

TESTING FOR COMPETITION IN
BANKING SECTOR: EVIDENCE
FROM UKRAINE

by

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A thesis submitted in partial fulfillment of
the requirements for the degree of

MA in Economics

Kyiv School of Economics

2010

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Abstract

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This paper investigates the market structure of Ukrainian banking system during 2005:1 - 2009:1 and evaluates the degree of competition with the help H-statistics developed by Panzar and Rosse (1987). The estimated value of H-statistics varies from 0.11 to 0.62 and robust to inclusion of other variables in regression equations. In addition, the F test for perfect competition as well as pure monopolistic competition is rejected for all specifications. Thus, Ukrainian banks earn their profits in the market where monopolistic competition dominates.

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ACKNOWLEDGMENTS

The author wishes to express thankfulness to his supervisor Larysa Krasnikova for her supervision, invaluable comments and useful suggestions during the whole year. Special thanks to Tom Coupe for crucial comments and his help to implement my thoughts in given paper. At last, I express my sincerest gratitude to my parents and relatives for whom I have already become by now.

GLOSSARY

Banking Assets. Something valuable that a bank uses in generating profits.

Competition. The act of competing, as for profit or a prize; rivalry.

Loan Portfolio. Total of all loans held by a bank or finance company on any given day.

Chapter 1

INTRODUCTION

Today's financial globalization determines not only the modern trends of international capital movements, but also the development of financial system. In the financial market system, banks play the role of the major carriers and organizers of the monetary relations. Considering the fact that banks accumulate and manage the resources of corporate entities and individuals through attracting deposits and managing assets, economic agents' welfare becomes more and more dependant on the soundness of banking system. Segura (2010) argues that banks can be considered as public goods, because the financial stability of the banking system affects not only banks, but the entire economy since banks perform a variety of functions starting from providing country's payment system up to the corporate governance. In turn, Schaeck and Čihák (2008) state that competition in banking sector increases bank efficiency. That is, the level of competition of Ukrainian banks is an indicator of the whole banking system strength.

Hempell (2002) argues that there are several reasons why market competition in the banking sector is important. The first reason is the competitive selection: banks selected via a cut-throat competition are the ones that use their capital more efficiently, quicker adapt to market innovations and have more flexible, strategically balanced policy, better qualified management and efficient information systems. The second reason is that competition for the consumer of banking services leads to expansion of services and exclusion from the market low quality products, meaning that having higher level of competition institutions do their best in order to provide their clients with the best quality services. Finally, the consequence of competition is the reduction of prices for banking

services. In contrast, Cetorelli (2001) argues that neither monopoly nor perfect competition may be the most desirable market structure for the banking sector. The central bank as a regulator faces the tradeoff: more competition is more likely to lead to a larger amount of loans provided, while market power increases bank's incentives to determine the borrower's creditworthiness, thus leading to higher quality of applicant pool. Higher quality of applicant pool implies lower default rate among borrowers, which is beneficial for both parties (banks and borrowers).

The real economy and the banking sector of Ukraine experienced a serious downturn during the global financial crisis of 2008, worsened by political and economic instability in the country. According to the NBU, the profitability of assets of the Ukrainian banks in 2009 declined to 0.7 %. To compare, in 2005 the latter indicator was 1.1 %. In January, 2009 negative operational income reported by 64 banks out of 181 listed on the NBU website, whereas in 2005 all banks had positive income. Some institutions also report a considerable decline in capital (National bank of Ukraine). According to the analysis done by NBU, among the determinants of these negative financial results are the high cost of resources and the significant decline in asset quality. However, during this crisis, the performance of banks varied widely – some banks such as Rodovid and Nadra had to be protected by the state, while other banks were affected to a lesser extend. “Recent decreases in bank efficiency could be a signal that banks exploited increasing market power” (Casu and Girardone, 2009). That is, along with bank-specific characteristics (loans given, asset value) increase in market power is also a driver to poor performance.

In this paper the relationship between the operational income and factor prices (attracted funds, labor, capital) is investigated with the help of Panzar-Rosse (1987) approach. Given approach determinates the competitiveness of banking

sector based on the value of sum of factor prices coefficients (so-called H-statistics): the closer the value of H to one, the higher degree of competitiveness may be assigned to industry. This methodology is frequently applied when investigating the competition in particular industry. The strongest of this method is the assumption that banks are price takers in input market. However, the important advantage of this methodology is the use of operational income rather than output prices, since income is more likely to be observable than actual cost information. Given methodology is of special interest, because it assigns a concrete numerical value to the overall banking sector competitiveness, which gives the opportunity to determine the market structure of industry (monopoly, oligopoly, competitive market). Panel quarterly data covering the period of 2005-2009 are estimated with the help of fixed effects to account for bank-specific unobservables.

There were attempts to estimate the degree of competitiveness of Ukrainian loan market by other scientists. In particular, Maslovykh (2009) used Boone indicator and concluded that bank loan market of Ukraine may be considered as the competitive market. However, competitiveness of loan market does not necessarily imply that other markets in which banks operate are also competitive. For example, interbank foreign currency market, especially after establishing the floating exchange rate, which is additional instrument for different actions inconsistent with fair competition. Moreover, there were claims that NBU artificially sets the exchange rate, so that banks were able to benefit from it. Definitely, such actions ruin the existence of fair competition. This is why, to account for the rest of activities (not only loan market) the total income is used, but not interest revenue as the dependant variable. Combining Panzar-Rosse approach and panel regression (fixed effects) allows to account for bank specific unobservables fixed over time (e.g. geographical situation, quality of management, bank's ability to attract funds) and make the conclusions about the banking

system as a whole instead of focusing on every of its activity separately. Determining the level competition allows to see whether average consumer overpays for banking services (in case of monopolistic competition).

This paper contributes the literature on Ukrainian banking system in the following ways:

- the methodology by Panzar-Rosse accounts for testing the competition in a banking sector as a whole, thus containing the information about all bank's activities;
- the approach is beneficial when only limited data base is available. Panzar-Rosse statistics is considered as a valuable tool in modern literature when dealing with competition (Hempell, 2002);
- this is the first attempt to estimate the competitiveness of banking sector in Ukraine using this methodology;

The rest paper is organized as follows. Chapter 2 contains the literature review of empirical and theoretical papers, different methodologies the most frequently applied in modern literature to address the question about competition. Chapter 3 presents the methodology used in the paper, describes the models, justifies the variables and also contains the description. Chapter 4 focuses on main sources of data and its applicability to the given study. Chapter 5 provides with estimation results. The last part of the thesis (chapter 6) summarizes the main findings and specifies the directions for further research.

Chapter 2

LITERATURE REVIEW

The literature on measuring the competition may be divided between two approaches: structural and non-structural. The structural approach “investigates whether a highly concentrated market causes collusive behavior among larger banks resulting in superior market performance; whereas the efficiency hypothesis tests whether it is the efficiency of larger banks that makes for enhanced performance” (Bikker and Haaf, 2002). Non-structural models measure the overall competition level of particular industry without focusing on market structure. Panzar-Rosse approach is the representative of non-structural approach.

Boone and Lerner index are the most recent representatives of structural approach widely used in literature. For example, Leuvensteijn et al (2007) investigate the loan market in Euro area (France, Germany, Italy, Netherlands and Spain) and compared their findings to the UK, US and Japan. The Boone indicator was used for quantifying the impact of marginal costs on performance (measured in terms of market shares). It was found that during the analyzed period the US economy had the most competitive loan market among considered countries; French and British markets are reported to be less competitive overall. Authors state that “banks, which are more exposed to competition from foreign banks and capital markets, tend to be more competitive, particularly in Germany and the US, than savings and cooperative banks, which typically operate in local markets”. The latter finding is consistent with the fact that international banks, on average, are one step ahead from local banks in terms of its efficiency, quality of management etc. Similar findings are reported by Maslovykh (2009) who investigated the degree of Ukrainian loan market competitiveness with the help of

Boone indicator approach. The author concludes that loan market is competitive in Ukraine and foreign banks face relatively high degree of competition comparing to domestic banks which is similar to findings of Leuvensteijn et al. (2007).

Lerner index describes the relationship between elasticity and price margins for a profit-maximizing firm. The common thing for Boone indicator and Lerner index is that both require using marginal costs in analysis which are not directly observable. That is, additional approximations are needed (i.e. average costs, use of translog cost functions) to proxy marginal costs which are the main limitations of both methods.

Turning to the non-structural approach, the most popular models here are Bresnahan's market power and Panzar-Rosse models. Moreover, the latter models yield similar results to structural approach discussed previously. For example, Bikker (2003) justifies that EU countries have competitive loan and deposit markets when tested apart and jointly, thus inferring that members of European Union, on average, have competitive banking system although different countries have different concentration ratios. Casu and Girardone (2004) claim that the least competitive banking systems tend to be the most efficient. This happens because pro-competitive regulation pushes banks to gain higher efficiency through cost cutting and rationalization. However, not all banks manage to do so; less efficient banks are acquired by the most cost efficient banks. This is why relationship between competition and efficiency is not obvious. There are also debates concerning the influence of monopolistic or competitive market on welfare of agents. For example, Boot and Thakor (2000) report that increased competition in banking industry will improve borrower's welfare for some, but not for all. In turn, Cetorelli (2001) argues that increased

competition not always good and central banks may allow some monopoly at market, subject to its (central bank's) specific purposes.

Gischer and Stiele (2004) use Panzar-Rosse approach to measure the degree of competitiveness in German banking sector. The authors conclude that Germany faces competition which is far from perfect, but also far from completely collusive, because banks try to find the niches where competitive pressure is lower.

Bikker and Haaf (2002) investigated the interrelationship between competitive conditions and market structure controlling for the size of bank measured by the statutory fund among banks of Japan, Europe and US. The degree of competition was defined using Panzar-Rosse methodology. Level of competition increases with the size of bank and its geography also matters. That is, international banks face higher level of competition, which is consistent with other authors who used different methodology (Leuvensteijn et al., 2007; Maslovyh, 2009), namely, non-structural approach. Thus, the main conclusions of authors do not differ with respect to methodology employed. The adherents of either structural or non-structural approaches converge to the conclusion that higher level of concentration is associated with lower degree of competition.

It is worth mentioning, that estimation results for developed countries are different from emerging markets countries. Hempell (2002) and Majid et al. (2007) who investigate the competitiveness of German and Malaysian banking sectors respectively, using Panzar-Rosse approach and fixed effect estimation, report contradicting coefficients (different sign) near the same factor prices. For example, Hempell (2002) reported that rise in price of labor in Germany negatively affects the revenue of banks whereas Majid et al. (2007) concluded that opposite situation is observed in Malaysia. That is, one can not extrapolate the

existing models for investigating Ukrainian banking sector at least because of contradictions in literature concerning the factor prices and its effect on revenue.

Concerning the Ukrainian banking system researchers, mostly authors have been investigating the loan market and focused on the determinants of lending behavior of banks. For example, Talavera et al. (2006) report that macroeconomic uncertainty negatively affects the volume of banks' lending. Golodniuk (2006) concludes that banks' loans significantly depend on monetary policy. Small and undercapitalized banks are exposed more to impact of monetary policy. In spite of the fact that Ukrainian banking system is widely investigated, none of the researchers focused on the competition issue of Ukrainian banks as a sector. In this research the Panzar-Rosse (1987) approach is used to determine the degree of competitiveness by assigning a particular numerical value to the banking sector ranging from -1 to 1, from which conclusions are made about the dominant market structure (monopoly, oligopoly, perfect competition).

To conclude, literature analysis shows that in spite of different methodologies the main conclusion of authors is common: among the variety of banking systems investigated there was no case of perfect monopoly.

Chapter 3

METHODOLOGY

According to Thakor and Boot (2008) the Panzar and Rosse approach investigates the extent to which changes in factor input prices are reflected in equilibrium industry or bank-specific revenues. This method was chosen mainly because it does not account for market structure; it uses verifiable variables, which are explicitly stated in the balance sheet and allows for bank-specific unobservables, which is beneficial when conducting empirical research. In particular, Panzar and Rosse (1987) developed the approach to define whether empirical conduct of the banks in accordance with textbook models of perfect competition, monopoly or oligopoly (Goddard and Wilson, 2006).

Let's follow Panzar and Rosse (1987) to formulate their method. The model is derived from general market model, which determines the equilibrium number of banks and equilibrium output by maximizing profits at the bank and the industry level. The core assumption here is that market is in a long-run equilibrium (will be additionally tested). From theory it follows that to maximize profits the following condition must hold: $MR=MC$, in addition zero profits are earned in market equilibrium:

$$R_i^*(Y^*, n^*, Z_i) - C_i^*(Y^*, w_i, T_i) = 0 \quad (1)$$

R_i – revenues, n – number of banks, C_i – costs, Y_i – output, w_i – vector of k factor input prices, Z_i and T_i refer to vectors of exogenous variables that impact the bank's revenue and cost functions respectively.

Variables with asterisk (*) are the equilibrium values. The extent to which a change in factor input prices ($dw_{k,i}$) for $k=1, \dots, m$ is reflected in the equilibrium revenues (dR^*), earned by bank i . A measure of competition H is defined as the sum of the reduced form revenues with respect to factor prices:

$$H = \sum_{k=1}^m \frac{\partial R_i^*}{\partial w_{k,i}} \frac{w_{k,i}}{R_i^*} \quad (2)$$

According to Bikker and Haaf (2002) different values of H correspond to different conclusions about the degree of competitiveness. For example, $H \leq 0$ indicates a collusive oligopoly or a monopoly, in which an increase in costs causes output to fall and price to increase. Because the profit-maximizing firm must be operating on the price elastic portion of its demand function, total revenue will fall. If $0 < H < 1$, industry faces the intermediate case of monopolistic competition in which an increase in costs causes revenues to increase at a rate slower than the rate of increase in costs. Finally, $H=1$ points out the perfect competitive industry, in which an increase in costs causes some firms to exit, price to increase and the revenue of the survivors to increase at the same rate as the increase in costs.

The strongest assumption of this model, namely, that markets are in long-term equilibrium can be empirically tested. According to Stewart et al. (2009) markets in the competitive equilibrium imply that return is uniform among banks. That is, input prices should not correlate statistically with the rate of return. Consequently, by replacing the bank revenues by return on asset (ROA) and calculating the E statistics¹ one can define whether market in long term equilibrium ($E=0$), the rest of possible values of E would imply that market in disequilibrium.

When dealing with non-structural models describing the competition the choice must be done on how to define bank's production process. In given research input/output definition is used, developed by Sealey and Lindley (1977). However, the specifics of given research is different: only inputs and its effect on operational income is considered. In given research it is assumed that banks employ three factors: attracted funds (deposits, savings certificates, debt securities etc), labor and capital. Thus, banks care about the price for each factor. Different authors use different proxies for the factors specified above based on data availability. In this study factor prices are defined as follows:

FP1 – the ratio of interest expenses to deposits. This variable reflects the unit price of attracted funds.

FP2 - the ratio of personnel expenses to total assets. It is a proxy for the price of labor. Definitely, the ratio of personnel expenses to total number of employees is undoubtedly better measure of price of labor, but such information concerning the quantity of employees in bank is not available in Ukraine. Besides, this proxy for price of labor is widely used in literature.

FP3 - is the ratio of non-personnel expenditures to total assets. This is the proxy for average cost of capital.

The dependant variable is operational income (OI). The sum of coefficients near the factor prices yields the value of H-statistics defined above, from which can be deduced about the degree of competitiveness.

Besides factor prices the set of bank-specific variables will be included in estimation equation to check for robustness of factor prices to inclusion of other variables. Regression equations have different specifications, based on the

¹ E statistics is defined as the sum of coefficients near the factor prices having ROA as a dependant variable.

covariance matrix to avoid the multicollinearity problem. Bank specific variables are as follows:

Market share: Measured as a ratio of bank's assets to total assets of all banks. From theoretical point of view bigger banks can generate more profits from existing assets since they have higher product diversification, but as Pasiouras and Kosmidou (2007) point out there may be reversed effect on bank's profitability because "economy of scale" sometimes affects only small banks. So, expected sign is ambiguous.

Statutory fund dummies (STF). Given variables are included to see whether size of bank influences the revenue bank generates. In research the distinctiveness is made between local banks (statutory fund \geq €1000 thousand), regional banks (\geq €3000 thousand) and big banks (\geq €5000 thousand). The distinction comes directly from the legislation about the bank's activity.

Total assets (TASS) are included to control for the size of bank. Some authors also reason its inclusion in order to have the proxy for economies of scale (Shaffer, 1994).

Loans to assets (RL) ratio is considered as the proxy for risk. Expected sign is ambiguous since riskier banks sometimes are able to generate higher revenues.

Equity over total assets (EQAS): this variable is used as a proxy for the bank capital. The expected sign is ambiguous, since banks with higher level of equity tend to be less risky than those with lower level of equity which means that bigger banks may be less profitable. From the other side, banks with higher equity level don't need as much external financing comparing to banks with lower level of equity, thus paying less interest on loan and decreasing their expenses. So, this

variable is widely used by different authors (Dietrich and Wanzenried, 2009; Delis et al., 2006 etc) and often reported to be highly significant.

The key tasks of given research is to determine the overall competitiveness of Ukrainian banking system and to check its robustness to inclusion of another variables in estimation equations. This is why all bank specific variables will be included in revenue equations in different combinations.

Specifications considered in the research to determine the H statistics are given below:

Specification 1:

$$\ln OI_{it}^t = \alpha_0 + \sum_{k=1}^3 \alpha_j \ln FP_{it}^j + \beta_1 \ln(TASS) + \beta_2 RL + \beta_3 \ln(EQAS) + \varepsilon_{it} \quad (3)$$

Specification 2:

$$\ln OI_{it}^t = \alpha_0 + \sum_{k=1}^3 \alpha_j \ln FP_{it}^j + \sum_{k=1}^3 \pi_1 STF + \lambda_1 \ln RL + \lambda_2 MS + \varepsilon_{it} \quad (4)$$

Since there are debates in literature about scale or not to scale the dependant variable on the value of assets, estimation results for both scaled and unscaled equations are reported.

According to the correlation matrix (see appendix A). Market share and total assets are highly correlated (>0.8). This is why when defining the regression equation either total assets or market share is used.

H statistics is given by $H = \alpha_1 + \alpha_2 + \alpha_3$.

Since there are two specifications used in the study, one needs corresponding two specifications for testing the long-term equilibrium (E). Specification (5) for testing the latter assumption for equation (3) and specification (6) for testing whether assumption holds for equation (4):

$$\ln(1 + ROAA)_{it}^t = \alpha_0 + \sum_{k=1}^3 \varphi_j \ln FP_{it}^j + \beta_1 \ln(TASS) + \beta_2 RL + \beta_3 \ln(EQAS) + \varepsilon_{it} \quad (5)$$

$$\ln(1 + ROAA)_{it}^t = \alpha_0 + \sum_{k=1}^3 \varphi_j \ln FP_{it}^j + \sum_{k=1}^3 \pi_1 STF + \lambda_1 \ln RL + \lambda_2 MS + \varepsilon_{it} \quad (6)$$

where: ROA – return on assets.

E statistics defined as: $E = \varphi_1 + \varphi_2 + \varphi_3$.

To estimate equations (3)-(6) the fixed and random effect estimation are used. Various specification tests are to be applied to determine the best fit model.

Error term is assumed to be:

$$\varepsilon_{it} = u_i + e_{it} \quad (7)$$

According to Wooldridge (2003) simple regression may suffer from omitted variable (efficiency of management, bank's access to funding etc) bias – this is the key reason for using the fixed effects estimator. The variable u_i captures all unobserved, time-constant factors that affect dependant variable. The fixed effect estimator is robust to possible correlation of u_i with other explicative variables.

Chapter 4

DATA DESCRIPTION

Data were collected primarily from the two sources: NBU and Association of Ukrainian banks websites. The period is covered by the panel quarterly data ranges from 2005:1 to 2009:1 inclusively and consists of 4 observations per each year (quarterly data) reported in: January, April, July, October. The choice of period for research is based on data availability. Because mostly variables used in regression were not directly given, some deductions and ratios were made in order to obtain all necessary variables for regression.

The main bank-by-bank dataset may be divided by four blocks:

- *Assets*. Given block enabled the research with the key scale variable – assets per se. In addition, block allows to calculate the proxy for risk – loans to assets ratio and market share of particular bank.
- *Financial results*. Contain the information about all kinds of expenses which together with other blocks allow calculating the proxy for labor expenses (factor price 2) and proxy for capital expenses (factor price 3), operational income, return on assets. Unfortunately, given block stops reporting the “personnel expenses” after 2009:1. The latter fact makes impossible to expand research to further periods.
- *Liabilities*. This block together with “assets” allows to determine the price of attracted funds (factor price 1). Also statistics concerning the owners of deposits is reported (physical vs juridical person).

- *Equity*. Main variables contained within given block are statutory fund dummies, which are reported in UAH. So, statutory fund in EUR in particular quarter was found by converting the UAH into EUR using the exchange rate prevailing at the same quarter. Reported equity column allows to calculate the equity to assets ratio.

Reliability of data for some banks has been crosschecked by comparing the data reported on the NBU website and those available at bank's website. The sample of about 40 % of banks has been taken in different points of time. Large discrepancies were not observed since every rational bank understands that biased information may lead to the loss of already obtained clients' credence. Besides, according to the information of website by Financial Initiative bank, Ukrainian banks keep working at their openness. To illustrate this, "from 107 banks included in the rating, 22 received the highest credibility category, 59 showed acceptable credibility level and 26 financial institutions were assigned satisfactory credibility level" (Financial Initiative, 2008). Thus, the major part of banks is quite reliable (at least starting from 2005), which makes Ukrainian statistics useful. All sites mentioned above have the data from which it is possible to calculate all explicative and endogenous variables for equations (3) - (6).

Except for the Panzar-Rosse (1987) approach, there are also exist less advanced methodologies for determining the level of competition in particular industry, namely, the concentration ratio (CR) and Herfindahl-Hirschman Index (HHI). The concentration ratio is the sum of market shares (MS) of m largest banks (3, 5 and 10 are the most widely used) calculated as the ratio of bank's i assets and total

amount of all banks' assets; assets are defined as the proxy for bank activity². The HHI is calculated as the sum of squared market shares of all industry participants.

Figures 4.1 and 4.2 contain the concentrations ratios for loans and assets respectively. Empirically CR3 and CR5 for loans declined by January, 2009 comparing to January, 2005, may be because of increased quantity of banks (160 vs. 179), whereas the CR10 increased within the given period. That is, loans concentration ratios yield ambiguous results depending on the number of banks m used.

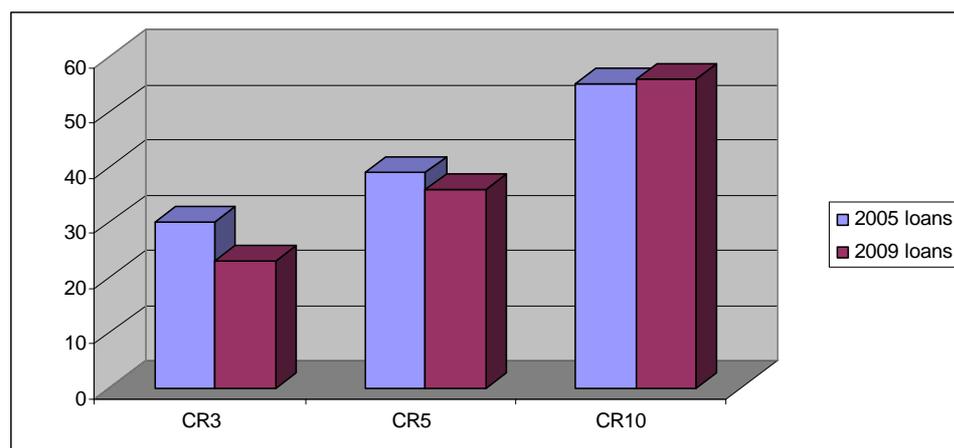


Figure 4.1. Concentration ratios for loans, %

Concentration ratios in terms of assets (figure 4.2) show similar results to loans: decrease in CR3 and CR5, and negligible changes in CR10. This may be explained by the fact that top 10 banks (in terms of assets) are different in 2005 and 2009 and during the wave of mergers and acquisitions of Ukrainian banks, foreign banks had an opportunity to become top 10 banks. Although high concentration ratio does not necessarily imply that market faces imperfect competition, but the

² Alternatively in order to make proxy for bank activity more narrow loans or deposits may be used instead of assets.

fact that 5 % (10 banks) are owners of 50 % of loans and assets puts a question mark on the degree of competitiveness of Ukrainian banking sector.

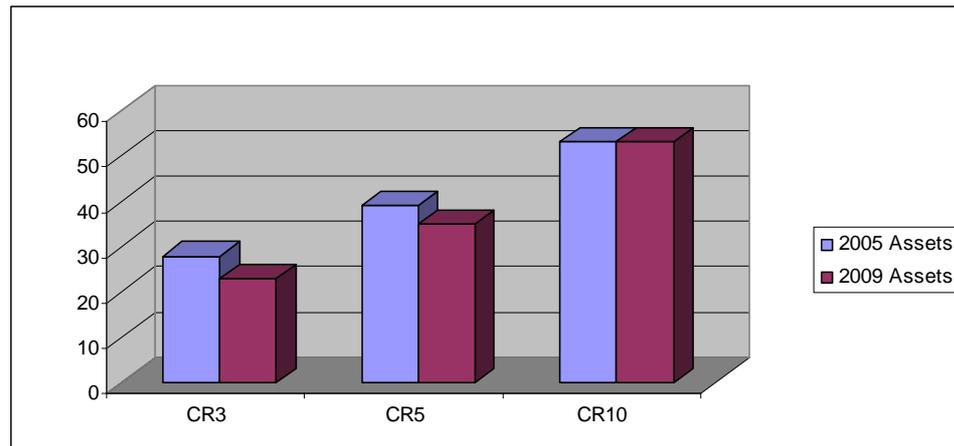


Figure 4.2. Concentration ratios for assets, %

Looking at figure 4.3 one can see that HHI declines in January, 2009 comparing to January, 2005. In spite of fluctuations HHI during the whole period indicates an unconcentrated index which is consistent with competitive market.

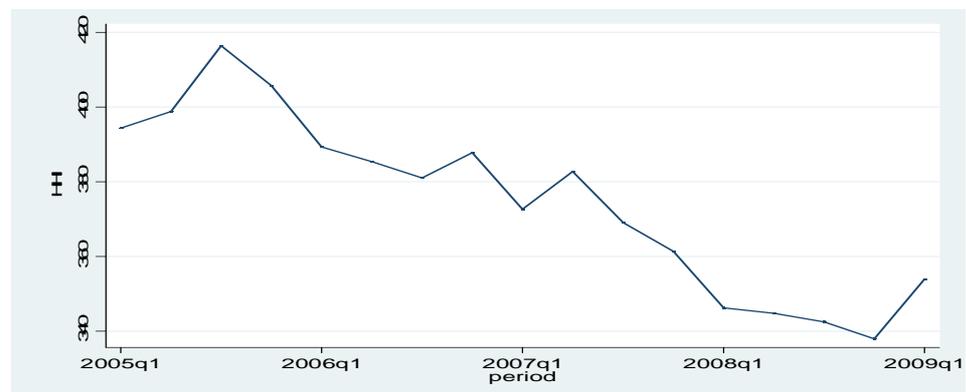


Figure 4.3. HHI during 2005-2009

However, Claessens and Laeven (2004) and Bikker (2003) shown that concentration ratios and HHI are poor measures of competition, because industry may have high concentration ratios whereas the overall level of competition is quite high. In given paper more advanced methodology is used developed by Panzar and Rosse in order to obtain the unambiguous results concerning the degree of competition of Ukrainian banks. To estimate the degree of competition regression equations (3) and (4) include three factor prices variables defined in the methodology section and bank-specific variables to control for different size of banks and risks.

Descriptive statistics for all variables necessary for estimation of equations (3), (4) is presented in table 4.1. It contains the aggregated statistics over the whole period 2005:1-2009:1. Worth mentioning that, the total number of observations is 2861 (see appendix for descriptive statistics of the whole population). However, due to the log-log specification of estimated equations and unbalanced panel data, negative values of operational income were dropped (91 observations). That is, regression sample represents about 97 % of initial population (2770 vs 2861), which makes sample data quite reliable.

Table 4.1. Sample summary statistics over the whole period

Variable	Obs	Mean	Std. Dev.	Min	Max
Operational income, mil UAH	2770	122.54	409.68	0.06	9844.54
ROA, ratio	2770	0.01	0.02	-0.45	0.23
Interest revenue/deposits and equivalentents (FP1), ratio	2770	0.05	0.04	0.00	1.30

Table 4.1 – Continued

Variable	Obs	Mean	Std. Dev.	Min	Max
Personnel expenses/total assets (FP2), ratio	2770	0.02	0.01	0.00	0.23
Non-personnel expenses/total assets (FP3), ratio	2770	0.02	0.01	0.00	0.22
loans/assets (RL), ratio	2770	0.66	0.25	0.02	11.25
total assets (TASS), mil UAH	2770	2471.93	6474.24	24.21	80200.00
equity/assets (EQAS), ratio	2770	0.22	0.18	0.00	2.24
market share (MS), %	2770	0.61	1.39	0.01	11.11
Statutory fund dummies					
statutory fund (small banks), mil euro	72	2488.51	378.87	1744.38	2988.51
statutory fund (medium banks), mil euro	468	4103.18	564.77	3006.66	4995.33
statutory fund (big banks), mil euro	2230	31090.77	63801.47	5000	1280369

Looking at table 4.1 one can deduce that in spite of the quite high operational income the return on asset in banking sector is quite low (on average 1 %). This may be explained by the high value of total assets (average value about 3 billion UAH). Loans to assets ratio varies a lot from 0.02 to 11.25 multiple. Worth mentioning that most part of Ukrainian banks are big banks with statutory fund higher than 5 000 000 euro.

Chapter 5

ESTIMATION RESULTS

Estimation results for both specifications (3), (4) are reported in Appendix C. Since there are two different specifications which use both scaled and unscaled operational income, the total number of regression equation totals to four. Equations in Appendix C do not control for time specific intercept. In contrast, Appendix E contains obtained results for the same specifications, but controlling for time-specific intercept and Appendix F reports the long-run equilibrium test when controlling for time specific intercept.

Let's consider equations without time dummies first (Appendix C). From estimated results it may be concluded that all factor prices are significant at 1 % confidence interval. In given case, in spite of different value of H statistics (ranges from 0.94 to 0.99) the main conclusion is not changed: Ukrainian banking system faces the intermediate case of competition (between monopolistic and perfect) in which an increase in costs causes operational income to increase at a rate slower than the rate of increase in costs. Obtained estimates of H statistics are robust to inclusion of other explicative variables (since all specifications yield similar value of H), in spite of difference in values of estimates near the factor prices. In spite of the fact that, the value of H statistics is very close to 1 the F-test rejects the hypothesis that $H=1$ ($H=0$ is rejected either) 1 % confidence interval in three out of four different specifications (see Appendix C).

As an alternative to fixed effect one could use the random effect estimation. However, the random effect model is rejected by Hausman and Breusch-Pagan tests. Thus, that variation of bank-specific unobservables across banks is not

random, but constant over time and correlated with the independent variables included in the model.

From looking at estimate results it may be concluded that rise in total assets by 1 % increases the operational income by 1.05 % (economy of scale) and operational income/asset ratio by .05 %, which is consistent with the difference in models' specifications.

Estimation results suggest that ratio of loans to assets has the significant impact on the dependant variable although its value changes as the specification of the model changes. On average increase in the loans/assets ratio by 1 % causes operational income to increase by 0.2-0.5 % (depending on the specification of model) and operational income to assets ratio by 0.2 %. Thus, in any case, Ukrainian banking loan market remunerates for risk.

Dummy variables reflecting the size of statutory capital are quite ambiguous and depend on the model specification. Market share has unambiguously positive significant impact on dependent variables despite of its specification.

Let's switch to Appendix D where regressions coefficients are reported, but controlling for time specific intercept. Depending on the specification the value of H statistics varies from 0.11 to 0.62, indicating much higher variation comparing to the specifications which did not control for time specific intercept. Nevertheless, since the value of H statistics lies in the interval between 0 and 1 for all specifications, the conclusion about monopolistic competition in Ukrainian banking sector is still valid and confirms the results of regressions obtained without control for time specific intercept (Appendix C). Concerning the bank specific variables one can deduce that total assets and equity to assets ratio have positive and significant impact on operational income disregarding the scaling. However, the market share positively and significantly impacts operational

income only in specification with unscaled dependant variable (operational income per se).

Thus, two sets of models presenting the same conclusions concerning the market structure of the market (monopolistic competition). In order to choose the best one needs to refer to the assumption of long-run equilibrium, according to which the profitability of banks should not be statistically correlated with factor prices. For doing the dependant variable in both specifications is replaced by the return on assets (ROA) and regressed against all explicative variables considered in particular specifications (equations (5), (6)). According to Matousek et al. (2009) at competitive markets the return is uniform across the banks. That is, bank's operational income should not be correlated statistically with the rate of return ($E=0$). Table C2 contains the value of E statistics for specification without period dummies in which F test rejects the hypothesis that $E=0$ since the p-value is 0. In contrast, from Table D2 it follows that for specification 1 the hypothesis that $E=0$ can not be rejected at even 10 % confidence interval, whereas the E statistics for specification 2 may be rejected at 10 % confidence interval. In any case, when controlling for time-specific intercept the assumption about long-run equilibrium is more likely to hold comparing to models without time dummies (Appendix C).

To conclude, it was found that controlling for time dummies imply that assumption about long run equilibrium holds. In such a way, it is deduced that Ukrainian banking sector faces the monopolistic competition since estimated value of H statistics ranges from 0.11 to 0.62. The hypotheses about pure monopoly and perfect competition are strongly rejected.

Chapter 6

CONCLUSIONS

In given paper the Panzar-Rosse (1987) approach is used to estimate the degree of competition of Ukrainian banking sector. Instead of focusing on some particular bank's activity (loan or deposits market), this methodology tests the level of competitiveness over bank's activities, since the total operational income is used as a dependant variable. From estimated results it may be deduced that purely theoretical formulation of H statistics is consistent with bank's conduct in the case of Ukraine; given methodology proved itself to be quite reliable and widely used in modern literature. Panzar-Rosse methodology assigns a particular numerical value which is the basis for the conclusion about the dominant market structure in the industry.

Banks play the vital role in economy through payment system functioning, redistribution of wealth through attracting deposits and giving loans etc. Moreover, there are certain papers which prove that economic growth of the country is linked to the development of banking system (Strahan, 1996; Levine, 2003). The crucial role of banks in country's growth makes the issue of competition extremely important. Since, the inevitable consequence of competition is the reduction of prices charged by banks for their services which positively impacts the welfare of consumers.

In paper different specifications are used to see whether factor prices coefficients are robust to inclusion of different variables. Regressions which contain the time-specific intercept tend to be more reliable comparing to models with common intercept, since time dummies insure that long-run equilibrium assumption holds.

Concerning the estimated value of H statistics, it varies between 0.11 and 0.62 (controlling for time-specific intercept). In spite of fluctuations, the main conclusion of a paper is common for all specifications: Ukrainian banks earn their profits in market with monopolistic competition, which is far from perfect³. The hypothesis about perfect monopoly is strongly rejected for all specifications. However, there is still place for improvement towards the perfect competition.

Concerning the bank specific variables, total assets have positive and significant impact on both scaled and unscaled operational income. Loans to assets ratio indicates that market remunerates for risk – higher values of operational income are associated with proxy for risk. Equity positively and significantly impacts operational income, whereas the market share has ambiguous impact on income.

From the theoretical point of view the estimated value of H statistics indicate that average consumer overpays for bank services comparing to perfect competition situation. Governors are also worse off since the competitive markets are easier to regulate through market mechanisms, whereas the monopolistic competition requires directive policy methods.

As an extension of given paper one could extrapolate the given methodology for determining the level of competition in other industries. This would help policy makers to apply the most appropriate mechanism for regulations (market or administrative mechanism).

³ Although models with common intercept suggest the value of H at the level of 0.98. The assumption about long-run equilibrium fails, since the value of E is not equal to zero statistically.

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APPENDIX A

Table A1: Correlation matrix of regression sample

	Operational income	Factor price 1	Factor price 2	Factor price 3	Total assets	Loans/Assets, ratio	Equity/Assets, ratio	Market share, %	Return on assets, ratio
Operational income	1.00								
Factor price 1	0.02	1.00							
Factor price 2	0.07	0.33	1.00						
Factor price 3	0.01	0.37	0.76	1.00					
Total assets	0.89	-0.05	-0.04	-0.11	1.00				
Loans/Assets, ratio	0.10	0.07	0.10	0.09	0.10	1.00			
Equity/Assets, ratio	-0.17	0.06	0.17	0.24	-0.23	0.08	1.00		
Market share, %	0.72	-0.07	-0.05	-0.09	0.84	0.08	-0.26	1.00	
Return on assets, ratio	0.05	0.04	-0.14	-0.17	0.03	0.03	-0.04	0.03	1.00

APPENDIX B

Table B1: Descriptive statistics of the whole population

Variable	Obs	Mean	Std. Dev.	Min	Max
Operational income, mil UAH	2861	118.76	403.95	-10.45	9844.54
ROA, ratio	2861	0.01	0.03	-1.41	0.23
Interest revenue/deposits and equivalents (FP1), ratio	2861	0.05	0.13	-1.64	6.48
Personnel expenses/total assets (FP2), ratio	2861	0.02	0.01	0.00	0.23
Non-personnel expenses/total assets (FP3), ratio	2861	0.02	0.01	0.00	0.22
loans/assets (RL), ratio	2861	0.66	0.26	0.00	11.25
total assets, mil UAH (TASS)	2861	2404.07	6381.57	24.21	80200.00
equity/assets, ratio (EQAS)	2861	0.23	0.19	-0.65	2.24
market share (MS), %	2861	0.59	1.37	0.01	11.11
statutory fund (small banks), mil euro	75	2481.858	381.0205	1744.38	2988.51
statutory fund (medium banks), mil euro	481	4110.86	565.1078	3006.66	4995.33
statutory fund (big banks), mil euro	2305	30412.17	62887.89	5000	1280369

APPENDIX C

Table C1: Estimation results for regression equations (3) and (4)

Dependant variable	Specification 1		Specification 2	
	LN(OI)	LN(OI/ASSETS)	LN(OI)	LN(OI/ASSETS)
log of FP1	0.134 (0.031)**	0.134 (0.031)**	0.523 (0.060)**	0.151 (0.033)**
log of FP2	0.294 (0.033)**	0.294 (0.033)**	0.736 (0.058)**	0.341 (0.032)**
log of FP3	0.512 (0.025)**	0.512 (0.025)**	-0.274 (0.053)**	0.464 (0.026)**
log of Total Assets	1.051 (0.012)**	0.051 (0.012)**	-	-
log of Loans/Assets	0.177 (0.037)**	0.177 (0.037)**	0.429 (0.085)**	0.189 (0.038)**
log of Equity/Assets	0.022 (0.005)**	0.022 (0.005)**	-	-
small banks	-	-	-0.62 (0.082)**	0.068 -0.037
midle banks	-	-	-0.314 (0.045)**	0.067 (0.022)**
market share	-	-	0.676 (0.104)**	0.072 (0.020)**
Constant	0.215 -0.19	0.215 -0.19	13.832 (0.125)**	0.866 (0.064)**
Observations	2770	2770	2770	2770
H stats (logFP1+logFP2 +logFP3)	0.94	0.94	0.985	0.956
F test that $\sum FP=1$, p-value	0	0	0.52	0
Number of unique_id	212	212	212	212
R-squared	0.9	0.81	0.54	0.81

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%

Table C2: Long-run equilibrium test for regression equations (3) and (4)

Dependant variable	Specification 1	Specification 2
	ln(ROA)	
log of FP1	0.006 (0.004)	0.007 (0.005)
log of FP2	-0.004 (0.004)	-0.003 (0.003)
log of FP3	0 (0.002)	-0.001 (0.002)
log of Loans/Assets	0.005 (0.004)	0.006 (0.004)
log of Total Assets	0.002 0.001	-
log of Equity/Assets	0 0	-
small banks	-	0.004 (0.002)*
midle banks	-	0.002 (0.001)
market share	-	0 (0.001)
Constant	-0.008 (0.022)	0.014 (0.008)
Observations	2770	2770
E stats (logFP1+logFP2+logFP3)	0.002	0.003
F test that $\sum FP=0$, p-value	0	0
Number of unique_id	212	212
R-squared	0.05	0.05

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%

APPENDIX D

Table D1: Estimation results for regression equations (3) and (4)⁴

Dependant variable	Specification 1		Specification 2	
	LN(OI)	LN(OI/ASSETS)	LN(OI)	LN(OI/ASSETS)
log of FP1	0.06 (0.030)*	0.06 (0.030)*	0.197 (0.046)**	0.073 (0.032)*
log of FP2	0.27 (0.032)**	0.27 (0.032)**	-0.191 (0.048)**	0.228 (0.033)**
log of FP3	0.286 (0.037)**	0.286 (0.037)**	0.102 -0.054	0.272 (0.037)**
log of Loans/Assets	0.301 (0.039)**	0.301 (0.039)**	0.487 (0.067)**	0.316 (0.040)**
log of Total Assets	1.104 (0.029)**	0.104 (0.029)**	-	-
log of Equity/Assets	0.03 (0.009)**	0.03 (0.009)**	-	-
small banks	-	-	-0.008 (-0.061)	0.024 (-0.037)
midle banks	-	-	-0.009 (-0.029)	0.048 (0.021)*
market share	-	-	0.497 (0.058)**	-0.007 (0.019)
Constant	-1.337 (0.327)**	-1.337 (0.327)**	10.161 (0.230)**	-0.274 (0.167)
Observations	2770	2770	2770	2770
H stats (logFP1+logFP2+log FP3)	0.616	0.616	0.108	0.573
F test that $\sum FP=1$, p-value	0	0	0	0
Number of unique_id	212	212	212	212
R-squared	0.92	0.84	0.82	0.84

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%

⁴ All four specifications in Table D1 control for time specific intercept.

Table D2: Long-run equilibrium test for regression equations (3) and (4)⁵

Dependant variable	Specification 1	Specification 2
	ln(ROA)	
log of FP1	0.004 (0.004)	0.005 (0.004)
log of FP2	-0.001 (0.003)	-0.004 (0.004)
log of FP3	-0.006 (0.003)*	-0.007 (0.003)*
log of Loans/Assets	0.008 (0.004)*	0.01 (0.004)*
log of Total Assets	0.008 (0.003)**	-
log of Equity/Assets	0.001 (0.001)	-
small banks	-	0.002 (0.002)
midle banks	-	0.001 (0.001)
ms	-	-0.001 (0.001)
Constant	-0.094 (0.042)*	-0.012 (0.016)
Observations	2770	2770
E stats (logFP1+logFP2+logFP3)	0.00	-0.01
F test that $\sum FP=0$, p-value	0.27	0.07
Number of unique_id	212	212
R-squared	0.09	0.08

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%

⁵ All four specifications in Table D2 control for time specific intercept