EUROCOLLEGE WORKING PAPERS
NO. 1

Kalle Ahi

COMPETITION AND CONTESTABILITY IN CEEC BANKING SECTOR ON THE EVE OF EU ACCESSION – THE CASE OF ESTONIA

TARTU 2002

The publication of this material is supported by European Union.
The content of this project does not necessarily reflect the position
of the European Community, nor does involve any responsibility
on the part of European Community.

Editing: Liina Kulu
Language editing: Kaili Ahi
Design and layout: Liina Kulu
Cover design: Aita Linnas

ISBN 9985-4-0275-8
ISSN 1406-7870

Tartu University Press
78 Tiigi St., 50410 Tartu, Estonia

FOREWORD

As accession negotiations draw to a close, both academic and public debates on the enlargement of the European Union have become more intense and more sophisticated. While in the early phases of the enlargement process, the candidate countries were often seen as the objects of integration policy and research, they are now emerging as active partners and participants in debates about European governance.

EuroCollege, a centre for EU-related teaching, training and research at the University of Tartu, Estonia, is committed to promoting both academic and policy debates on the various challenges associated with the Eastern enlargement. In 1998, with support from the EU's Phare programme, EuroCollege launched an Estonian-language publication series in order to increase awareness and stimulate discussion about the impact of EU accession at all levels of the Estonian society. The thirteen issues published to date present analysis and arguments by many prominent scholars and policy experts.

EuroCollege Working Papers is a new, English-language series that reaches out to a broader, international audience in an attempt to stimulate discussion about the policy dilemmas associated with the Eastern enlargement. More academic in orientation, the series has two goals. First, it provides an avenue for disseminating the results of research conducted by young Estonian academics and graduate students whose work focuses on some relevant aspect of EU accession. Second, the series seeks to stimulate the exchange of ideas among the emerging centres for EU studies in Central and Eastern Europe as well as the more established research institutes in the West. By providing a forum for academic discussion, the series will facilitate the integration of young CEE scholars into the academic community focusing on European integration. With this kind of dialogue in mind, the series is open to academic contributions from scholars, experts, and graduate students whose work focuses on issues related to EU enlargement, regardless of the country of origin. Potential contributors are encouraged to contact Liina Kulu at liina@ec.ut.ee (Tel. + 372 7 376 379) or send their manuscripts to EuroCollege, University of Tartu, Lossi 3-304, Tartu 51003, Estonia. The first publications of the series are sponsored by the European Union, the EuroFaculty programme, and Tartu University's EuroCollege.

I hope that the articles published in this series will draw our attention to overlooked issues, interesting findings and novel arguments that help us better understand the challenges associated with Europe's current transition.

Piret Ehin, Vice Director of EuroCollege

INTRODUCTION

In most transition economies the banking sector is expected to experience major changes in the next few years as a result of the transition process within financial sector itself as well as the potential accession of some economies (candidate countries) to the European Union. One aspect of their accession to the European Union is the fact that banks in these countries will probably have to compete in an integrated market for financial services. These changes are likely to put banks' profitability under significant pressure and enhance forces leading to restructuring and possible consolidation. In this context, we are interested in an analysis of the level of competition in the banking market and related efficiency issues in some of these countries.

The degree of competition in the banking sector has been at the frontier of research for the past two decades. It is well understood that banks and financial intermediaries as a whole play a crucial role in the well-functioning of modern economies, due to their comparative advantage in terms of information gathering, screening and monitoring which result in economies of scale and scope (Diamond 1984). For that reason, banks are sometimes characterised as being "special".

The contemporary banking theory, (see Bhattacharia 1993) which takes into account informational structure of the market, argues that the importance of such imperfections as adverse selection, moral hazard and costly state verification should be included in the analysis of the primary and secondary effects of banking competition on welfare. A considerable amount of theoretical literature (Petersen and Rajan 1995; Guzman 2000 and papers cited therein) has proved the positive impact of some monopoly power within the banking sector, resulting from the existence of agency costs and asymmetric information in the capital markets. The research carried out by the World Bank shows that the most progressive applicant countries have not only relatively low interest rate spreads (below those of Germany) but also low amounts of domestic bank credit in relation to the GDP (WDI 2001) which indicates a significant degree of credit rationing (cf. Stiglitz and Weiss 1981) and is a standard reaction to information asymmetry. However, as the market becomes more mature and transparent, the positive effects of some monopoly power should diminish.

Furthermore, financial development and economic growth are increasingly perceived to be complementary (Levine 1997), though the efficiency and effectiveness of financial intermediation and financial development can, in general, also facilitate economic growth, if not being a cause of it (King and Levine 1993a, 1993b; Levine and Zervos 1998; Pagano 1993).

It is widely acknowledged that the EMU will significantly affect the degree of competition in the banking sector, due to *inter alia* the heightened disintermediation and increased actual and potential competition within the sector itself and outside the industry. In turn this will have an impact on banking behaviour and banking market structure. Deregulation, advances in technology and the growth of institutional investors and securities markets are among the most important developments. The bulk of commentaries of the consequences of the EMU on financial markets (see De Bandt 1998) suggest that the introduction of the single currency seems likely to increase the scope of disintermediation and intensify the competition for traditional products within the banking sector. In effect, banks are left with the problem of "excess capacity" (Davis and Salo 1998) and this may have a direct influence on competitive conditions in the candidate countries.

The entrance of foreign banks will be fostered by the enlargement of the euro-zone, because (i) due to the Copenhagen criteria the legal barriers that hinder the foreign entry will have to disappear and (ii) without currency risk *vis-à-vis* Western Europe and stable macroeconomic conditions, long-term commitments in CEE become more promising.

With regard to the difficulties of empirically evaluating the competitive conditions in specific banking markets, the traditional approach sometimes referred as traditional industrial organisation theory or structure, conduct and performance (SCP) paradigm, has been utilised to infer competitive conditions from market structure variables such as concentration ratios. SCP paradigm asserts that the firm's market power increases with industrial concentration, as a direct link from the industry structure to competitive conduct is perceived. As SCP predicts, higher concentration in the market will provide market participants with additional incentive for collusive conduct and according to the theory will lead to higher margins and profitability of banks. The standard SCP paradigm, which has first been posited by Bain, (see Bain 1951) has been challenged by efficient structure hypothesis and more recently by new empirical industrial economics (NEIO) approaches to competition.

The NEIO approach follows the competitive conduct of firms analysed directly, without the use of structural measures that have been found poorly indicating the actual market power exercised by market participants (see Vesala 1995, p. 17–21). Research in the line of NEIO approach tests the actual degree of competition and is based on more solid theoretical models of conduct. As a result, more powerful econometric techniques are employed in order to measure the market power utilising observations about the firms' behaviour. There are two most widely recognised approaches to testing the extent of competition. The test of comparative statics in demand can be applied to single product industries where the industry demand is not separable in exogenous variables. The method utilises the simultaneous equation approach to solve the econometric identification problem of the conjectural variation model.

We rely on the method of comparative statics in costs developed by Panzar and Rosse (1987) which is based on firms reduced form revenue equations. Alternative hypothesises about the nature of competitive behaviour are derived from the model of monopolistic competition, which can be tested by evaluating the unit input factor elasticities with respect to reduced form revenues. Panzar and Rosse defined the sum of these factor price elasticities as an H-statistic and showed how values of this statistic can be mapped to capture the standard models of competitive behaviour. There are numerous studies that have applied this methodology to study market structures and competitive behaviour of banks in various banking systems, typically North American and Western European. For instance, recent studies have focused on the market structure of the EU and the US banking sectors (see appendix I, pp. 28).

In this paper we focus on competitive conditions in the Estonian banking market and address the question, whether this market can be characterised as contestable. According to the contestability theory (see Baumol 1982), the competitive conduct of banks can be preserved without regard to the number of competitors, as freedom of entry and exit of any market is not constrained by substantial sunk costs and that potential rivals in the market have the same cost functions as banks already engaged in banking activities.

The conclusions drawn could prove useful to evaluate the actual level of competition in the Estonian banking market, which has undergone important structural changes and is on the way to closer integration with the world's financial markets. We show that competition and efficiency issues in the Estonian banking must be analysed in the broader context of the European integration.

The paper is structured as follows. In Section 1 we give an overview of the development of Estonian banking sector and seek briefly to motivate the analysis by considering how structural changes triggered by accession to the EU may affect competitive conditions. In Section 2 we provide the theoretical motivation for an analysis and assessment of the level of competition in banking markets. In Section 3 we estimate a reduced form revenue equation and evaluate an H-statistic in order to draw conclusions on actual level of competition among Estonian banks.

The paper was written during the research visit to the University of Sussex, Brighton in July 2002. The financial assistance of the research mobility grant funded by the European Commission is greatly appreciated.

1. MAIN FEATURES OF THE INSTITUTIONAL DEVELOPMENT IN ESTONIAN BANKING

The foundation of an operating financial sector, which pursues the principles of market economy and is based on private capital, has been a major task of economic reforms in transition economies in order to, besides other important tasks, ensure the allocative efficiency of resources. Successful reforms are mostly based on building the adequate institutional framework and conditions for banks and capital markets. This has equally been the priority of monetary authorities in Estonia.

The development of the banking sector is one of the fastest and among the most dynamically developing sectors in Estonian economy. An increase in financial deepening is reflected in the ratio of total financial intermediation to the GDP, which constituted up to 130% in the end of 2001 (the total assets of banks, capitalisation of securities, leasing and insurance premiums). As banks are active in leasing and insurance markets, the share of bank-based intermediation is approximately 2/3 of total intermediation. Therefore, the financial system in Estonia is mainly bank based and the operating efficiency in the banking sector, as an important determinant of competitiveness of Estonian economy, is of major concern.

The development of the Estonian banking system is limited to a decade. Important qualitative and quantitative changes have taken place since the currency reform in 1992. The development in the first phase (until 1995) is characterised by the presence of a large number of small and inadequately capitalised banks with weak regulative framework and supervision.

The market was influenced by the first wave of banking crisis and substantial consolidation. The changes in the market structure are closely connected to the regulative shocks and actions taken by the Supervisory Board. Consequently, the banks gained the reliability and started to perform according to the best banking practice. Because of reforms and structural adjustment, the number of banks decreased dramatically – from 42 banks in 1992 to only 16 in 1996.

The currency board system puts an additional pressure to the financial system, as the liquidity within the system has to be maintained by the banks themselves. The ability of the Central Bank to act as a lender of the last resort is limited. Banks have to cope with capital flows, quite sensitive to both external and internal factors. 1997 was the year of rapid expansion and increase in the level of competition among banks. The internal factors (boom in asset prices, tough

lending-market competition and inadequate risk management) and important external factors (financial crisis in South-East Asia and later in Russia) brought along the second wave of restructuring.

The succeeding second-wave of restructuring after the banking crisis in 1998 reduced the number of banks from 16 to 7. Essential consolidation and foreign capital flow into the Estonian banking sector has improved its credibility by strengthening the rules for internal governance and promoting operational efficiency. Financial conglomerates of Swedish and Finnish origin hold 82% of the banks share capital. The consolidated capital adequacy ratio of Estonian banking groups is a comfortable 14% on the average with no banks below the 10% minimum (see table 1).

Table 1

Selected indicators of Estonian banking

	1996	1997	1998	1999	2000	2001
Number of commercial banks	13	11	6	7	7	7
Number of private banks	12	11	5	6	7	7
Number of state-owned banks	1	0	1	1	0	0
Concentration index C3 (%)	58.8	69.7	93.0	92.4	91.1	90.7
Concentration index C5 (%)	74.7	83.4	99.4	98.8	98.8	99.0
Total assets, EUR m	1,466.5	2,593.7	2,620.0	3,008.4	3,695.3	4,374.1
ROE	30.6%	34.9%	-10.1%	9.2%	8.4%	18.6%
ROA	2.9%	3.3%	-1.2%	1.5%	1.22%	2.5%
Capital adequancy (%)	12.4	13.6	17.0	16.1	13.2	14.4
Total assets/GDP	43.8%	63.4%	55.7%	61.7%	67.7%	76.5%
Foreign ownership in share capital	33.4%	44.2%	60.7%	61.6%	83.6%	85.4%
Major foreign ownership in total assets	2.6%	2.3%	90.2%	89.8%	97.4%	97.8%

Source: Eesti Pank (Bank of Estonia) (www.ee/epbe) and author's calculations.

The profitability ratios (ROA and ROE) have been quite volatile – remaining between 30–35% in 1995–1997, but the adverse effect of sharp decline in securities market and turbulence in the world's financial markets had substantial impact on the banks' profits. It seems that since 2001 the earning power of banks has recovered. The major source of income stems from interest bearing assets (mainly loans) – e.g. net interest income. Banks have been successful in attracting foreign capital to meet the increasing demand for bank financing. The share of foreign deposits and other liabilities and foreign currency denominated liabilities constitutes up to 40–45% of total liabilities of the credit institutions. Interest rates on foreign deposits should be exogenous to the bank and in order to meet the financing needs of the real sector imply quite a flat curve of supply funds.

Banks have been able to shift the currency risk of Estonian kroon (EEK) to the borrowers, as the share of loans in foreign currency is about 80% of total loan stock. This tendency may imply some bargaining power in loan markets. Economies of scale and advanced technologies exploited over recent years have played an important role in the positive profitability outlook of the banks.

The figure 1 shows the dynamics of HHI (*Herfindahl-Hirchman index* of market concentration) and the capital adequacy ratio from consolidated balance sheets. The value of the index has increased rapidly with the major shift in 1998. The HHI index is positively correlated with adequacy ratio (with R-squared 0.35), it shows that the consolidation in banking had a positive influence on solvency and credibility of banks.

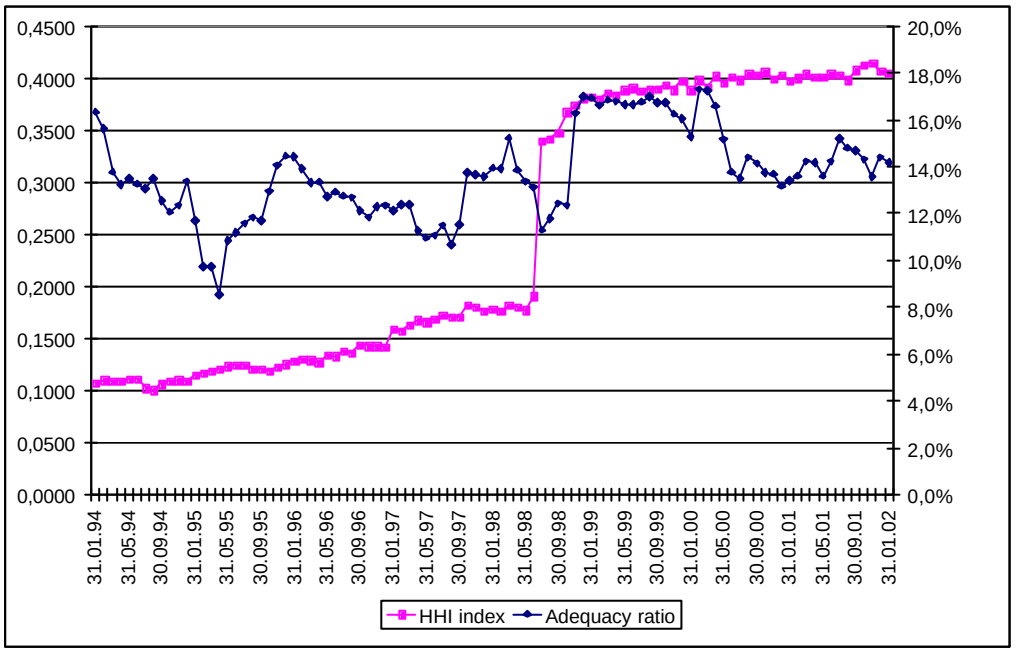

Figure 1. The dynamics of HHI index and capital adequacy ratio of Estonian banks (1994-2001).

Evaluating the assets and liabilities of Estonian banks, it may be argued that the dependence on institutional foreign borrowing has slightly declined since 1999 and the volume of deposits and loans granted has increased with stable growth rate of 20%. The quality of the loan portfolio is outstanding, as the share of non-performing loans has been quite stable and has not increased over 2% of the total loan portfolio in recent years. Compared to other countries in transition this ratio is very low. One explanation to this phenomenon in countries with poorer performance may be the soft budget constraints hypothesis. According to this hypothesis, enterprises with lower credit quality (usually state owned) have less binding (bank-) financing constraints. Unsuccessful firms with continuous losses still get additional financing from banks.

Despite of consolidation, the interest rates have declined since 1999 in both lending and deposit market. Main indicators are presented in the figure 2 below.

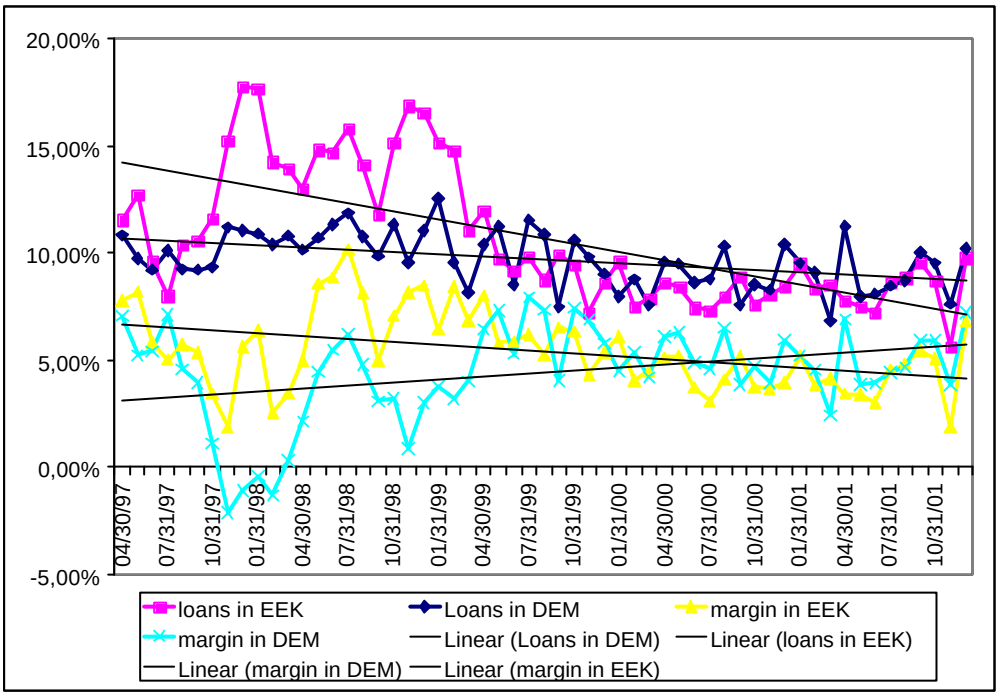

Figure 2. The dynamics of interest rates on loans denominated in EEK and DEM and interest rate margins (1997–2001).

The lending rates both in DEM and EEK nominated currencies show a clear decreasing trend. But according to the data, it is difficult to analyse the changes in "implied" country risk based on currency adjusted interest margin. The sources and lending volumes by currencies do not match and the margins are unadjusted to the structural differences and therefore may not reflect the influence of less intense competition in the banking market.

An increase in interest rates in 1997–1998 can be explained by the liquidity problems within the banking system (stemming from securities market crisis and external shocks). The fact that major share of credit flow is denominated in foreign currency but deposit flow is denominated in local currency may imply that banks have a possibility to exploit the market power in deposit markets as well as in retail markets.

A more detailed analysis of the components of banks total return on assets (ROTA) shows that main source of substantial increase from approx. The value 1% in 1994 to 2.9% in 2001 is mainly caused by decrease in net non-interest rate margin (NNIR). This indicates that banks have been able to manage the expenditures more efficiently but may also exhibit a "hidden" price increase of

banking services. Estonian banking may be characterised as being in the process of ongoing innovation of banking products with an aggressive expansion to non-traditional areas of financial intermediation for banks.

These processes may be an important source of market power for banks. The following more quantitative analysis is conducted in order to explore the competition explicitly as the structural measures and profitability and margins have proven to be inadequate to assess the competitive conditions and its impact on the performance of banks.

2. THEORETICAL MOTIVATION: THE PANZAR-ROSSE *H*–STATISTIC

In order to assess the competition of the banking market, we employ a test derived by Panzar and Rosse (1987), hereafter referred to as "*H*-statistic" (Rosse and Panzar 1977; Panzar and Rosse 1987). The *H*-statistic is calculated from reduced revenue equations and measures the sum of elasticities of total revenue with respect to input prices. Panzar and Rosse (1987) show that this statistic reveals information about the market or industry in which firms operates. In particular, the *H*-statistic is non-positive if a firm is a profit maximising monopolist or a conjectural variations short-run oligopoly (Panzar and Rosse 1987, p. 453). In such a case an increase in input prices increases marginal cost and there may be no response or even a negative response in equilibrium output and total revenue. In contrast, the *H*-statistic is unity for a natural monopoly in a perfectly contestable market and also for a sales-maximising firm subject to break-even constraints (Shaffer 1982). The *H*-statistic is unity when there is perfect competition. Though, the proportional change in costs induces an equiproportional change in revenues; with a perfectly elastic demand, output does not change, while the output price rises at the same extent that cost has changed. Under the monopolistic competition, revenues will increase less than proportionally to changes in input costs and the value of the statistic is between the above-mentioned limiting cases.

A critical feature of this approach is, however that the increasing relationship between *H*-statistic and competition may not hold in certain oligopoly equilibrium. The underlying assumptions for this methodology are the profit maximisation, equilibrium in the industry and normally shaped revenue and cost functions. Virtually, the model is a joint test of the underlying theory and competitive behaviour.

The empirical test for equilibrium is justified on the grounds that competitive capital markets will equalise risk-adjusted rate of returns across banks in such a way that, in equilibrium, rates of return should not statistically be correlated with

input prices. The long-run equilibrium test is carried out by using as well the *H*-statistic where it measures the sum of elasticities of return on assets with respect to input prices. Note that in the equilibrium tests the dependent variable in the revenue equations is the return on assets (ROA) and not the bank revenue variable as in the competitive position tests. Values of the *H*-statistic equal to zero would indicate equilibrium and values less than zero disequilibrium. However, if the sample is not in the long-run equilibrium, it is true that $H<0$ no longer proves monopoly, but it remains true that $H>0$ disproves monopoly or conjectural variation short-run oligopoly. Table 2 reports in brief the *H*-statistic values for the different interpretations of the Rosse-Panzar *H*-statistic.

Table 2

Interpretation of the H–statistic

Value of H index	Competitive conditions
$H< 0$	Monopoly or conjectural variations short-run oligopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition or natural monopoly in a perfectly contestable market or sales maximising firm subject to break-even constraint
	Equilibrium test
$H\infty < 0$	Long-run equilibrium
$H\infty = 0$	Disequilibrium

Sources: Rosse and Panzar. 1977; Panzar and Rosse 1987; Shaffer 1982, 1983; Nathan and Neave 1989.

The extension of the Panzar and Rosse methodology requires the assumption that banks are treated as single product firms. This is consistent with the so-called intermediation approach to banking where banks are viewed mainly as financial intermediaries[1].

[1] As discussed in Freixas and Rochet (1997, pp. 77–81) or De Bandt and Davies (2000, pp. 1048–49) there are two principal approaches to the bank output measurement. In the production approach banks are treated as firms that use capital and labour to produce different categories of loan and deposit account. Number of accounts or related transactions measures the output. Total costs are all operating costs used to produce these outputs. In the intermediation approach, banks are viewed as intermediators of financial services rather than producers of loans and deposit account services, and the value of loans and investments are used as output measures; labour and capital are inputs to this process and hence operating costs plus interest costs are the relevant cost measure.

3. EMPIRICAL ESTIMATION

The empirical estimation of competitive conditions in Estonian banking is based on the following general formula.

$$R_{it} = f(W_{it}, B_{it}, S_{it}, K_{it}),$$

where W_{it} – the vector of input prices for bank i at period t,

B_{it} – vector of variables characterising business mix of the banks,

S_{it} – variables characterising efficiency of scale and scope for bank i,

K_{it} – variables associated with willingness to risk of particular bank.

We use the intermediation approach for modelling the activities of banks. The intermediation approach assumes that the bank uses deposits and other financial resources to grant new loans as the interest expenses are included in addition to operating costs, into variable costs of the bank. The intermediation approach has some merits for successful modelling of banking activities, but perhaps the most important disadvantage is that the off balance sheet operations (guarantees, line of credits, derivatives etc.) are ignored. But using our specification of control variables, these activities are still at least partially accounted for.

We use two proxies for the specification of bank earnings (*Rit*). For the first specification, gross income for a bank i is considered (except extraordinary items) and for the second, only interest earnings are included. More detailed overview of variables used in testing bank competition with corresponding references to the format of official statements approved by the Bank of Estonia are presented in appendix 2 (see p. 28).

All equations tested below are based on three inputs the banks use to offer the services of financial intermediation. According to the intermediation approach employed in this paper, labour, deposits and other financial resources and bank capital are used.

Our empirical specification uses different formulation for capital cost (e.g. Molyneux 1994, pp. 448–50; Shaffer 1982), where the data about accounting depreciation of physical assets and number of branches is applied as proxies. In this paper we use a novel approach to run empirical tests and employ the ratio of non-interest expenses to total assets.

The difficulties associated with the evaluation of "economic" cost of capital have been a subject for different research papers. Vesala (1995) has for example applied the cost of non-deposit based financial resources in empirical specifications and excluded the physical capital completely. This specification implies a

cost function with non-equilibrium nature, as the quantity of physical capital is quasi-fixed.

The main advantage of the competition tests based on reduced form revenue equations is the possibility of utilising panel data of Estonian banks. We use pooled quarterly panel data of all Estonian banks (those who have valid licenses) from the period 1995-2001. The maximum number of banks under consideration is 22.

The main data source of the balance sheets and income statements is the Internet homepage of the Bank of Estonia (Eesti Pank) (http://www.ee/epbe/avalik_aruanne/) for the period of 2000–2001 and private database of the author for the period 1995–1999. The data has been modified and updated in order to assure the comparability and accuracy of estimates, because the official formats for bank reporting have been chanced since the beginning of 2000.

The basic econometric model that we are going to estimate is presented as follows.

$$\ln(TINTR_{ti}) = g_1 \ln(PL_{ti}) + g_2 \ln(PF_{ti}) + g_3 \ln(PK_{ti}) + g_4 \ln(OK_{ti}) + g_5 \ln(PRL_{ti}) + \\ + g_6 (L\_A_{ti}) + g_7 (TD\_D_{ti}) + g_8 MKIV\_A + g_9 VP\_A$$

where *TINTR* – total interest revenues (bank *i* for period *t*),

PL – unit price of labour,

PF – interest rate on liabilities,

PK – price of physical capital,

OK – equity capital,

PRL – provisions as a share of loan portfolio,

L_A – loans to total assets ratio,

T_D – time deposits to total deposits ratio,

MKIV_A – non-interest bearing assets as a share of total assets,

VP_A – securities portfolio as a proportion of total assets.

The Panzar-Rosse *H*-statistic is thus estimated as H = $\sum_{m=1}^{3} g_m$. The outline of hypothesises based on input price elasticities to different revenue specifications are presented in table 2 (p. 13).

We added the scale variables measuring the capacity at which level the bank operates (assumed to be fixed in the short-run), including equity, but also total assets and loan portfolio for some specifications. The business mix is captured by several exogenous and bank-specific variables that may shift the cost and

revenue schedule. In this context, we employ loans as a proportion of assets, the share of time deposits to total deposits and also non-earning assets and securities as a proportion of assets. The share of provisions is added as a control variable for risk and the quality of the loan portfolio.

The expected signs for some variables are ambiguous. The share of non-earning assets from total assets (*MIKV_A*) is expected to have negative influence on earnings. This can be more easily seen in the case of interest revenues as endogenous variable. For the total earnings, the direction of the relationship depends on the structure of components (the share of interest revenue for example) and the nature of non-interest bearing assets. The scale variables are expected to have a positive effect on revenues.

The share of provisions as an indicator of risk and the loan portfolio quality is stated in absolute value. The primary effect of this variable is expected to be negative, but in practice, the loans are provisioned while granted. The interest revenue is also accounted on accrual basis as a result of which a positive correlation may be expected. The rate of provisions has been rather stable during the period under investigation and has shown even a decreasing trend, while the interest and total earnings have shown a fair or even rapid growth in some periods. The proportion of loans (*L_A*) is expected to have a positive influence on revenues and the same expectations are valid for securities portfolio, where both equity stock and fixed income securities are included.

Higher share of time deposits to total deposits (TD_D) which increases the cost of capital for a bank is expected to have a positive impact on earnings while a constant spread is considered. In the same time if the higher percentage of relatively more expensive sources used to finance lending activities, the demand for bank-specific financing might decrease and, thus have a negative influence on bank earnings.

The securities portfolio has generally a positive impact on earnings, but this relationship may not obviously be monotonic. Estonian banks, during the crisis in the local securities market, implemented different practices for loss accounting. The positive expectation about the latter relationship is supported by the fact that the major share of poor-quality shares in trading portfolio were indicated as long term investments and were excluded from the portfolio of securities. In addition, the rate of return from fixed income securities has been rather stable during the period considered.

The empirical implementation of equation on a panel of banks with a time-series and cross sectional dimension requires some precaution. Various forms of estimation were employed in the main set of tests. In empirical literature on banking competition, cross-sectional results are usually reported. The implicit assumption is that all banks have access to the same factor markets, which only differ in terms of scale of operations, although it is reasonable to believe that, depending

on their specialisation, banks may rely on different factor markets. Here, we argue that the time-series dimension is equally important. In addition, as it is well known, running an OLS regression on our econometric model, year by year (t=1…T), may provide irregular results, and we therefore decided to concentrate on pooled sample regressions.

We used an econometric software package EVIEWS 3.1 for empirical estimation. The estimation technique is based on pooled cross-section estimation with fixed effects and with cross-section weighting. Using model with fixed effects (bank specific intercepts and time dummies) is theoretically justified while the sample covers whole population of banks. The equation was also estimated utilising SUR (seemingly unrelated regression), which gives more efficient estimates for parameters if the residuals may be correlated. This can be expected as the sample might have been open to exogenous, but homogenous shocks affecting the whole population (turbulence in Russian financial markets, developments in other foreign capital and forex markets). We did not present the results from SUR estimation, because this method did not produce qualitatively different results.

The serious problem that had to be solved during the estimation is connected with great structural changes and consolidation in the Estonian banking market. The number of banks included in the sample was 20 in the first quarter of 1995, but declined to 7 until the end of 2001. Without controlling the possible bias created by number of mergers and acquisitions in the market, the results of econometric estimations may be biased. To overcome that econometric problem we used a novel approach here. We accounted for the two more relevant acquisitions of banks were Tallinna Pank and Eesti Hoiupank was taken over by Eesti Ühispank and Hansapank respectively. The time series of those banks were adjusted in a way that after the mergers the pooled cross-sections were as if generated by *de novo* banks. First, we estimated the model without the mentioned adjustments – the estimated values for *H*-statistic were not significantly different from time series were the effect of consolidation was taken account. Though, the test ran to control for the equilibrium of the banking system and did not provide significant results.

The following estimation of input price elasticity of banks is based on both total interest earnings (TINTR) and total income (TI). The input prices are presented in log form; hence the sum of these parameter values can be directly interpreted as elasticity estimates that we are looking for.

The empirical results for the whole period (1995–2001) are presented in the following table 3.

Table 3

Estimates for H-statistic for full sample period (1995-2001)

Variable	Specification for earnings			
	Total interest revenues (TINTR)		Total revenues (TI)	
	Parameter	t-value	Parameter	t-value
PL	0.090	2.906***	0.071	2.299**
PF	0.517	8.586***	0.499	8.594***
PK	0.040	2.001**	0.072	2.848***
OK ($\times 10^{-3}$)	0.523	5.076***	0.526	4.939***
PRL	5.530	5.676***	3.672	2.552**
L_A	1.266	4.194***	1.255	3.318***
TD_D ($\times 10^{-3}$)	-0.047	-2.166**	-0.051	-1.786*
MIKV_A	-4.128	-9.927***	-3.151	-7.380***
VP_A	1.159	3.434***	1.197	4.957***
Number of observations	249		250	
H–statistic	0.647		0.642	
$\overline{R}^2$	0.996		0.998	

Note: The estimates are based on fixed effect model with cross-section weights. The t-values are calculated using White heteroscedasticity adjusted standard errors. Fixed bank effects are not presented.

*T-values: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.*

The estimated income price elasticities (*H*-statistic) for both equations are not significantly different at the standard level of probability and are 0.647 and 0.642 for TINTR and TI respectively.

We used the Wald one-tale test for coefficient restrictions and showed that at significance level of $p = 0.05$ ($p = 0.10$ for the two-tale test respectively), the value of *H*-statistic (TINTR) lies between the interval $0.573 < H < 0.721$. Thus the hypothesis of long-run or short-run conjectural monopoly ($H < 0$) and perfect competition can be rejected ($H = 1$).

The Wald test for equation with total revenues as endogenous variable leaves the *H*-statistic value between the ranges $0.575 < H < 0.709$ (with respective level of statistical significance $p = 0.10$ for the two tale test). Like the first model, both monopoly and perfect competition can be rejected. Thus for the full period of 1995–2001, Estonian banking market appears to be operating as if in monopolistic competition.

Both models are highly significant, with adjusted coefficient of determination ($\overline{R}^2$) higher than 99.5% for either cases. The estimates for parameters are all

highly significant as well, with $p < 0.01$ for the majority of estimated values. The estimated signs of the parameter are consistent with *per se* expectations and their values do not differ across both equations. The price increase of inputs is passed through to increase in revenues. The raise in revenues is the most substantial in the case of deposits and interest expenses as the main elements of variable costs among banks. This result is at least partly supported by findings of Ahi (2002) who uses the model of comparative statics in demand (see Bresnahan 1989 for theoretical motivation and Shaffer 1993; Bikker and Haaf 2000 for empirical applications to banking industry) and shows that Estonian banks are price takers in deposit markets (e.g. the price of deposits is exogenous to the banks).

Tests of hypotheses based on *H*-statistic provide us with valuable information about competitive conditions in the Estonian banking market. Despite the high level of consolidation, the Estonian banking market is characterised as fairly competitive, even though the perfect competition is rejected.

Finally, in order to confirm that the Panzar-Rosse statistics provides useful results we have to determine whether the banking systems under consideration are in equilibrium. The test relies on the fact that input prices should not be correlated with bank profitability in equilibrium. This is especially important for the cases of perfect competition and monopolistic competition. To implement such a test, we compute a "modified" version of the Panzar-Rosse statistics by running the same equation as with the bank's return on assets (ROA) as endogenous variable. The principal idea behind the test is that the acceptance of perfect competition hypothesis, with the input prices perfectly correlated with revenues, is valid only if input prices are not found to be correlated with profitability. Empirical literature uses both, ROE (return on equity) and ROA as the dependent variable. We preferred ROA for running the empirical test, because return on equity ratio has been far more volatile within the sample period, partially due to legislative actions undertaken by monetary authorities (e.g. changes in minimum capital requirement and capital adequacy ratio).

The results for equilibrium tests are presented in table 4 below. The model A is based on the specification of equations, which are given in table 3 (p. 18) but we added an alternative model (B) with a different set of control variables. The ratio of return on assets (ROA) is based on pre-tax profits of banks, adjusted for extraordinary income and expenses. Our approach allows for better comparability of pooled sample estimates and is less sensitive to regulatory changes[2] and variability in items with extraordinary nature.

[2] The most influential regulatory change is connected with tax law, e.g. tax exemption for retained earnings.

Table 4

Equilibrium test for banks (1995–2001)

Variable	Specification			
	Model A		Model B	
	Parameter	t-value	Parameter	t-value
PL	0.218	1.458	0.084	0.545
PF	-0.064	-0.501	0.079	0.550
PK	0.103	1.550	0.097	0.893
OK ($\times 10^{-3}$)	-0.250	-0.925		
PRL	-16.448	-5.003***	-12.04***	-3.768
L_A	2.563	2.258**	1.164	1.035
TD_D ($\times 10^{-3}$)	-0.055	-1.720*	-0.057	-1.242
MIKV_A	3.536	1.967*	5.231**	2.313
VP_A	-0.197	-0.155		
TA ($\times 10^{-3}$)			-0.341**	-2.584
LOAN ($\times 10^{-3}$)			0.525**	2.466
Number of observations	245		245	
modif. H–statistic	0.257		0.260	
$\overline{R}^2$	0.413		0.437	

Note: The estimates are based on fixed effect model with cross-section weights. The t-values are calculated using White heteroscedasticity adjusted standard errors. Fixed bank effects are not presented.

*T-values: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.*

According to the equilibrium test, the respective values of modified *H*-statistic are 0,257 for the model A and 0,260 for the model B. The input prices are each individually not significantly correlated with profitability in both equations. We used the Wald test to determine whether the time series of banks are in equilibrium (the test hypotheses are presented in table 2, p. 13). The results of the testing procedure for both models are conclusive. The zero-hypothesis (H = 0) can not be rejected for neither of cases at 5% significance level[3]. Thus the data characterising the behaviour of banks can be regarded as if in equilibrium. It should be noted that equilibrium does not mean that competitive conditions are not allowed to change – an assumption that would be contradicted by the period we consider, characterised by a process of structural changes. It only implies that changes in banking are taken as gradual.

Unfortunately, the regressors, used in above regressions (input prices put aside) are not good predictors of profitability. For both models, only four out of six reg-

[3] The computed values of F–statistic are 3.43 (p = 0.0656) and 2.422 (p = 0.121) respectively for both equations.

ressors turned out to be statistically significant. The scale variable (OK) and VP_A in equation (A) are not significant. We made adjustments to the original model and used a set of different exogenous variables in order to model equilibrium behaviour of banks more carefully. We found the scale variables, both total assets (TA) and loan stock (LOAN) significant with relatively good fit (adjusted coefficient of determination is however close to 0.40 in both equations). The prediction of equilibrium behaviour of banks is hence robust to different specifications with expected signs and similar values of parameters.

Several papers (see Shaffer 1982 or Panzar and Rosse 1987) have pointed out that the estimated values of *H*-statistic, for any other structural model than perfect competition, can not be taken as an exact measure of the extent of banking competition. At the same time Vesala (1995), De Bandt and Davies (2000) and several other authors have shown that the predictions of *H*-statistic can be taken as indicators of contestability with constant price elasticity of demand. Based on this assumption, there exists an inverse linear relationship between the value of *H*-statistic and Lerner index and the estimated value of the statistic can be taken as a predictor of actual competition level and is directly comparable to other studies which use similar framework for competition analysis. A thorough analysis of both streams in theoretical and empirical literature shows that at minimum, the shifts in competitive behaviour can be traced using this methodology.

In order to test possible shifts in banking competition we divide the whole sample into two sub-samples; the first period is between 1995–1998 2nd quarter and the second from 1998 3rd till the end of 2001. This division is motivated by substantial breaks in the structure of banking sector; illustration of this can be the substantial shift in the value of HHI index.

We estimated two models with different specifications in order to analyse qualitative changes in banking competition. Both models are based on previous tests and use the same explanatory variables as presented in tables 3 and 4. The results of the tests for both periods are given in appendix 3 (p.31).

The estimated values for *H*-statistic based on models C and D for period 1995–1998 are 0.631 and 0.596 respectively. Both specifications indicate a monopolistic competition for this period and we may conclude that according to the Wald test, these values are not significantly different from the estimates for full sample period[4]. The robustness of the results is further supported by the values of parameters, whose signs and values are justified by expectations *per se*.

In order to analyse the possible shifts in competition we estimated similar equations for the period 1998–2001. The results are presented in appendix 3 and

[4] The respective border values of *H*-statistics are added to respective estimates according to 10% significance level for the two-tail test.

are based on estimation of models E and F. The values of income price elasticities are higher than in the first period (H = 0.771 for model E and 0.776 for model F). We were able to show that according to model E, the zero-hypothesis – *H*-statistics for two periods are not statistically different, can be rejected[5]. Thus according to our basic specification, the competitiveness in the Estonian banking market has increased and the increase is statistically significant.

However, some of the parameter estimates have changed their signs, but as discussed above, the expectations for variables TD_D and PRL can be justified for both directions.

[5] The value of F-statistic is 4,039.

DISCUSSION OF THE RESULTS AND CONCLUDING REMARKS

Our research shows that Estonian banking is operating in a competitive environment despite the high concentration in the market. The results of the research are valuable and important not only in the context of the analysis of Estonian local banking market efficiency but these can be extended to the banks in CEE countries. Only a few analyses have treated the efficiency of financial intermediation in transition and especially in the EU candidate countries so far, although the financial systems of those countries are notably bank-oriented.

Studies that cover banking competition and their various applications in transition economies are also rather scarce. Theoretical studies (Hainz 1999, Schnitzer 1998) concentrate on informational structure of the market and deal with policy issues (market regulation) and the influence of market structure on restructuring of the firms, credit allocation and corporate control. The main conclusion is that those transition countries, which financial systems are mostly bank-oriented, suffer greatly from informational imperfections like adverse selection and moral hazard. A more concentrated banking system with some monopoly power is preferred to one with atomistic competitors. Though, the monetary authorities may justify a more concentrated banking market with some monopoly power of banks.

A brief overview of studies that have employed *H*–statistic are presented in appendix (1). The results of these studies show that in general, the level of banking competition is not unique across different countries. There exists a significant difference in competition in EU banking markets if compared to Anglo-American countries, the latter exhibiting significantly higher level of competition. Several studies show that the banking markets still have some local nature as smaller regional banks are usually less competitive, acting sometimes as local monopolies ($H<0$). Thus the structural developments triggered by the EMU may still have important consequences on banking markets.

A recent paper by Drakos and Konstantinou (2002) seeks to evaluate competitive conditions in CEEC accession countries. They show that these banking markets exhibit rather similar market structures compared to major European economies (e.g. Germany, France, Italy; see De Bandt and Davis 2000) and there exists no significant difference in the level of competition compared to two benchmark countries, Turkey and Greece. The findings of Drakos and Konstantinou are more powerful as these banking markets may be taken as if in transition but with different path of institutional and economic development. Unfortunately the paper of Drakos and Konstantinou has some severe metho-

dological flaws, especially connected with econometric estimation of reduced form revenue equations, which makes the results difficult to compare with our findings. Still, we are able to show that transition process has definitely succeeded in introducing a higher level of competition but according to theoretical models of banking competition, this may have happened at the expense of more severe credit rationing.

Evaluation of the empirical results of competition tests has several important implications. Firstly, if the transition of Estonian economy to the EU is considered, we are able to show that Estonian financial system is well integrated into the world financial markets. An analysis of competition in Estonian banking market cannot be limited to local banking institutions. Therefore, the financial intermediation in Estonia has to be treated in a much broader context of the European integration. High contestability of the market links the domestic money and credit market closely to the euro area and hence the lending rates and margins are not solely determined by domestic factors. Estonian banks, in a perfectly competitive environment are, thus more vulnerable to exogenous shocks and their ability to absorb the negative developments in the world's financial markets may decrease dramatically. One could expect the lending margin e.g. quasi-monopoly profits to be eroded after the accession to the EMU. The empirical evidence show that Estonian banking system has successfully integrated into the world's financial system and the pressure from outside competition from joining EMU in the future may have little or no direct effect at all on Estonian banks.

Secondly, our research has important implications for the methodology of tests evaluating the banking competition. Ahi (2002) employs the model of conjectural variations in order to test the contestability in Estonian banking and shows that the model of perfect competition cannot be rejected on the basis of the aggregate data of Estonian banks. The findings of the current paper fully support the critics of Corts (2000) and Genesove and Mullin (1998) that the tests based on comparative statics in demand may systematically underestimate the actual degree of competition. Another important conclusion is that the traditional SCP paradigm fails to capture the effect of the market structure on competition. In effect, the actual level of competition has even increased after the substantial consolidation among market participants, just to the contrary the standard SCP paradigm would predict.

REFERENCES

Ahi, K. Bank Competition and Monopoly Power in Transition Economies- the Case of Estonia. – 50th Anniversary Financial Conference - Svishtov, 2002, Bulgaria (conference papers), pp. 1011- 1030.

Bain, J. S. Relation of Profit Rate to Industry Concentration. – Quarterly Journal of Economics, 1951 65, pp. 293–324.

Baumol, W., Panzar, J., Willig, R. Contestable Markets and the Theory of Industry Structure, HBJ, New York, 1982 (quoted from Vesala (1995)).

Bhattacharia, S., Thakor, A. Contemporary Banking Theory. – Journal of Financial Intermediation, 1993, Vol. 3, pp. 2–50.

Bikker J. A., Haaf, K. Competition, Concentration and their Relationship: an Empirical Analysis of the Banking Industry. 2000, *mimeo*, pp. 47. http://www.eco.rug.nl/ccso/download/bikker.pdf.

Bresnahan, T. F. Empirical Studies of Industries with Market Power. Chapter 17 in Richard Schmalensee and Robert D. Willig, eds., Handbook of Industrial Organisation, Vol. II. New York: North-Holland, 1989, pp. 1011–1057.

Coccorese, P. Assessing the Competitive Conditions in the Italian Banking System: Some Empirical Evidence. – Banka Nazionale del Lavoro Quarterly Review, 1998, No. 205, pp. 170–191.

Corts, K. Conduct Parameters and the Measurement of Market Power. – Journal of Econometrics, 1999, Vol. 88, pp. 227–250.

De Bandt, O. Davis, E. P. Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU. – Journal of Banking and Finance, 2000, Vol. 24, pp. 1045–1066.

Diamond, D. Financial Intermediation and Delegated Monitoring. – Review of Financial Studies, 1984, Vol. 51, pp. 393–414.

Drakos, K., **Konstantinou, P.** Competition in Central European Banking: A Comparative Analysis, 2002, 27 pp. http://www.city.ac.uk/economics/iefs/Papers/Konstantinou.pdf

Eesti Pank (Central Bank of Estonia), www.ee/epbe.

Freixas, X., Rochet, J-C. Microeconomics of Banking, The MIT Press, Cambridge, 1997, 312 pp.

Genesove, D., Mullin W. P. Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890- 1914. – Rand Journal of Economics, 1998, Vol. 29, No. 2, pp. 355–377.

Guzman, M. G. The Economic Impact of Bank Structure: A Review of Recent Literature. – Economic and Financial Review, 2000, 2nd quarter, Federal Reserve bank of Dallas pp. 11–25; http://netec.mcc.ac.uk/WoPEc/data/Articles/ fipfeddery:2000:i:Q2:p:11-25.html

Hainz, C. Credit Contracts and Restructuring in Transition Economies: on the Role of Bank Competition and Collateral. 1999, University of Munich, 1999. http://www.vwl.unimuenchen.de/ls_schnitzer/download/Discussion-papers/wdi3.pdf

Hempell, H. Testing for Competition Among German Banks. Discussion Paper of Economic Research Centre of the Deutche Bundesbank, 2002, http://www.bundesbank.de/vo/download/dkp/2002/04/200204dkp.pdf

Hondroyiannis, G., Lolos, S., Papapetrou, E. Assessing Competitive Conditions in the Greek Banking System. – Journal of International Financial Markets, Institutions and Money, 1999, Vol. 9, pp. 377–391.

King, R., Levine, R. Finance, Entrepreneurship and Growth: Theory and Evidence. – Journal of Monetary Economics, 1993a, Vol. 35, pp. 513–542.

King, R., Levine, R. Finance and Growth: Schumpeter Might Be Right. – Quarterly Journal of Economics, 1993b, Vol. 108, pp. 717–737.

Levine, R., Zervos, S. Stock Markets, Banks and Economic Growth. – American Economic Review, 1988, Vol. 88, pp. 537–558.

Levine, R. Financial Development and Econimic Growth: Views and Agenda. – Journal of Economic Literature, 1997, Vol. 35, pp. 688–726.

Lloyd–Williams, D. M., Molyneux, P., Thorton, J. Market Structure and Performance in Spanish Banking. – Journal of Banking and Finance, 1994, Vol. 18, No. 3, pp. 433–443.

Molyneux, P. Lloyd-Williams, D. M., Thorton, J., Competitive Conditions in European Banking. Journal of Banking and Finance, 1994, Vol. 18, pp. 445–459.

Molyneux, P., Altunabas, Y., Gardener, E. Efficiency in European Banking, 1996, John Wiley & Sons, Chistester.

Nathan, A., Neave, E. H. Competition and Contestability in Canada's Financial System: Empirical Results. – Canadian Journal of Economics, 1989, Vol. 22, pp. 576–594.

Pagano, M. Financial Markets and Growth. An Overview. – European Economic Review, 1993, Vol. 37, pp. 613–622.

Panzar, J., Rosse, J. Testing for Monopoly Equilibrium. – The Journal of Industrial Economics, 1987, Vol. 35, pp. 443–456.

Rambarran, A. Bank Competition and Contestability in Trinidad and Tobago. Research Department of the Central Bank of Trinidad and Tobago, 2000, *mineo*. www.cemla.org/pdf/red-iv-ar.pdf

Rime, B. 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, 1999, 135 (1), pp. 21–40.

Rosse, J., Panzar, J. Structure, Conduct and Comparative Statics. 1977, *mimeo* (quoted from Panzar and Rosse. (1987)).

Shaffer, S. A Non-structural Test for Competition in Financial Markets. Published in Proceedings of a Conference in Bank Structure and Competition. Chicago: Federal Reserve Bank of Chicago, 1982, pp. 225–243 (quoted from Molyneux (1994)).

Shaffer, S. Non-structural Measures of Competition: Toward a Synthesis of Alternatives, 1983, – Economics Letters, Vol. 12, pp. 349–353.

Shaffer, S. A Test of Competition in Canadian Banking. – Journal of Credit, Money and Banking, 1993, Vol. 25, No. 1, pp. 49–61.

Schnitzer, M. On the Role of Bank Competition for Corporate Finance and Corporate Control in Transition Economies. – Centre for Economic Policy Research Discussion Paper No. 2013, 1998. http://www.vwl.unimuenchen.de/ls_schnitzer/download/bankcomp.pdf

Vesala, J. Testing for Competition in Banking: Behavioural Evidence from Finland. – Bank of Finland Studies E:1, 1995, 206 pp.

Appendix 1

Results of the Panzar–Rosse test in different banking markets

Source	Period	Data	Results
Nathan and Neave (1989)	1982-1984	Canada	perfect competition for 1982; monopolistic competition in 1983–1984
Shaffer (1982)	1979	New York	monopolistic competition
Lloyd-Williams *et al.* (1991)	1986-1988	Japan	monopoly
Vesala (1995)	1985-1992	Finland	monopolistic competition (exl. two years
Molyneux *et al.* (1994)	1986-1989	France, Italy, UK, Germany, Spain	monopoly in Italy, monopolistic competition in other countries
Molyneux (1996)	1986-1988	Japan	monopoly
Coccorese (1998)	1988-1996	Italy	monopolistic competition
De Bandt and Davis (2000)	1992-1996	France, Germany and Italy	large banks- monopolistic competition, small banks- monopolistic competition in Italy, monopoly in France and Germany (substantial year to year variations)
Rime (1999)	1987-1994	Switzerland	monopolistic competition
Bikker *et al.* (2000)	1989-1996	15 EU countries	monopolistic competition
Hondroyiannis *et al.* (1999)	1993-1995	Creece	monopolistic competition with year to year variations
Rambarran (2000)	1969-1997	Trinidad and Tobago	monopolistic competition, no significant shift in competition after financial liberalisation
Hempell (2002)	1993-1998	Germany	monopolistic competition, Universal banks have less monopoly power as compared to savings and union banks
Drakos and Konstantinou (2002)	1993-2001	Bulgaria, Czech Rep, Hungary, Romania Poland, Greece, Turkey	monopolistic competition in CEEC, no significant differences with Greece or Turkey

Appendix 2

Definitions of Variables Employed in Panzar and Rosse Test

Endogenous variables

Variable	Abbreviation	Definition*
Total interest revenues	TINTR	interest income (400)
Total revenues (extraordinary items exl)	TI	the sum of interest revenues, commission income and financial income (400+418+429)
Return on assets (gross)	BROA	ratio of total revenues to total assets {(400+418+429)/373}
Return on assets	ROA	ratio of pre-tax profit minus extraordinary items to total assets {(432-431)/373}

Factor unit prices

Variable	Abbreviation	Definition
Price of labour (1)	PL	ratio of total wage costs plus social security and health insurance taxes to total assets {(422+423)/373}
Price of labour (2))	PL2	ratio of total wage costs plus social security and health insurance taxes to the sum of loans and deposits {(422+423)/(376+355)}
Price of funds	PF	ratio of interest expenses to deposits (406/376)
Price of capital	PK	ratio of overhead and other non-operating costs to total assets {(425+429)/373}

Scale variables

Variable	Abbreviation	Definition
Equity	OK	sum of sub-ordinate debt, share capital, reserves and current period profit or loss {(389+390+391+392)}
Non-interest bearing assets	MIKV	sum of fixed assets, cash, claims to CB, CB backed securities (370+350+351+352)
Total assets	TA	total assets(373)
Loan portfolio	LOAN	loans granted to clients (376)

Variables characterising risk and business mix

Variable	Abbreviation	Definition
Share of deposits	L_A	ratio of deposit stock to total assets (376/373)
Share of loan portfolio	L_ASSET	Ratio of loan stock to total assets (355/373)
Loan provisions	PRL	ratio of loan loss provisions to total stock of loans (363/355)
Share of securities portfolio	VP_A	Sum of bond, other fixed income securities and stocks as share of total assets{364+366)/373}
Share of time deposits from total deposits	TD_D	Ratio of time deposits to total deposits 378/376

*Note: * The codes of items according to chart of accounts of banks are given in brackets.*

Panzar–Rosse test in Estonian banking market (TINTR as endogenous variable)

Variable	1995–1998 2nd quarter				1998 3rd quarter –2001.			
	Model C		Model D		Model E		Model F	
	Parameter	t–value	Parameter	t–value	Parameter	t–value	Parameter	t–value
PL	0.060	2.192**	0.098	3.803***	0.398	4.242***	0.344	4.087***
PF	0.567	10.847***	0.592	11.442***	0.208	10.800***	0.278	4.407***
PK	0.004	0.197	0.009	0.480	0.165	3.391***	0.154	3.102***
OK ($\times 10^{-3}$)	0.739	11.102***			0.062	0.765		
PRL	4.557	2.688***	4.972	3.097***	-1.301	-0.732	-1.693	-1.216
L_A	1.221	3.310***	0.492	1.779*	-1.447	-1.999**	-1.863	-4.229***
TD_D ($\times 10^{-3}$)	-0.028	-1.212	-0,024	-0.968	1.112	5.192***	0.429	1.051
MIKV_A	-3.243	-7.006***	-3.517	-8.475***	-3.805	-3.702***	-2.669	-3.507***
VP_A	1.289	2.766***			-0.390	-0.660		
TA ($\times 10^{-3}$)			0.056	2.450**			0.0504	2.030**
LOAN ($\times 10^{-3}$)			0.148	4.025***			-0.034	-0.973
Number of observations	180		183		90		92	
H–index	0.631 (0.555<H<0.707)		0.699 (0.631<H<0.767)		0.771 (0.632<H<0.91)		0.776 (0.648<H<0.904)	
$\overline{R}^2$	0.997		0.998		0.9844		0.969	

Note: The estimates are based on fixed effect model with cross-section weights. The t-values are calculated using White heteroscedasticity adjusted standard errors. Fixed bank effects are not presented.
T-values: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.