing the equilibrium condition of banks is presented. In Section 4, using a non-formal equation generated on the basis of the theoretical model, we test the structure-conduct-performance (SCP) and relative market power (RMP) hypotheses and present the related findings. Section 5 provides a summary and conclusions.

2 Structural approach of measuring competition: hypotheses and empirical applications

In a broader sense, the structural approach to measuring competition incorporates the testing of hypotheses which provide an explanation for the existence of a positive structure-performance relationship. Thus, first we give an overview of the evolution of such hypotheses, i.e. the market power and alternative hypotheses. Then, we summarize the main features of empirical methods applying the structural approach, with special emphasis given to the measures of market structure and bank performance. Afterwards, the empirical literature on the relationship between market structure and performance is reviewed. Finally, we discuss some critical features of the structural approach.

2.1 Hypotheses for explaining the relationship between market structure and performance

The relationship between market structure and performance was first investigated within the framework of the *structure-conduct-performance (SCP) paradigm*. The original SCP model interprets performance as the result of an exogenous market structure, which influences banks' conduct. The SCP paradigm assumes that higher concentration enables banks to collude, which may in turn provide for the possibility of higher prices and realising extra profits on a given market.

Offering an alternative explanation to the relationship between market structure and performance, the *efficiency hypothesis* first formulated by Demsetz (1973) questions the reasoning underlying the SCP paradigm.[5] Applied to banking, this hypothesis assumes that if a bank operates more efficiently than its competitors, it will realise higher profit, owing to lower operational costs. At the same time, more efficient banks acquire a larger market share. As a result, differences in efficiency lead to an uneven distribution of market positions and high concentration. The efficiency hypothesis

[4] To our knowledge, only one study has examined the structure-performance relationship for a CEE country so far (Košak (2000) investigated this relationship for the Slovenian banking system).
[5] Literature often refers to the efficiency hypothesis as the "efficient structure hypothesis".

proposes that the positive relationship between market structure and performance is merely superficial, as efficiency determines both market structure and performance.

Prior to the late 1980s, the majority of empirical studies on the relationship between structure and performance regressed profitability against (a) structural variable(s), e.g. market concentration and/or market share. Thus, the SCP hypothesis was supported when concentration exhibited a significant positive relationship with profitability. In earlier studies (e.g. Smirlock (1985)), proponents of the efficiency hypothesis used the market share of the individual banks as a proxy for efficiency. The efficiency hypothesis was considered to be confirmed when, of concentration and market share, only the latter was able to correlate positively with profitability.

Shepherd (1986) criticised this method, arguing that those adopting it assumed implicitly that the main source of market power was high market concentration, which allowed for the possibility of collusive conduct. Shepherd's hypothesis asserts that it is the dominance of the individual market participants that is the most direct source of market power, irrespective of what the ultimate source of such dominance is. This concept can be linked up with the emergence of the *relative market power (RMP) hypothesis*. Applying the RMP hypothesis to the banking industry, only banks with a large market share and well-differentiated products can exert their market power in setting prices and thus earn extra profit. Banks with smaller market shares operate as a "competitive fringe". Accordingly, under the relative market power hypothesis, individual market shares can function as the correct proxy for assessing market power and market imperfections.

The RMP hypothesis was found to be empirically proven when concentration in equations explaining performance turned out to be insignificant, while market share was significantly positively related to prices and/or profitability. It is clear then that the employment of market share in equations to provide an explanation for the relationship between profit and structure does not always yield unambiguous results, as a certain bank's strong market position may well point to either market dominance or superior efficiency.

Some of the empirical research employing the structural method was conducted to test the SCP and RMP hypotheses by analysing the price-concentration (market share) relationship. However, this method *alone* is unsuited for the validity of either the SCP or the RMP hypothesis to be unequivocally judged. The reason for this is that market power and efficiency effects may "mix" in the explanatory variables describing market structure. If, for instance, both are present simultaneously, they may well neutralise each other in the concentration (market share) coefficient, exerting an opposite impact on prices. Problems may also arise when, contrary to the efficiency hypothesis, efficiency is in effect negatively correlated with either concentration or market share. In such cases, the significantly positive coefficient of market structure may be misleading, i.e. it may fail to confirm unambiguously either the SCP or the RMP hypothesis, reflecting the combined effect of market power and inefficiency.

Berger and Hannan (1993) point out that an indisputable solution to the above methodological problems can only be provided through integrating explicit *efficiency variable(s)* into the equations. Furthermore, Berger (1995) clearly divided the

efficiency hypothesis into X-efficiency and scale efficiency hypotheses.[6] Under the *X-efficiency hypothesis*, the costs incurred by banks with efficient management and/or technologies are lower, with resultant higher profitability. More X-efficient banks acquire larger market shares, which increases market concentration. According to the *scale efficiency hypothesis,* the costs of banks with efficient scales are lower than their less efficient competitors with resultant higher profitability. Banks with efficient scales can acquire larger market shares, which increases market concentration.

Simultaneous application of market structure (concentration and market share) as well as X-efficiency and scale efficiency variables provides for the possibility that each of the two market power and efficiency hypotheses can be unequivocally confirmed or rejected. The SCP (RMP) hypothesis can be verified when there is positive correlation between concentration (market share) and profit. In this respect, the other structural variable and efficiency variables are irrelevant. Likewise, the X-efficiency (scale efficiency) hypothesis can be verified when there is positive correlation between X-efficiency (scale efficiency) and profit, with the other efficiency variable and the coefficient of market structure variables being irrelevant. In order for efficiency hypotheses to be confirmed, there must also be a positive correlation between market structure variables (concentration and market share) and efficiency.

In addition to the above four hypotheses on the relationship between structure and performance, *the quiet life hypothesis*, which is considered a special case of market power hypotheses in the literature, should also be mentioned. This hypothesis argues that the management of banks with large market shares is less focused on efficiency, as the use of market power in setting prices automatically raises revenues.[7] Increased market power thus goes hand in hand with deteriorating efficiency. As a result, such banks are unable to show superior profitability. In line with the above reasoning, the quiet life hypothesis puts forward an alternative explanation for the *lack of relationship* between profitability and market structure.

In the empirical literature, testing of the quiet life hypothesis embraces all the hypotheses to explain the negative correlation between concentration and cost efficiency. Berger and Hannan (1998) present the following classification of these hypotheses:

- the quiet life hypothesis;
- targeting objectives other than that of profit maximisation, e.g. "expense preference behaviour" or excessive risk avoidance;
- seizing and holding market power: the management devotes resources to either seizing or holding market power; and
- survival of incompetent management: the market power expressed in price setting enables incompetent management to keep its position.

When structural methods are discussed, in addition to the tests of market power and efficiency hypotheses, studies investigating *the relationship between the rigidity of*

[6] Although earlier studies also used proxies to address the issue of X- or scale efficiency, they were only allowed to apply to one or the other efficiency factor. Market share often served as the proxy of X- or scale efficiency. Total assets or the logarithmic values of such were often used to approximate scale efficiency.

[7] Either the SCP or RMP hypothesis is partially applicable.

banks' interest rates and market power should also be mentioned. Under a related hypothesis, if banks have market power, they react asymmetrically to changes of varying direction in money market rates through their respective pricing decisions. Thus, for instance, they may decide to lower interest rates rapidly on deposits when market rates fall, and increase them with a time lag in the reverse situation. By contrast, in competitive markets changes of any nature trigger rapid reactions.

2.2 Main features of studies adopting the structural method

Measures of performance

As mentioned, empirical studies analysing the structure-performance relationship take two main approaches to measuring bank performance. One uses the price of a product or service, the other applies a profitability indicator to measure performance. Studies investigating the price-concentration relationship mainly use average loan rates, deposit rates or revenues from fees and commissions (projected on the stock of demand deposits).

Applying such price variables has been criticised for several reasons. As average interest rates are calculated from balance sheets (denominator) and income statements (numerator), stock variables (e.g. loan portfolio at the end of the period under review) are combined with flow variables (e.g. interest revenues in the period under review). Most of these shortcomings can be eliminated by employing interest rates on the individual products that can be gained from "survey" type statistics. However, the fact that employing interest rates on the individual products ignores (possible) cross-subsidies reflected in the prices of the individual products may give rise to further problems.

For lack of individual loan or deposit rates, studies investigating the structure-performance relationship for European banks use net interest margin as a proxy for pricing (see e.g. Goldberg-Rai, 1996, Vander Vennet, 2002). Corvoisier and Gropp (2001) include loan and deposit margins as price variables in their study that relies on aggregate data.

Another widely accepted method to measure performance is the use of *profitability indicators* (e.g. ROA and ROE). Its main advantage is its simplicity and the fact that the performance of the banks as multi-product companies can be expressed with one single number. The main drawback of this method is similar to that observed when using average interest rates, as these profitability indicators also link flow variables with stock variables.

Market definition

One of the neuralgic points of the SCP studies is identifying relevant markets. As banks offer a wide range of products, it is rather hard to pin down a comprehensive market. The credit and deposit markets are structurally segmented according to client groups and product types. On the basis of segmentation according to client groups, there are wholesale (large corporate customers) and retail (SMEs and the household sector) banking services. With the segmentation according to product types, there are

market segments relating to various types of loans (e.g. mortgage and consumer loans) and deposits (e.g. demand, time and savings deposits).

As soon as the product market is identified, the geographical demarcation of the market should also be established. The relevant market of information-intensive retail banking products and services is restricted not only by transportation but also information costs. As a result, the traditional approach to defining the market of retail banking services considers local banks to be service providers. In most U.S. studies the local markets are approximated by the metropolitan statistical areas (MSAs). Local markets in Europe are, however, much harder to identify. A common method applies samples consisting of banks in a group of countries. In this case the local market is identical to the national market. The downside of this method is that it fails to differentiate between large banks covering the whole domestic market and the small ones of local importance.

Measuring market structure

In order to measure market structure, SCP studies in the United States invariably employ deposit market concentration. Studies in Europe, however, commonly use concentration calculated from total assets. It should be noted that concentration is not necessarily the best indicator of competition, since, for instance, leading banks may compete even in a highly concentrated market. What lends practical importance to concentration indexes is that they are easy to apply in decisions on competition policy (e.g. the approval of mergers).[8]

Due to its simplicity and limited data requirement, the CR_k concentration ratio is one of the most commonly used concentration indexes in empirical literature, which sums the market shares of the k largest banks allocating equal weighting to each bank. A drawback to this ratio is that it only makes use of part of the information that can be gained from the distribution of market positions. Thus, for example, it fails to reflect the impact of shifts in the positions of market leader banks (as it attaches equal weighting to the k largest banks) and ignores smaller ones. There are no rules for defining the appropriate value of k; accordingly, such values are arbitrarily established. Practice shows that the index is most frequently calculated for the 3, 5 or 10 largest banks.

The Herfindhal-Hirschman index (HHI), which is the sum of the squared market shares of the individual banks, is the most widely used measure of concentration. Its upside is that it makes full use of the information obtainable from the distribution of market positions. Owing to the manner in which it is calculated, it attaches greater weighting to larger banks and allows for all banks. The possible values of HHI range from $1/n$ to 1. The index is at its lowest when each market participant's share is equal, while its theoretical maximum is linked to pure monopoly.[9] Of the other structure-related variables employed in empirical studies, the following can also be highlighted:

[8] The best known example is U.S. practice. According to the guidelines of the U.S. Department of Justice, a merger is approved only if market concentration (Herfindhal-Hirschman index) in the relevant local market following such merger remains below 1,800 points, and the growth of the concentration index, in comparison to the pre-merger situation, does not exceed 200 points.

[9] For the purposes of simple interpretation, an index multiplied by 10,000 is used in the empirical literature. It follows that the theoretically viable extreme values are 10,000/n and 10,000.

the number of branch offices, the respective market shares of banks, the differences between the market shares of leading banks.[10]

The degree of competition is also greatly affected by barriers to entry that potential new entrants are subject to. Such restrictions may be of regulatory (e.g. capital requirement and terms of authorisation, etc) or economic (e.g. acquiring minimum efficient scales, product differentiation and absolute cost advantages, etc) origin. In empirical research, the best-known example of explicitly allowing for barriers to entry is the distinction that earlier U.S. studies made between states which restricted branching and those with more liberal licensing rules ("unit banking" states vs. "liberal branching" states).

2.3 Findings of the studies adopting the structural method

Between the 1960s and mid-1990s simple structural models, the vast majority of which were designed to investigate U.S. banking markets, prevailed in empirical literature analysing the structure-performance relationship. The use of expanded structural models, which also include efficiency variables, only started to gain ground from the mid-1990s. After a summary of the results of simple SCP tests is presented, these studies will be treated separately.

The results of simple structural models

U.S. banking markets

A great number of empirical analyses have been carried out since the 1960s, exploring the profit (price)–concentration relationship in the U.S. banking markets. In what follows, relying on Molyneux's overview (1996), we seek to provide a summary of the major conclusions of the U.S. SCP studies conducted between 1960 and 1991.

While investigating the relationship between *concentration* and *deposit rates*, authors generally use average deposit interest rates, despite the methodological shortcomings discussed above. The majority of such investigations have failed to identify any significant correlation between market structure and deposit interest rates. It should be noted, however, that a substantial part of these studies cover the period prior to 1980, when regulations pertaining to deposit interest rates (Regulation Q) were still in effect. Accordingly, results may well be distorted. By contrast, the methodologically more reliable studies dealing with the period following deregulation and using individual interest rates have yielded more convincing findings in favour of the SCP hypothesis (e.g. Berger-Hannan, 1989 and Calem-Carlino, 1991). High as the explanatory power of the models in these studies is, the impact of concentration on interest rates has been found to be insignificant.

One of the conclusions in empirical analyses of the relationship between *concentration* and *loan interest rates*, which can be generalised, is that average loan interest rates are an unsuitable measure of banks' performance. The use of individual loan rates obtained from survey-type interest rate statistics has proved to be much

[10] E.g. the difference between the market shares of either the first and the second or the first and the third largest banks.

more effective. Even if a significant correlation was found between concentration and loan interest rates, this only had a minor impact. In addition, the explanatory power of the various models is often weak, which suggests that major variables are ignored in equations.

The findings of numerous empirical studies on the relationship between *concentration and profitability* in the banking market are rather diverse: about half of these studies have identified a significant correlation. Of the various types of SCP studies, models on the *concentration–profitability* relationship have the weakest explanatory power. Some of the studies, according to which concentration does not affect profitability significantly, have detected a positive correlation between market share and profitability, which they trace back to efficiency. Smirlock (1985) as well as Evanoff and Fortier (1988) claim that as soon as market share is integrated into the model, the concentration variable loses its explanatory power. By contrast, Hanweck and Rhoades (1984) have only found links between market share and prices, but not between market share and profitability.

European banking markets

To date, relatively few empirical analyses of the structure-performance relationship have been carried out in relation to European banking markets. The reason for this is that there is no satisfactory data available on local (regional) markets. Consequently, it is much harder to define the markets to be investigated. As far as European banking systems are concerned, concentration ratios can, more often than not, be computed only for the domestic market as a whole. Moreover, due to the universal nature of European banks, the problem that banks operate as multi-product institutions is often more accentuated when the relevant market is defined.

The majority of European studies test the SCP hypothesis for *a group of countries*. Molyneux and Teppett (1993) carried out a panel analysis of the banks in five EFTA countries (Austria, Switzerland, Sweden, Norway and Finland) for the period between 1986 and 1988. Overall, their findings seem to confirm the SCP hypothesis. The authors, however, discarded the efficiency hypothesis. Molyneux (1993) examined the structure-performance relationship in 19 countries and concluded that the traditional SCP hypothesis could be confirmed in the case of the Portuguese, Spanish, Swedish, British and Turkish banking systems. Vander Vennet's findings (1993) confirmed the SCP hypothesis for a few European countries (Belgium, Ireland, Portugal and Spain). [11] Corvoisier and Gropp (2001) sought to explain to what extent the wave of consolidation in the EU in the second half of the 1990s had been able to offset the competition-enhancing impact of deregulation. Their empirical model was based on a simple Cournot model, employing country and product specific concentration indexes as a major explanatory variable. The results suggest that the impact of concentration on pricing varies from product to product. In the case of loans and demand deposits, higher concentration leads to less competitive pricing (SCP hypothesis), whereas in the case of savings and time deposits, no such impact can be detected. In contrast, deposit margins are lower in more concentrated markets (efficiency hypothesis).

[11] This study already departs from the traditional SCP methodology in as much as it employs the efficiency variable.

A part of the European studies examined the structure-performance relationship for a *single country*. Mooslechner and Schnitzer (1992) looked at the structure-profitability relationship in the Austrian banking market for the years 1988 and 1989. They divided the market into various regions and defined each bank's market on the basis of the geographical distribution of the branch network. The findings of this cross-sectional analysis using data on 956 banks were unable to confirm either the SCP or the efficiency hypothesis. By contrast, a panel analysis of 13 large banks identified a significantly positive correlation between concentration and profitability and market share and profitability. Lloyd-Williams et al. (1994) tested SCP and the efficiency hypotheses on the Spanish banking market for the period between 1986 and 1988, using panel regression.[12] Their findings point to a positive correlation between concentration and profitability, i.e. they confirm the SCP hypothesis. Analysing the relationship between concentration and mortgage loan and savings deposit interest rates, Egli and Rime (1999) sought to assess the potential impact of the UBS–SBC merger on Switzerland's retail banking services market. Their findings revealed that the SCP hypothesis applies to savings deposits in larger local markets (cantons), while no positive correlation exists between concentration and interest rates in the case of mortgages. In respect of small cantons, the SCP hypothesis was not found to hold for either savings deposits or mortgages.

An overview of the results of expanded models

Using the expanded structural model by Berger and Hannan (1993), which also includes direct efficiency variables, Berger (1995) tested four hypotheses: the SCP, relative market power, X-efficiency and scale efficiency hypotheses for the U.S. banking market. His results supported the RMP and X-efficiency hypotheses, although the impact on profitability was rather small.

The main conclusions of the empirical studies that apply the same methodology to *the European banking markets* are as follows:

- Goldberg and Rai (1996) investigated the structure–performance relationship forn banks in 11 European countries during the period between 1988 and 1991. Unlike the majority of earlier empirical studies using the traditional SCP model, their study could not detect any significantly positive correlation between concentration and profitability. Of the alternative hypotheses, the X-efficiency hypothesis was found to apply for banks in countries with low concentration.[13]
- Punt and Van Rooij (2001) tested the four hypotheses for banks in 8 European countries for the period 1992-1997. Their results supported only the X-efficiency hypothesis unequivocally.
- Vander Vennet (2002) used data on banks in 17 European countries (EU member states, plus Switzerland and Norway) to test the two market power and efficiency hypotheses for the years 1995 and 1996.[14] His findings only partially corroborated the SCP hypothesis, since although the coefficient of the concentration variable

[12] As the authors only managed to calculate concentration for the domestic market as a whole, only the time variability of concentration could be relied on in the panel regression.
[13] A complete sample of banks was divided into banks on low or high concentration markets, and the validity of the four hypotheses was tested separately.
[14] The complete sample comprises 2,375 banks, which account for at least 85% of the aggregate balance sheet total in each country.

was positive in each equation, it only proved significant in the regression explaining ROA.[15] On the other hand, findings confirmed the X-efficiency hypothesis convincingly.

Of the structural methods measuring the degree of competition, expanded structural models with integrated efficiency variables can be considered to be the most suitable. Due to the relative scarcity of this kind of studies, general conclusions derived from them should be treated with caution. Overall, findings suggest that in the period under review differences in the profitability of the individual banks both in the United States and Europe can mainly be explained by differences in efficiency, rather than market power.

Testing the quiet life hypothesis

Berger and Hannan (1998) tested potential explanations for the negative relationship between cost efficiency and concentration as one hypothesis with regards to U.S. banks. Their findings confirmed the quiet life and related hypotheses. In their assessment, this puts an end to the apparent contradiction that while the findings of price/concentration studies generally show support in favour of the SCP hypothesis, empirical results are much less convincing in the case of the profit/concentration relationship.

Punt and Van Rooij (2001) tested the quiet life hypothesis for banks in eight European countries. Based on their results, the quiet life hypothesis can not be confirmed in the case of European banks.

Market structure and the rigidity of interest rates

Berger and Hannan (1991) as well as Neumark and Sharpe (1992) point out the inflexible adjustment of interest rates on deposits when they studied U.S. banks. They interpreted such rigidity as proof of the existence of market power. In terms of the assessment of the market concentration and market power relationship, it is even more important to remark that a higher degree of rigidity was experienced in markets with a higher degree of concentration. In comparison, Jackson (1997) managed to identify a high degree of interest rate rigidity in deposit markets with not only high, but also low concentration. This, however, seems to suggest a U-shaped relationship between market concentration and market power, which runs counter to the SCP hypothesis.

2.4 Shortcomings of the structural approach

Given the mixed results of empirical studies, a number of researchers have concluded that it cannot be verified with certainty whether the SCP hypothesis holds for banking markets. In what follows, some major theoretical and methodological criticism is presented.

[15] The author uses three performance variables: ROA, ROE and net interest margin.

Contestability of markets

One of the possible explanations for the lack of the profitability/structure relationship bases its reasoning on *the contestability of markets hypothesis*, which argues that competitive pricing may well exist despite the small number of market players (or high concentration), provided that market entry is relatively easy and that the costs of entry can be regained upon exit (i.e. there are no sunk costs). The reason why this hypothesis has become increasingly popular is that recent deregulation and technological development have enhanced the contestability of banking markets. Molyneux (1999) argues that due to an ever-widening circle of financial service providers (competition intensified by non-banking financial institutions), an internal market of considerable size created by the EMU as well as the current state of competition, concentration in the domestic banking markets is becoming less and less relevant in terms of competition policy.

Others (e.g. Dermine 2002) concede that such factors have added to the contestability of markets, but they also emphasise that in certain areas of banking, the dominance of banks has not yet been broken. Thus, payment services and SME lending in the retail segment are still considered to be local markets, where banks can abuse their power.[16]

Non-linearity of the concentration–performance relationship

In a dispute over the structure–performance relationship, it was the findings of the research conducted by Jackson (1992) that first raised the possibility that this relationship was not linear. Jackson found a negative relationship between concentration and deposit rates in markets with low concentration. The negative correlation ceases to exist in middle levels of concentration and becomes positive in highly concentrated markets. This suggests that as concentration is high, any increase in concentration results in even more competitive conduct. In Jackson's view, the non-linearity of the relationship runs counter to the SCP hypothesis. Reference has already been made to a study by Jackson (1997) on the rigidity of deposit interest rates. The findings of this study also pointed to the existence of a U-shaped relationship between market concentration and prices. Further examples of the non-linear nature of the profit (price)–concentration relationship have been cited by Berger and Hannan (1992) (for U.S. markets) as well as Goldberg and Rai (1996).

Lack of examination of banking conduct

One of the shortcomings of the empirical studies employing the SCP model is that they fail to allow for banks' market conduct explicitly (Bikker and Haaf (2002a)). Instead, in effect, they treat it as being determined by structure. One exception is the study by Calem and Carlino (1991), whose findings suggest that in the case of U.S. banks, non-competitive conduct was not restricted exclusively to concentrated markets.

[16] A well-known example for this is provided by the report of the Competition Commission in the UK about competition in the SME services market. The Competition Commission's 2002 report explored several phenomena curbing competition in the relevant market and subsequently stated that the four largest banks, relying on their market power, had made considerable extra profit in the period under review.

Furthermore, as pointed out by Cetorelli (1999), a positive market concentration-market power relationship can only be justified theoretically, if we assume that banks behave as Cournot oligopolists. He argues that in more general theoretical models, which do not make such restrictive assumptions about banks' behaviour (i.e. which allow interaction among banks), the relationship between market concentration and market power is less obvious.

Difficulties in measuring market structure

The SCP paradigm assumes that each bank profits from high prices caused by collusion among market participants, thus profitability depends to some extent on concentration. Literature on the industrial organisation approach points out that the use of simple concentration indexes may be misleading. Of these concentration ratios, the most frequently employed in empirical analyses are:

- the CR_k index, which sums the market shares held by the *k* largest banks, placing equal emphasis on leading banks and ignoring the rest;
- the Herfindhal index which, while placing greater emphasis on larger market players and allowing for each bank, adopts a calculation method that automatically excludes the competitive conduct of banks as a diminishing factor.

Molyneux (1993) investigated the impact of co-operation and rivalry among European banks for the period from 1986 to 1989. His findings reveal that the larger the market share of the market leading bank, the more common the co-operation between the individual banks is, which in turn boosts the average profitability of the sector. At the same time, the stronger the second largest bank's market position, the more competitive banking conduct is, however, this is still insufficient to offset the impact of the largest bank curbing competition. As a result, there is a positive correlation between market concentration and profitability.[17]

Other factors

Empirical studies often fail to consider factors that may be important in terms of assessing an actual relationship between structure and performance. Few empirical studies deal with, for example, the non-price factors of competition, despite the fact that they are also likely to affect banks' performance considerably.
Furthermore, Gilbert (1984) argues that a serious shortcoming of earlier SCP studies in the United States is that they ignore the impact of regulations (e.g. Regulation Q) on concentration and performance.

3 A formal model for describing banks' pricing behaviour

After reviewing the empirical literature, as a starting point for our empirical research we introduce a formal model in order to determine the variables relevant to banks' pricing and profitability.

[17] The conduct of the other major (i.e. third, fourth and fifth) banks has practically no impact on the profitability of the banking sector.

Several authors provide theoretical evidence that market structure is positively related to pricing and profitability in the Cournot oligopoly. Such authors include Cowling and Waterson (1976), Dansby and Willig (1979), Farrell and Shapiro (1990) as well as Bikker and Haaf (2002a). According to the traditional theory of Cournot oligopoly, in the equilibrium, the profit is positive and falling if there is an increase in the number of banks, in other words, if competition intensifies. Having an assumption on competitors' anticipated actions, through determining the output quantity, banks are capable of influencing interest rates. The money market sensitivity of a Cournot bank's lending and deposit rates rises and falls due to increased competition and growth in the number of banks respectively. Finally, in the Cournot oligopoly there may be barriers to entry. With this in mind, the use of a simple Cournot framework seems to be the optimal choice for determining the equilibrium condition of banks and finding the relevant variables with regard to banks' performance.

Our simple formal theoretical model is used as the starting point for testing market power hypothesis, similar to those used by Startz (1983), Jappelli (1993), Corvoisier and Gropp (2001). The assumption is that banks are price takers in the deposit and money markets but price setters in the loan market. In addition, we think that there are a high number of equally small banks in the banking industry that act as Cournot competitors to the extent that they believe that their rates do not influence rivals' behaviour in the loan market. Further assumptions are that each bank has the same cost function, runs one branch, has one kind of asset (loan) and has one kind of liability (deposit). Naturally, banks manage their excess liquidity or deficit in the inter-bank market. The demand for loans facing bank *i* has a negative correlation with the difference between the rates offered by the bank and its competitor and with the average rate on the loan market. Every bank has the same linear[18] loan demand function:

$$(1) \qquad L_i = \frac{A_0}{N} - \frac{\varepsilon_i^{\,L}}{N-1}\sum_{j\neq i}^{n}(r_i^L - r_j^L) - \frac{r^L E^L}{N}.$$

Differentiating (1) with respect to r_i^L we receive the first-order condition:

$$(2) \qquad \frac{\partial L_i}{\partial r_i^{\,L}} = -\varepsilon_i^{\,L} - \frac{E^L}{N^2},$$

where

L_i = demand for loans at bank *i*;
r^L_i= lending rate of bank *i*;
r^L_j = lending rate of the rival of bank *i*;

r^L= average lending rate, $r^L = \frac{\sum_{i=1}^{n} r_i^L}{N}$;

[18] Here we use the simplifying assumption that demand is linear. However, empirical tests prove that the money demand curve is typically non-linear. As a logical consequence, the loan demand curve is non-linear too.

ε_i^L = elasticity of loan demand of bank *i*, substitution effect
(the demand for loans at bank *i* declines if bank *i* sets the lending rate higher than that of a competitor);
A_0 = financing requirements of the economy
(the total demand for loans equals the financing requirements of the economy if the interest rate or elasticity equals zero);
E^L= total demand elasticity for loans, $E^L = -\frac{\partial L}{\partial r^L}$;
N = number of banks.

In the equilibrium, each bank has the same lending rate. Hence, the sum of identical loan demand functions is derived as

(3) $L = A_0 - r^L E^L$, where $L = \sum_{i=1}^{n} L_i$.

Now, a simple cost function[19] is introduced:

(4) $C_i = F_i + \gamma_i^L L_i + \gamma_i^D D_i$,

where

F = fixed costs;
γ_i^L, γ_i^D = coefficients.

Furthermore, each bank's net position on the inter-bank market[20] is

(5) $M_i = (1-\alpha) D_i - L_i$,

where

M = inter-bank net position;
D = deposit supply;
α = reserve ratio[21].

Also, introducing the measure of lending risk, the profit of bank *i* can be written as[22]

(6) $\pi_i = (1-\mu_i) r_i^L L_i - \mu_i L_i + r M_i - r_i^D D_i - C_i$,

[19] Another simplifying assumption is that the cost function is linear and that the marginal cost is constant. Empirical tests tend to rely more frequently on translog cost functions, such as Shaffer (1993) and Shaffer and DiSalvo (1994).
[20] The assumption is that there are no classical capacity barriers in the sense that banks are able to raise missing funds either from the inter-bank market or the central bank.
[21] The interest rate paid on reserves is negligible.
[22] The assumption here is that the bank can only choose the volume of loans or deposits, while the amount of capital is given. Naturally, apart from the basic fund (D) and asset (L) components, other balance sheet items (such as liquid assets and capital for instance) can also be introduced, but they play virtually no role from an optimisation point of view. Banking literature only introduces other balance sheet items in the context of specific tests, such as those carried out by Pausch and Welzel (2002), who studied the effect of capital adequacy on bank profits.

where

r = money market rate;
μ = the expected loan loss ratio[23].

Using equations (4), (5) and (6), maximum profit can be expressed as

$$(7) \qquad \max_{(r_i^L)} \pi_i = (1-\mu_i) r_i^L L_i - \mu_i L_i + r M_i - r_i^D \frac{M_i + L_i}{1-\alpha} - F_i - \gamma_i^L L_i - \gamma_i^D \frac{M_i + L_i}{1-\alpha}.$$

The first derivative of equation (7) with respect to the lending rate is

$$(8) \frac{\partial \pi_i}{\partial r_i^L} = \left[(1-\mu_i) r_i^L - \mu_i\right] \frac{\partial L_i}{\partial r_i^L} + (1-\mu_i) L_i - \frac{r_i^D}{1-\alpha} \frac{\partial L_i}{\partial r_i^L} - \gamma_i^L \frac{\partial L_i}{\partial r_i^L} - \frac{\gamma_i^D}{1-\alpha} \frac{\partial L_i}{\partial r_i^L}$$

and after substituting equation (2) we obtain

$$(9) \frac{\partial \pi_i}{\partial r_i^L} = \left[(1-\mu_i) r_i^L - \mu_i\right] \left(-\varepsilon_i^L - \frac{E^L}{N^2}\right) + (1-\mu_i) L_i - \frac{r_i^D}{1-\alpha} \left(-\varepsilon_i^L - \frac{E^L}{N^2}\right) - \left(\gamma_i^L + \frac{\gamma_i^D}{1-\alpha}\right) \left(-\varepsilon_i^L - \frac{E^L}{N^2}\right).$$

Then, using the aggregate loan demand function (3) and imposing symmetry ($r_i^L = r^L, r_i^D = r^D, \mu_i = \mu, \varepsilon_i^L = \varepsilon^L, \gamma_i^L = \gamma^L, \gamma_i^D = \gamma^D$) the equilibrium condition can be written as

$$(10) \left[(1-\mu) r^L - \mu\right] \left(-\varepsilon^L - \frac{E^L}{N^2}\right) + (1-\mu) \left(\frac{A_0 - r^L E^L}{N}\right) - \frac{r^D}{1-\alpha} \left(-\varepsilon^L - \frac{E^L}{N^2}\right) - \left(\gamma^L + \frac{\gamma^D}{1-\alpha}\right) \left(-\varepsilon^L - \frac{E^L}{N^2}\right) = 0.$$

Rearrangement yields the equilibrium lending rate[24]:

$$(11) \qquad r^L = \frac{A_0}{N\varepsilon^L + \frac{E^L}{N} + E^L} + \frac{r^D + (1-\alpha)\mu + (1-\alpha)\gamma^L + \gamma^D}{(1-\mu)(1-\alpha)} \frac{N\varepsilon^L + \frac{E^L}{N}}{N\varepsilon^L + \frac{E^L}{N} + E^L}.$$

An oligopolistic competitor faces the profit maximising equation[25], where the margin between lending and deposit rates is determined essentially by economic cycles (A_0,

[23] Loan loss ratio = (1–recovery rate) x probability of default
[24] Of course, besides the equilibrium condition of the lending rate, assuming similar to Startz (1983) that the banks are price takers in the loan and money markets but price setters in the deposit market, in the same way we can also derive the equilibrium deposit rate.
[25] To check whether the function really gives a profit maximum, that is whether the objective function is concave, see the Appendix.

μ), costs (γ^D, γ^L,α), the degree of competition (N, ε^L) and elasticity of loan demand (E^L).

As our primary goal is to analyse the impact of competition on pricing and profitability, below we will focus exclusively on the effect of changes in the number of banks (N) and degree of substitution (ε^L). On the basis of equation (11) it is easy to see that sharper market competition markedly narrows the margin between market lending and deposit rates. An increase in the number of banks (N) and a rise in the substitution effect between banks (ε^L) will cause the margin to narrow.

If there is perfect competition, the L'Hopital rule can be applied:

$$(12) \qquad \lim_{N\to\infty,\varepsilon^L\to\infty} r^L = \frac{r^D + (1-\alpha)\mu + (1-\alpha)\gamma^L + \gamma^D}{(1-\mu)(1-\alpha)}$$

and using equations (5) and (12), if the banks raise funds only from the inter-bank market:

$$(13) \qquad \lim_{N\to\infty,\varepsilon^L\to\infty} r^L = \frac{r + \mu + \gamma^L}{(1-\mu)}.$$

Accordingly, under perfect competition the margin between lending and deposit rates is a function of the marginal cost, the reserve ratio and the loan loss ratio. In contrast, the margin between lending rates and money market rates is logically not determined by the reserve ratio.

4 Testing the SCP and the RMP hypotheses in the Central and Eastern European region

Using the Cournot model[26], we determined the most relevant variables with regard to the pricing in the previous section. Applying these results, below we will build non-formal equations, which will enable us to test the validity of the SCP and RMP hypotheses in the Central and Eastern European region.[27]

4.1 Variables of the non-formal model

As the first step, taking into account the profit maximising condition of a Cournot competitor we must find proxy variables. On the basis of the data available and other empirical tests, the proxy variables are defined as follows:

[26] We used only the relevant variables of the Cournot model in order to build a non-formal model. We didn't apply the assumptions of Cournot model (same cost function, etc.) in the empirical tests.

[27] This paper is not aimed at testing the X- and scale efficiency hypotheses. Due to limited availability of data we have not been able to construct cost functions for the region's banks or X- and scale efficiency variables that could be derived from the former.

Original	Proxy
Bank-specific variables	
π (Profit)	ROA (Profit after tax/Total assets)
(r^L-r^D) (Margin)	Net interest margin {NIM} (Net interest income/Interest-bearing assets)
N (Number of banks) and ε^L (Elasticity of loan demand)	Degree of competition {MS} (Market share)
C (Operating costs)	Operating costs {C} (Operating costs/Total assets)
μ (Loan loss ratio)	Loan loss reserves {LLR} (Loan loss reserves/Total loans)
Country-specific variables	
N (Number of banks)	Degree of competition {HHI}[28] (Herfindhal-Hirschman Index^2)
α (Reserve ratio)	Reserve ratio {R}
E^L (Total elasticity of loan demand)	Depth of bank intermediation {TA} (Total assets of the banking sector/GDP)
A_0 (Aggregate loan demand)	Real GDP growth {GDP}
Additional variable	Inflation {CPI}

Even though we were guided by the principle of simplicity in selecting the proxy variables, we encountered a number of difficulties concerning availability and theory. The first problem was to decide what kind of indicator to use to approximate pricing decisions. The optimal pricing variables would have been the spreads calculated from individual new bank loans and money market rates, as well as money market rates and announced deposit rates in order to investigate the two markets separately. Unfortunately, interest rates from individual banks are not available. Instead, we calculated the net interest margin from the financial statements of individual banks, an indicator frequently used in literature as an alternative indicator offering good approximation of the margin between average lending rates and average deposit rates. Pricing decisions are reflected in the net interest margin, although only in aggregated form (aggregating pricing decisions in the loan and deposit markets).[29] Accordingly, the model used the HHI and market share based on total assets instead of loans and deposits. In addition, the profitability was proxied by the return on assets.

Another key point was to decide which indicator was better to express cost differences among banks: the operating cost as a ratio of operating income or the total assets. If the market power hypotheses hold, the cost to income ratio can be in

[28] HHI is defined as the squared sum of market shares multiplied by 10,000.

[29] To calculate the net interest margin we use interest-bearing assets rather than total assets as a denominator. Our calculation of the net interest margin was based on the method presented in an ECB (2000) study entitled "EU banks' margin and credit standards" (pp. 27). In particular, we took account of the effect that some interest-bearing assets are financed by non-interest-bearing liabilities.

negative correlation with the concentration and market share due to the higher income, resulting from wider margins. In contrast, by using the cost to total assets ratio we can avoid this problem.

Risks are most commonly presented in terms of the ratio of non-performing loans to total loans. Due to problems with availability, we used loan loss reserves instead of non-performing loans.

From the country-specific indicators, information on reserve ratios is available for each country. Furthermore, the elasticity of loan demand was proxied by the depth of bank intermediation. Clearly, as banks play an increasing role in private sector financing, this generates for example higher interest rate sensitivity. Another good proxy would have been the size of capital market financing, but as its level is negligible in the CEE countries we refrained from using this indicator in the model. Although in these countries, the level of foreign bank and inter-company lending is lower than that of domestic bank lending, it still plays an important role in financing domestic enterprises. Due to the limited data availability, however, we were not able to incorporate these variables into the model.

Guided by the principle of simplicity, we used the rate of real GDP growth to represent changes in the demand for loans. Finally, prompted by empirical evidence, it seemed justified to introduce inflation as an additional variable.

4.2 Equations of the non-formal model

Using the selected proxy variables, the non-formal equivalent of the equilibrium equation can be written as:

$$NIM_{it} = \beta_1 + \beta_2 HHI_{jt} + \beta_3 MS_{it} + \beta_4 C_{it} + \beta_5 LLR_{it} + \beta_6 R_{jt} + \beta_7 TA_{jt} + \beta_8 GDP_{jt} + \beta_9 CPI_{jt} + u_{it} \quad (14)$$

However, the full testing of the SCP and RMP hypotheses requires formulating the equation for structure and profitability, in addition to the equation between structure and prices:

$$ROA_{it} = \gamma_1 + \gamma_2 HHI_{jt} + \gamma_3 MS_{it} + \gamma_4 C_{it} + \gamma_5 LLR_{it} + \gamma_6 R_{jt} + \gamma_7 TA_{jt} + \gamma_8 GDP_{jt} + \gamma_9 CPI_{jt} + v_{it} \quad (15)$$

In the equation, i denotes individual banks, j countries (or "local markets") and t the time horizon. The model employs panel estimation with several types of specifications, where u_{it} and v_{it} denote error terms.

The tests primarily focus on the coefficients of concentration and market share. Equations (14) and (15) can be used to support the SCP hypothesis, namely that banks can earn higher net interest margins and profits in a concentrated market, if β_2 and γ_2 are significantly positive. Moreover, if β_3 and γ_3 are significantly higher than zero, the banks have relatively greater market power, which they can exploit in pricing and earning higher profits. The SCP and RMP hypotheses do not hold if the coefficients for concentration and market share are significantly negative or zero.

Our model, including equations (14) and (15), can clearly demonstrate the validity of the SCP and RMP hypotheses. If efficiency, not explicitly included in our equation, has a negative correlation with the net interest margin and a positive correlation with concentration and market share, then the positive coefficients of the structural variables in equation (14) can by themselves prove the dominance of the SCP and RMP hypotheses. If, however, efficiency is negatively correlated with the net interest margin, concentration and market share (that is, the more concentrated the market and larger the bank, the more inefficiently it operates and the larger the interest margin), the positive coefficients of the structural variables may be misleading in the competition – price context. While in this case efficiency is negatively correlated with concentration and market share and necessarily positively correlated with profitability, a condition for confirming the SCP and RMP hypotheses is that the structural variables in equation (15) must have significant positive coefficients. As we have no information available on the relationship between efficiency and our structural variables, a definite verification of the SCP and RMP hypotheses requires that concentration and market share positively determine both price and profitability.

It should also be noted that β_2, β_3 and γ_2, γ_3 are defined independently, as while the SCP test examines the relationships between concentration, pricing and profitability across several local markets (countries), the RMP test looks at possible correlations between market share, pricing and profitability across individual banks.[30]

In addition to market structure, cost and risk levels can be priced in the net interest margin as well. According to the banks' profit maximisation condition, values β_4 and β_5 in equation (14) are likely to be significantly positive. Depending on the extent to which cost and risk levels are priced in by the banks, coefficients γ_4 and γ_5 are likely to have negative values or values which are not far from zero in equation (15).[31]

As for country-specific variables, the reserve ratio coefficient in equation (14) is expected to be significantly positive, assuming that banks fully pass on the cost of reserves to customers in the form of higher interest margins. The total assets of the banking sector/GDP ratio may have a negative correlation with both the margin and the profitability, as a country with deeper financial intermediation has theoretically a higher elasticity of loan demand.

The rate of economic growth may have a positive correlation with the net interest margin. Robust growth driven by investment can lead to a larger interest margin by stimulating demand for loans. Furthermore, we assume that economic growth is more likely to have a positive effect on ROA due primarily to the cyclical pattern of revenues.

The level of inflation may correlate positively with the net interest margin.[32] Higher and more volatile inflation may lead to higher net interest margins by reducing predictability and increasing risks. No clear relationship can be defined between

[30] Thus, rejecting the SCP hypothesis does not automatically imply rejection of the RMP hypothesis and vice versa.
[31] If cost and risk levels are fully priced in, these factors would not affect profitability.
[32] Hanson and Rocha (1986) and Demirgüc-Kunt and Huizinga (1998) find a positive correlation between inflation and net interest margins as well as profitability.

inflation and ROA, as there are inflationary effects on both revenues and expenses. However, the correlation is likely to be positive if there are higher variations in inflation rates across countries, as then the inflation compensation incorporated in interest rates exceeds costs. Furthermore, due to near-zero or very low (inflexible) interest rates paid on demand deposits, an environment of higher inflation provides opportunities for higher profit.

4.3 Countries reviewed and the main criteria of comparison

The countries, and simultaneously local markets, selected for this analysis in the region have stable macroeconomic conditions and have made remarkable progress in the area of financial reform and establishing the required regulatory framework. The eight countries studied are Estonia, Lithuania, Latvia, the Czech Republic, Slovakia, Poland, Hungary and Slovenia (CEE-8). These countries can join the EU in 2004 and later the Economic and Monetary Union, after satisfying the Maastricht criteria.

Over the past few years, steady integration by the CEE-8 countries into the European economy has fostered stability, efficiency and competitiveness in the real economy and financial intermediation. Despite the global economic slowdown, the impact of which has been felt through the close economic integration with the EU, the CEE-8 economies have continued to grow. Several countries had introduced inflation targeting, which helped nearly every one of them to bring the rate of inflation down to single digits by 2001. Although the majority of acceding countries suffered some weakening in fiscal discipline, frequently associated with a current account deficit, they have managed to keep their deficits at sustainable levels. Furthermore, every country has managed to cover external financing requirements by non-debt generating capital inflows.

Besides macroeconomic stability, the main criteria for the comparability of banking sectors in the reviewed countries are similarly high degrees of capital liberalisation and progress made in banking reform along with nearly identical regulatory efficiency.[33] Based on a European Commission report, the liberalisation of capital flows in acceding countries is essentially almost complete. The CEE-8 countries can also be regarded as being nearly homogenous in terms of the grade of liberalisation of securities' transactions, the money market, current accounts and loans and deposits, with there being virtually no barrier to these types of capital flows in any of the countries. Short-term capital flows are also fully liberalised in most of these countries. Direct investment remains the only clearly heterogeneous area, with a number of countries maintaining sectoral restrictions. At the same time, capital flows associated with non-residents' real estate purchases continue to be restricted in every country.

The quality of the regulatory framework has also improved substantially over the past few years. Based on the assessment of the EBRD, by 2000-2001 every CEE-8 country had successfully laid down the groundwork for the regulatory framework required for an efficient banking system. However, not one country has been able to satisfy the BIS requirements in full so far. Inadequacy of prudential rules relating to consolidated regulation and supervision remains the greatest shortcoming.

[33] The comparison can be made using Tables 1, 2 and 3.

4.4 Types of financial institutions tested and sources of data

Our main concern in defining the types of financial institutions has been homogeneity, in order to avoid distortions. Accordingly, the reviewed industry is that of commercial banks, where both deposit taking and lending are key activities. Hence, our analysis does not cover the non-bank financial sector, which is often subject to different regulations or only competes with commercial banks in specific market segments.

Furthermore, to ensure homogeneity it was necessary to narrow the group of tested commercial banks even further. The banking sector includes many small banks with specialized services, which focus on small specific market segments with strong product differentiation. This category comprises banks providing e.g. car purchase loans, hire-purchase credit and personal loans. The implication is that the net interest margin of a small bank with specialized services is not fully comparable with that of larger banks, which have more universal activities. To facilitate comparison, institutions with a lower-than-1% market share in terms of total assets are excluded from the sample. Thus, the institutions tested are commercial banks with a market share of over 1%.

In view of the need for completeness and comparability, two reliable sources of data have been used. The annual balance sheets and profit and loss accounts of the individual commercial banks of the eight countries tested were taken from the database of Fitch-IBCA Bankscope. This database provides access to bank balance sheets in a non-consolidated form and a uniform structure. Even though the Bankscope database does not provide data on each and every commercial bank, it contains the balance sheets and profit and loss accounts of all major banks. After excluding banks with a lower-than-1% market share, the coverage rate of the banking sector stood at a relatively high level (over 80%) in the majority of the countries tested.[34] A major shortcoming of the database is that due to limited data coverage, only a relatively short time series can be used for a sufficient number of CEE banks. Consequently, the total number of observations equals 364, with 91 banks for each individual year in the period 1998-2001.

Country-specific data were provided by national central banks. Major banking sector and macroeconomic indicators were collected partly using a questionnaire and partly using the data published on national central bank websites.

4.5 Comparison of banking sectors[35]

An assessment of the period from 1998 to 2001 reveals that Estonia and Lithuania, the two countries with the highest market concentration, also had the widest net interest

[34] See Table 4.

[35] For the comparative charts of the reviewed countries, refer to the Charts section. The charts display the arithmetical means of the market-share-weighted annual average bank-specific indicators (such as net interest margin, ROA, cost and risk indicators) derived from the Bankscope database for the period between 1998 and 2001 with respect to the CEE-8 countries. In addition, the charts contain the arithmetical means of full-coverage country-specific indicators (such as HHI, reserve ratio, depth of bank intermediation, GDP, inflation) reported by the central banks for the period between 1998 and 2001with respect to the CEE-8 countries.

margin. In Poland and Hungary, which can be viewed as having almost competitive markets (with HHIs under 1000), net interest margins were not significantly lower and higher than the average of the region. The lowest margins belonged to the Czech Republic and Slovakia, countries with a medium level of concentration. Latvia and Slovenia, falling in the same category in terms of market structure, posted above-average margins. Thus, the degree of concentration could not by itself account for the variations in net interest margin.

At the aggregated level of the banking sector, however, there appeared to be a strong positive correlation between operating costs and the net interest margin. Besides having exceptionally wide margins, the Baltic countries showed poorer cost ratios than the CEE-8 average. By contrast, the Czech Republic, Slovakia and Poland, countries with below-average margins, had favourable cost levels. Above-average margins were coupled with the worst cost index in Hungary, and a cost ratio lower than the regional average in Slovenia.

Based on country data, a comparison of interest margins and risks showed a different relationship than expected. In contrast to the level of net interest margins, the Baltic countries had the lowest and the Czech Republic and Slovakia the highest proportion of loan loss reserve. The level of risk measured for Poland and Hungary was below average, whilst that for Slovenia was above average.

A comparison of the reserve ratio and the depth of banking intermediation with the net interest margin points to the expected relationship. It holds for each Baltic country as well as Hungary that below-average banking depth and higher reserve ratios were accompanied by higher net interest margins. By contrast, in the Czech Republic and Slovakia, above-average banking depth and lower reserve ratios were associated with smaller net interest margins. No similar relationship could be observed for Poland and Slovenia.

Of the reviewed countries, Hungary, Slovenia and Latvia had larger net interest margins against the background of above-average GDP growth, while the Czech Republic and Slovakia, where economic performance was weaker, had smaller margins. This was not the case in Estonia, Lithuania and Poland, where there was a negative correlation between the economy's performance and the net interest margin.

No correlation has been found between inflation and the net interest margin. In the reviewed period, inflation was the lowest in the Baltic countries and the Czech Republic, while being the highest in Hungary. Finally, in the majority of the reviewed countries above-average net interest margins were accompanied by higher profitability, and vice versa. The exceptions were Latvia, Hungary and Poland.

4.6 Estimation results[36]

First of all, equation (14) exploring primarily the relationship between market structure and prices was tested using standard panel estimation. The coefficients of variables were estimated for group, fixed and random effects.[37]

[36] The results refer to the region as a whole and are not suitable for drawing any conclusion for individual countries in the sample.
[37] For descriptive statistics, see Table 5.

The three models yielded very similar results in terms of the significance of the variables and the signs of the coefficients. However, the Hausman and the Lagrange multiplier tests clearly prove that the random effect is the most appropriate specification of the panel regression.

Results of the panel regression testing for the relationship between market structure and net interest rate margin

	Model[38]		
	Group effect	Fixed effect	**Random effect**
HHI	-0.000004***	-0.000006	**-0.000003****
	(-3.449)	(-0.165)	**(-2.200)**
MS	0.066***	0.090**	**0.065*****
	(8.3817)	(2.404)	**(5.142)**
C	0.221***	0.074**	**0.157*****
	(4.878)	(2.048)	**(4.563)**
LLR	0.064***	0.081***	**0.073*****
	(3.934)	(4.649)	**(4.197)**
R	0.013	-0.014	**0.006**
	(0.331)	(-0.512)	**(0.172)**
TA	-0.019***	-0.043***	**-0.025*****
	(-4.860)	(-3.992)	**(-4.911)**
GDP	0.008	-0.023	**-0.012**
	(0.236)	(-0.789)	**(-0.398)**
CPI	-0.026	0.075***	**0.019**
	(-0.978)	(3.152)	**(0.693)**
N	364	364	**364**
F test'	3.87***		
Hausman test"		8.20	
LM test"'			27.43***

*,**,*** Significance at 10%, 5% and 1% respectively.
' Significance suggests that the fixed effect is a more appropriate specification than the group effect. The F test follows an F distribution with degrees of freedom (N,NT-N-K), where K denotes the number of independent variables.
" Significance suggests that the fixed effect is a more appropriate specification than the random effect. The Hausman test follows a χ^2 distribution with K degrees of freedom.
"' Significance suggests that the random effect is an appropriate specification. The Breusch-Pagan test follows a χ^2 distribution with one degree of freedom.

The results in the attached table do not support the SCP hypothesis in the period between 1998 and 2001, as the HHI variable coefficient assumed significantly negative values for the random effect specification. This suggests that banks in countries with higher concentration did not realise higher interest margins than those in countries with low concentration.

[38] Each estimate has used a heteroscedasticity consistent covariance matrix.

It should be stressed, however, that using the net interest margin, which represents pricing behaviour in an aggregated form, and the related HHI based on total assets may have the disadvantage that despite rejecting the SCP hypothesis, a situation may arise where the SCP relationship exists in respect of different market segments. Such market segments include the market of (household) deposits, which has a higher concentration than the loan market due to one or two large deposit-taking banks that remain as the legacy of the artificially established two-tier banking system. Unfortunately, individual interest rates for different products are not available for the banks in the region.

By contrast, our results supported the RMP hypothesis, as market share had a significant positive coefficient. In other words, banks with larger market shares in the region probably exploited their relative market power by charging higher prices.

In accordance with our expectations, cost and risk factors also played an important role in the pricing behaviour of banks in the four years reviewed, with the coefficients for both variables being significantly positive. This proves that relatively higher costs and risks were accompanied by relatively higher prices. Furthermore, the positive value for the cost coefficient suggests that efficiency factors also played a role in pricing.

From the country-specific factors a strong link was found between the interest margin and the depth of bank intermediation. Consistent with the hypothesis specified earlier, higher elasticity of loan demand, proxied by financial depth, had a negative impact on the size of interest margins.

Because of its correlation with the depth of bank intermediation (co-linearity)[39] the reserve ratio did not exhibit any connection with pricing behaviour in the original models.[40] After removing the depth of bank intermediation from the models, the reserve ratio was significantly positively related to the net interest margin. This means that the banks in countries with higher reserve ratios offset the higher opportunity cost of holding reserves in the form of wider interest margins. Furthermore, real GDP growth and inflation had no significant impact on the net interest rate margin.

In the next step, equation (15), focusing on the relationship between market structure and profitability, was tested. The specification tests for equation (15) also indicated the presence of the random effect.

The results of the second test finalised the inferences derived on the basis of the first test. Accordingly, in contrast with the SCP hypothesis, the sample for the period between 1998 and 2001 showed no significant positive correlation between market structure and the pricing behaviour or profitability of banks.

[39] Economic theory has no explanation for the direct link between the depth of bank intermediation and the reserve ratio. The international trend appears to be that the more developed a country is the deeper its bank intermediation and the smaller the reserve ratio.

[40] Of the explanatory variables, we only found a relatively high correlation between the Total assets/GDP indicator and the reserve ratio. The ratio found for R^2 between the two variables was 28%, falling every time below the value of the multiple determination coefficients.

On the other hand, the RMP hypothesis was unanimously verified as the second test proved that market share was significantly positively related to the ROA. This indicates that large banks in CEE countries have taken advantage of their market power and generated extra profit through their pricing.

Results of the panel regression testing for the relationship between market structure and profitability

	Model[41]		
	Group effect	Fixed effect	**Random effect**
HHI	-0.000002	-0.000018***	**-0.000003**
	(-1.329)	(-2.646)	**(-1.30)**
MS	0.069***	-0.032	**0.067*** **
	(5.548)	(-0.868)	**(3.719)**
C	-0.288***	-0.350***	**-0.302*** **
	(-3.725)	(-4.01)	**(-5.170)**
LLR	-0.174***	-0.151**	**-0.171*** **
	(-4.419)	(-2.584)	**(-5.500)**
R	-0.109	0.002	**-0.081**
	(-1.570)	(0.029)	**(0.255)**
TA	-0.021**	0.023	**-0.018** **
	(-2.505)	(1.177)	**(-2.300)**
GDP	0.037	0.088*	**0.057**
	(0.650)	(1.803)	**(0.989)**
CPI	-0.013	-0.146**	**-0.040**
	(-0.336)	(-2.493)	**(-0.835)**
N	364	364	**364**
F test'	1.69**		
Hausman test"		11.06	
LM test"'			11.21***

*,**,*** Significance at 10%, 5% and 1% respectively.
' Significance suggests that the fixed effect is a more appropriate specification than the group effect.
The F test follows an F distribution with degrees of freedom (N, NT-N-K), where K denotes the number of independent variables.
" Significance suggests that the fixed effect is a more appropriate specification than the random effect.
The Hausman test follows a χ^2 distribution with K degrees of freedom.
"' Significance suggests that the random effect is an appropriate specification.
The Breusch-Pagan test follows a χ^2 distribution with one degree of freedom.

The coefficients of variables measuring costs and risks turned out to be significantly negative. This suggests that cost and risk levels were not fully priced into the net interest margin.

As in the previous test, the depth of bank intermediation had a significant negative coefficient, i.e. banks in countries with lower depth of intermediation realised higher profits through wider net interest margins. The reserve ratio (also taking account of its

[41] Each estimate has used heteroscedasticity consistent covariance matrix.

correlation with the depth of bank intermediation), real GDP growth and inflation were insignificant in the profit regression.

Finally, comparing the results of the two tests, it may be surprising that market share explained the net interest margin and ROA with coefficients of a nearly identical size. Normally, the market share coefficient should be larger with respect to the net interest margin, as it is invariably higher than that of the ROA. However, this observation is explained by the fact that a larger market share does not only reflect market power but probably also higher (X- or scale) efficiency.[42] The implication is that efficiency, which is not included in our model, is probably positively correlated with market share and profitability (the larger the bank the more efficient and profitable its operations).

5 Conclusion

This study was aimed at assessing the role of competition in the pricing behaviour and profitability of banks in Central and Eastern European countries. In addition, other factors influencing banks' performance were also examined.

The empirical test relied on data for a total of 91 banks in eight Central and Eastern European countries between 1998 and 2001. By this period, bank pricing had become market-based in the majority of banks in the region, due to progress made with macroeconomic stability and deregulation, the strengthening of banking sectors and the existence of dominant foreign ownership.

One of the most important findings of this study lies in showing that the tests could not confirm the SCP hypothesis in Central and Eastern Europe, as market concentration was found to have no positive correlation with either the net interest margin or ROA. This implies that in more concentrated markets, banks did not earn higher profits by means of colluding with other banks to apply higher margins.

On the other hand, the empirical results provided support for the RMP hypothesis. In the reviewed period, dominant banks of the countries in the region earned extra profits and caused a welfare loss by exploiting their pricing advantage arising from relative market power and by behaving in a manner that limited competition.

From the point of view of monetary transmission, the use of pricing power by large banks could be harmful, as they may only partially follow the central bank's interest rate steps, or only with a considerable time lag. However, from a financial stability point of view, in conformity with the hypothesis of trade-off between competition and stability, the verification of the RMP hypothesis could be seen as favourable because of the implied positive effect on the profitability of large banks.

Furthermore, the results have proved that cost and risk levels and the size of reserve requirements have become incorporated into pricing decisions. It appears to be the case that higher operating costs were passed on to customers in the form of wider net

[42] As noted earlier, this model was generated for testing the SCP and RMP hypotheses. Consequently, because of the lack of X-efficiency and scale efficiency variables, the separation of market power and efficiency effects is not possible within this framework.

interest rate margins. Similarly, a higher lending risk and a higher opportunity cost of holding reserves were also associated with higher net interest margins in the period under review.

Finally, there appears to be a close negative correlation between the relative size of the banking sector and pricing, as well as profitability. A comparison of the Central and Eastern European banking systems suggests that greater depth of bank intermediation was accompanied by lower net interest margins and profitability.

It should be noted, however, that the empirical findings of these tests must be treated with caution for a number of reasons. The findings may vary substantially depending on whether bank pricing behaviour is tested at aggregate level or at the level of market segments. Thus, if there is data available on individual banks' lending and deposit rates, it seems worthwhile to carry out some further research in order to test the validity of the SCP and RMP hypotheses in each market segment one by one.

It should also be remembered that the upcoming EU and subsequent EMU accession may bring significant changes in the effects of various factors on bank pricing and profitability. Sharper competition stimulated by an enlarged market may, for example, dampen the impact of relative market power and the resulting welfare loss in the region, while boosting the effectiveness of monetary transmission. Another crucial aspect is that the ongoing consolidation of banking sectors, improvement in efficiency and increased stability arising from real economic convergence are likely to reduce relative differences in cost and risk levels among banks in the Central and Eastern European countries and the upward pressure arising from these factors on pricing. Simultaneously with economic development, further intensification of bank intermediation may cause the negative correlation of the banking sector size with the interest margin and ROA to weaken.

The results of the tests suggest that banks' pricing decisions and profitability changes may also be affected by efficiency factors. Accordingly, research in the immediate term may branch out to exploring the role of the X- and scale efficiency in banks' performance.

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Tables

Table 1

Capital account regulation (2001)

Type of transaction	Estonia	Lithuania	Latvia	Czech Republic	Slovak Republic	Poland	Hungary	Slovenia
Direct investments	S	Free	S	S	S	S	S	S,L
Investments in real estate	L	L	S,P	L	L	L	L	L
Stock market operations	L	Free	Free	S	Free	L	L	L
Security & money-market operations	Free	Free	Free	Free	Free	P	P	Free
Operations in current & deposit account	Free	Free	Free	Free	Free	Q,P	Free	Free
Credits related to commercial transactions	Free	Free	Free	Free	Free	Free	Free	Free
Financial loans	Free	Free	Free	Free	Free	Free	Free	Free
Transfers in performance of insurance contracts	Free	Free	L	Free	Free	L	L	Free
Personal capital movements	Free	Free	Free	Free	Free	P,Q	Free	Free

Notes: Free: no limitations; L: Limited; P: Permission required; Q: Quantitative restrictions apply; R: Registrations required;
S: Free except certain sectoral limitations.

Source: European Comisssion
For details see: Begg, Eichengreen, Halpern, Hagen, Wyplosz (2003): Sustainable Regimes of Capital Movements in Accession Countries (CEPR Policy Paper No. 10)

Table 2

Legal transition indicator: financial regulation

2001	Estonia	Lithuania	Latvia	Czech Republic	Slovak Republic	Poland	Hungary	Slovenia
Overall	4-	3+	3	3	3	3+	4-	4-
Extensiveness	4	3+	3	3+	3	4	4-	4
Effectiveness	3+	4-	3	3	3	3	4-	4-

2000	Estonia	Lithuania	Latvia	Czech Republic	Slovak Republic	Poland	Hungary	Slovenia
Overall	3+	4-	3	3+	3	4	4	4
Extensiveness	4	4	3	4	3	4	4	4
Effectiveness	3-	4-	3	3-	3-	4	4	4

1: Legal rules concerning banking and securities regulation are perceived as very limited in scope.
2: Although financial market regulations may have been amended to accord with international principles, at least one important area of regulation is perceived as deficient.
3: Legislation for financial markets is perceived as reasonably comprehensive but could benefit from further refinement in some areas.
4: Comprehensive financial market legislation is perceived as conforming generally with minimum international standards.
4+: Banking and capital markets legislation and regulation are perceived as comprehensive and in conformity with international standards.
+/-: Top and the bottom of the categories.

Source: EBRD
For details see: EBRD Transition Report 2001

Table 3

EBRD index of banking sector reform

	1995	1996	1997	1998	1999	2000
Estonia	3	3	3.3	3.3	3.7	3.7
Lithuania	3	3	3	3	3	3
Latvia	3	3	3	2.7	3	3
Czech Republic	3	3	3	3	3.3	3.3
Slovak Republic	2.7	2.7	2.7	2.7	2.7	3
Poland	3	3	3	3.3	3.3	3.3
Hungary	3	3	4	4	4	4
Slovenia	3	3	3	3	3.3	3.3

1: Little progress beyond estabilishment of a two-tier system.
2: Weak liberalisation process.
3: Substantial progress in establishment of bank solvency and of a framework for prudential supervision.
4: Significant movement of banking laws and regulations towards BIS standards.
4.3 : Full convergence of banking laws and regulations with BIS standards.
+/-0.3: Top and the bottom of the categories.

Source: EBRD
For details see: EBRD Transition Report 2001

Table 4
Coverage of the banking systems 1998-2001

Estonia	93%
Lithuania	86%
Latvia	87%
Czech Republic	78%
Slovak Republic	81%
Poland	80%
Hungary	87%
Slovenia	82%

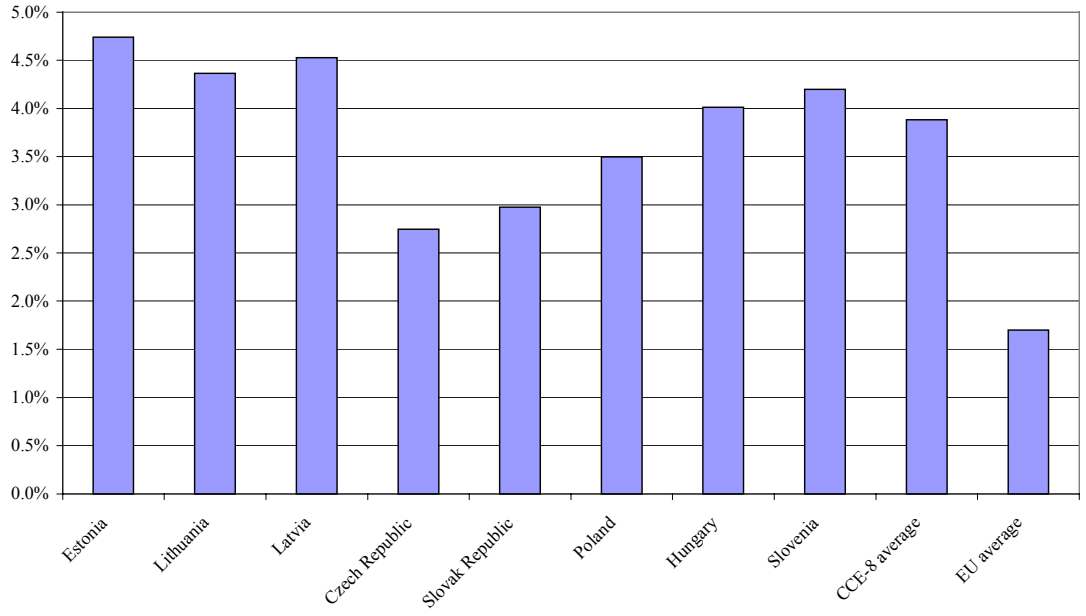
Table 5

	NIM	ROA	HHI	MS	C	LLR	R	TA	CPI	GDP
Mean	4.0%	0.3%	1430	7.2%	4.3%	5.4%	7.7%	72.8%	7.0%	3.6%
Maximum	11.0%	7.1%	4870	59.1%	19.8%	30.3%	13.0%	125.0%	12.5%	7.7%
Minimum	0.0%	-21.2%	705	1.0%	0.0%	0.0%	2.0%	23.0%	1.0%	-3.9%
Std. Dev.	1.8%	2.7%	782	9.2%	2.6%	4.5%	2.6%	25.4%	3.6%	2.3%
Observations	364	364	364	364	364	364	364	364	364	364
Cross sections	91	91	91	91	91	91	91	91	91	91

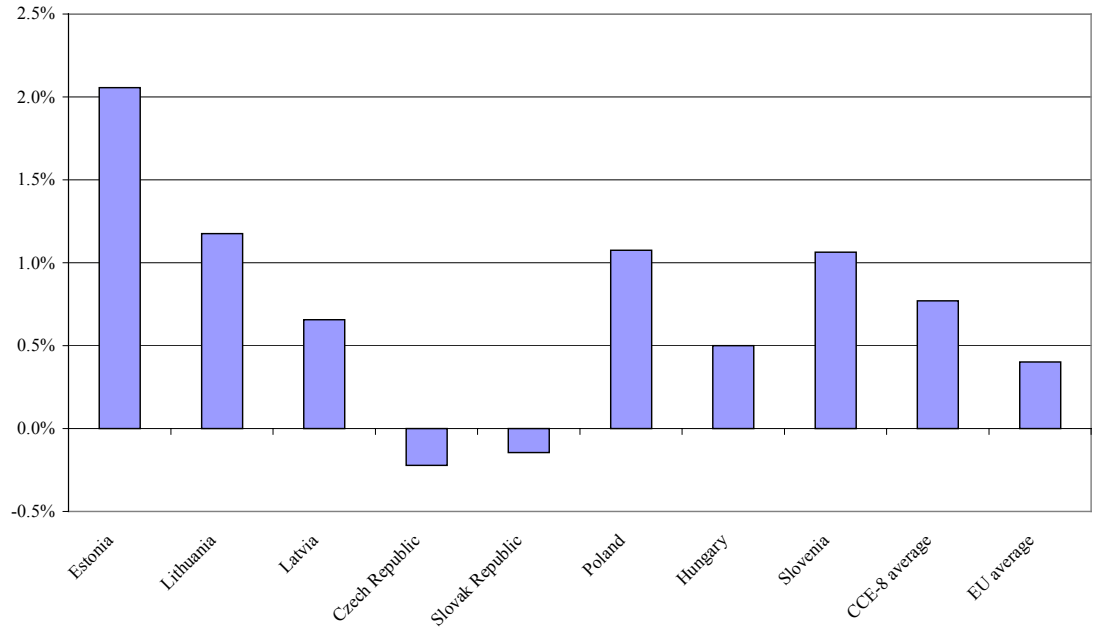
Charts

The charts display the arithmetical means of the market-share-weighted annual average bank-specific indicators (such as net interest margin, ROA, cost and risk indicators) derived from the Bankscope database for the period between 1998 and 2001 with respect to the CEE-8 countries. In addition, the charts contain the arithmetical means of full-coverage country-specific indicators (such as HHI, reserve ratio, depth of bank intermediation, GDP, inflation) reported by the central banks for the period between 1998 and 2001with respect to the CEE-8 countries. Finally, the arithmetical means of full-coverage comparative data for the period between 1998 and 2001 relating to the EU are also included.

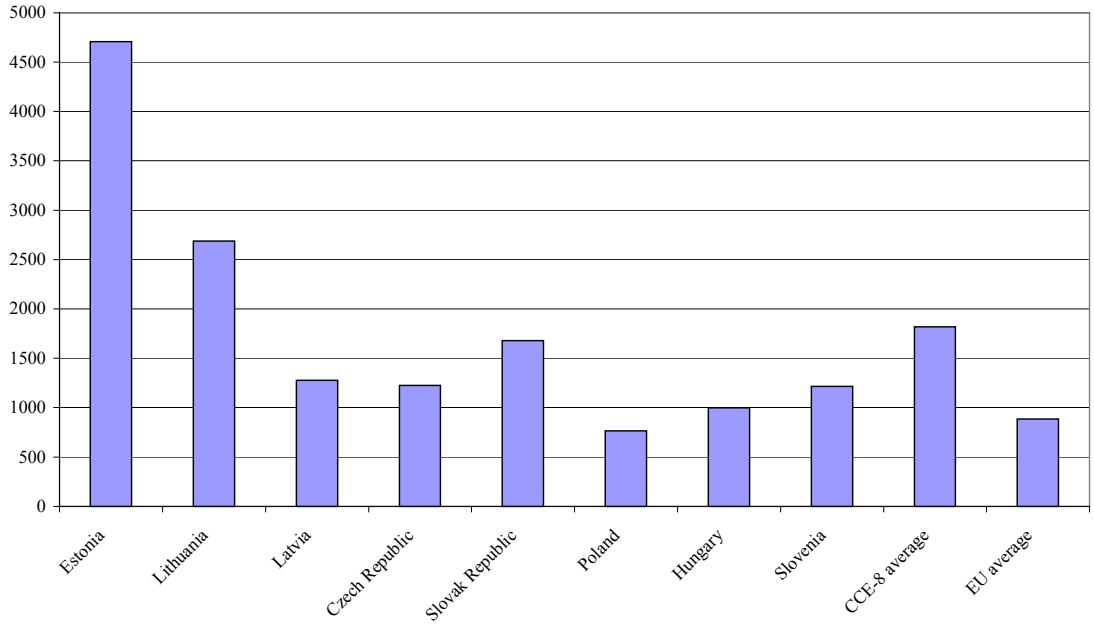
Net interest income/ Interest earning assets



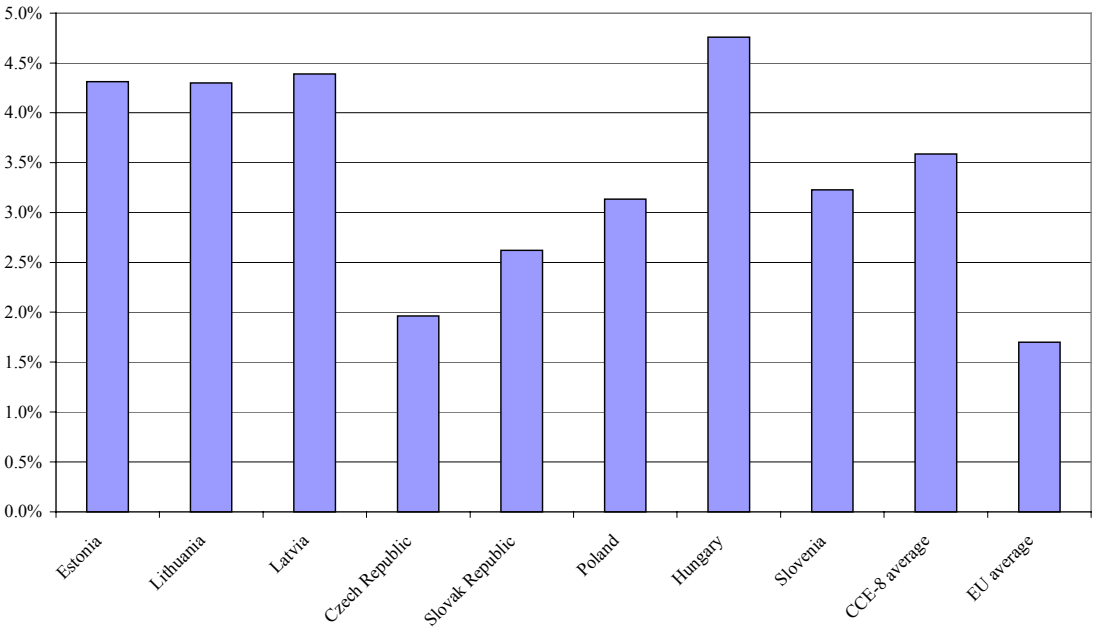
ROA



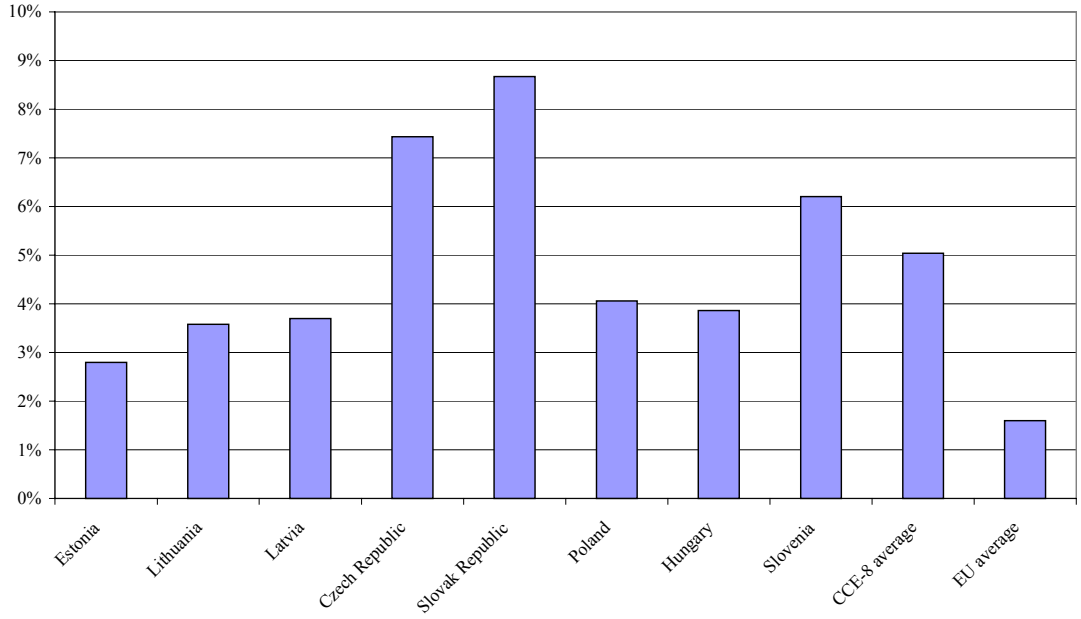
HHI (according to total assets)



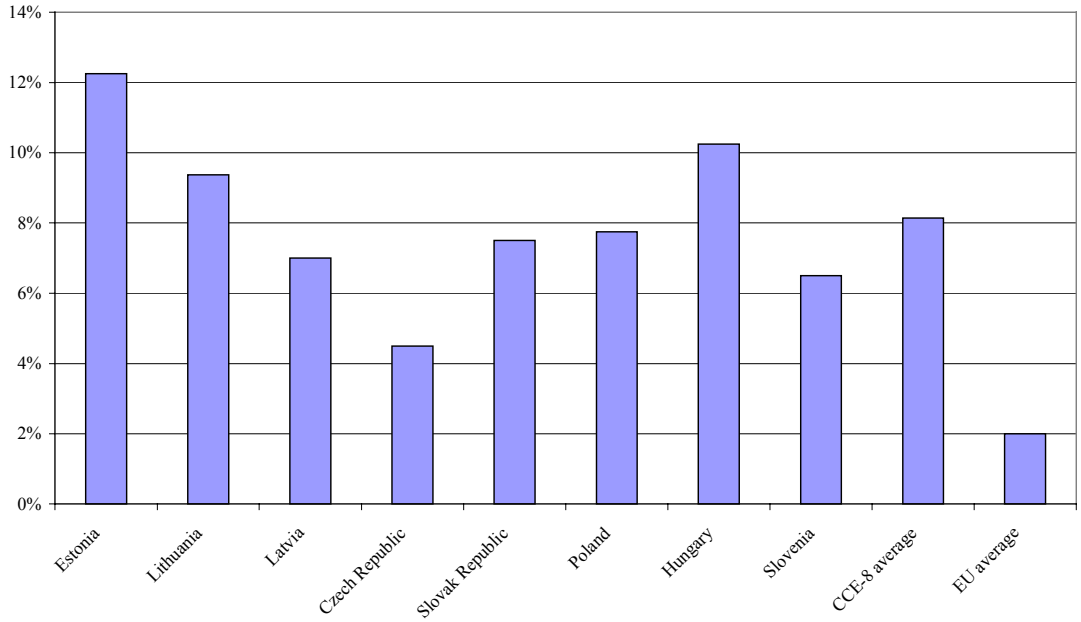
Operating costs/Total assets



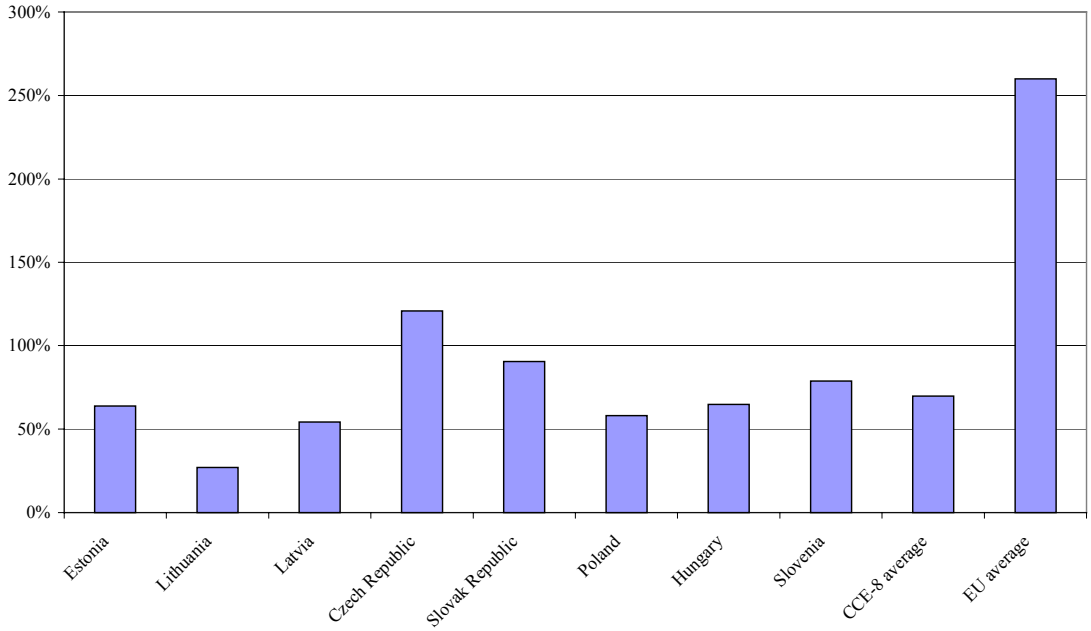
Loan loss reserves/Total loans



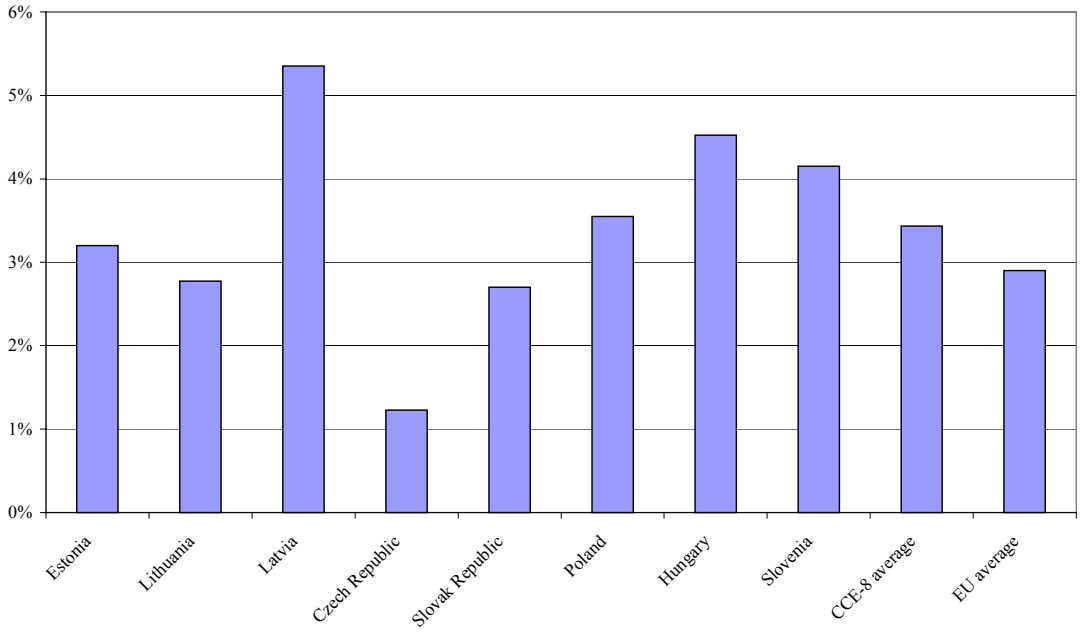
Reserve ratio



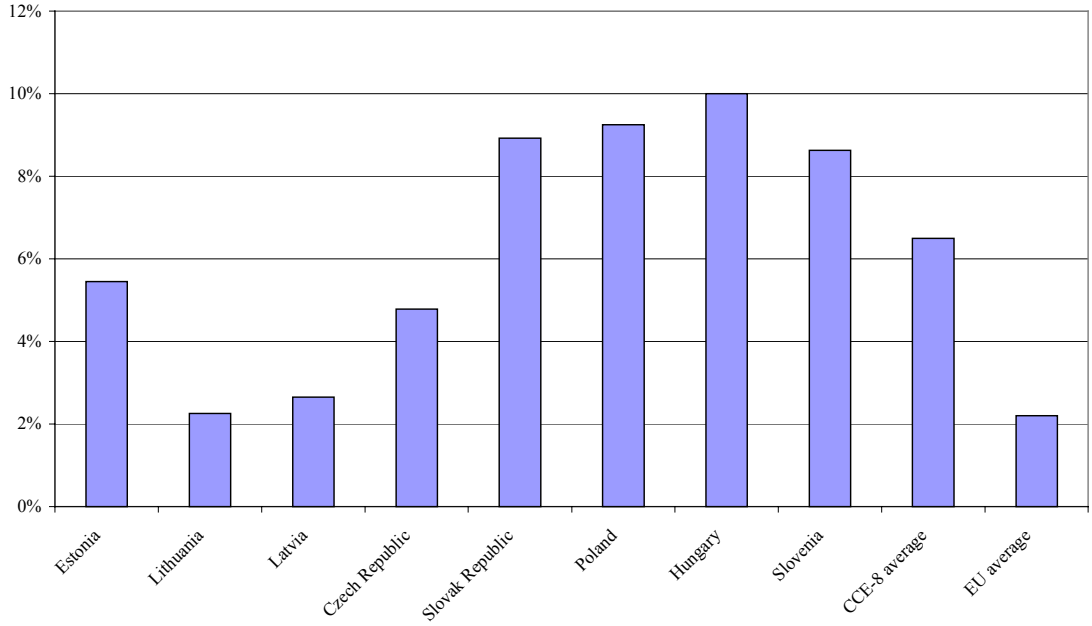
Total assets of the banking sector/GDP



Real GDP growth



Consumer inflation



Appendix

Verification of the concavity of the simple Cournot model used in this study.

The second derivative of function (7) is

$$\frac{\partial^2 \pi_i}{\partial {r_i^L}^2} = (1-\mu_i)\frac{\partial L_i}{\partial r_i^L} + (1-\mu_i) r_i^L \frac{\partial^2 L_i}{\partial {r_i^L}^2} - \mu_i \frac{\partial^2 L_i}{\partial {r_i^L}^2} + (1-\mu_i)\frac{\partial L_i}{\partial r_i^L} - \frac{r_i^D}{1-\alpha}\frac{\partial^2 L_i}{\partial {r_i^L}^2} - (\gamma_i^L + \frac{\gamma_i^L}{1-\alpha})\frac{\partial^2 L_i}{\partial {r_i^L}^2}$$

.

Assuming from equation (2) that $\frac{\partial^2 L_i}{\partial {r_i^L}^2} = 0$, we obtain:

$$\frac{\partial^2 \pi_i}{\partial {r_i^L}^2} = (1-\mu_i) 2 \frac{\partial L_i}{\partial r_i^L}.$$

As a result of $0 \le \mu_i \le 1$, but $\frac{\partial L_i}{\partial r_i^L} < 0$ as ε_i^L and $E^L > 0$:

$$\frac{\partial^2 \pi_i}{\partial {r_i^L}^2} < 0.$$

This proves that the objective function is concave and its first derivative gives the maximum point of the profit.

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