BANKS AND FINANCES

Ganna Karcheva, ScD in Economics
ORCID ID: https://orcid.org/0000-0002-5897-8445
The University of Banking, Kyiv, Ukraine
Karina Dalgic
ORCID ID: https://orcid.org/0000-0001-7015-6324,
The University of Banking, Kyiv, Ukraine

NON-STRUCTURAL MODELS OF THE ASSESSMENT OF BANKING COMPETITION IN UKRAINE

The article considers non-structural methods of assessing the level of the competition in the banking market of Ukraine, updates and improves them in accordance with the conditions of the banking market of Ukraine, and conducts current, dynamic, objective assessment of the level of banking competition. The modified Panzar-Rosse model (H-statistics) and the Lerner index were used to determine the impact of the processes of reforming the banking system of Ukraine on the level of banking competition. According to the results of the assessment of banking competition using the Lerner index, it is established that the banking system in Ukraine is characterized by monopolistic competition with the strengthening of market power of the state-owned banks. According to the results of the assessment of banking competition in Ukraine based on the values of the Lerner index for each of the groups of banks, the banks with the greatest impact on competition in the banking sector have been identified. Research (conducted using a modified Panzar-Rosse model according to the data of the general set of banks) confirmed the hypothesis that reforming the banking system not only improved its stability, but also improved banking competition. It is proved that it does not matter which variable to take for the construction of the Panzar-Rosse model – "operating income" or "interest income", – the models will be identical. The developed Panzar-Rosse model provides an inclusion of the indicators of stability of banks to the explanatory variables, as well as the usage of the net gross income as a productive variable, which is a better and more objective financial indicator of banks' performance and efficiency of competitive position management, coherent asset management and liabilities, income and expenses of banks. According to the results of the study, the ways to increase the level of competition in the banking sector of Ukraine are proposed.
Key words: banking sector; modelling; competition; reformation; stability.

Problem statement. Continuous monitoring of the competitive environment within the banking market is caused by the need to identify and generate early warning signals about the market situation, which will facilitate effective regulatory and supervisory decisions to adjust the trajectory of the development of the banking system. Especially relevant is the study of the level of banking competition in Ukraine as a result of the reformation of the banking system, which has taken place in recent years, as a result of which the banking system has undergone significant structural changes. Thus, there has been a significant reduction in the total number of banks due to the loss of solvency attributing to high risks in their activities, poor loan portfolios, significant lending to related parties, which caused the bankruptcy of these banks.

A characteristic feature of the reformed banking system of Ukraine was the decisive role of the state-owned banks in its development. They accounted for more than 60% of the banking system's assets, while before the crisis in 2008 state-owned banks accounted for 8%, this gives the reason to assume that the level of banking competition in Ukraine has decreased as a result of the reformation process. It is well known that the excessive level of monopolization and concentration of vast majority of resources within a limited

number of banks, negatively affects the development of the economy and banking system. It is therefore neccessary to study and assess the current level of the banking competition within Ukraine and the type of competition by non-structural methods adapted to Ukrainian realities, suggesting also the possible ways of improving the competition level which will contribute not only to the innovative development of products and services, but also the improvement of the practice of market players by increasing banking stability, liquidity and reputation.

Analysis of the latest studies and publications. There are two main approaches to measure the competition level: structural and non-structural. Traditional theory is based on the structural models that assume a relationship between the structure of the industry and the market share. Non-structural models directly measure the behavior of the market participants, this determine the degree of competition. Non-structural models allow analyzing the competition level on the basis of pricing in banks. In particular, non-structural models are based on the theory of equilibrium market, according to which pricing is based on cost (markup pricing).

Some researchers[1] (Beck T., 2008; Feldkircher M. et al., 2017) believe that concentration ratios (such as market share ratio or Herfindahl-Hirschman index), which are usually used as indicators of the competitive environment, are not always the objective indicators of competition, as they do not reflect the real market situation and are weakly correlated with the competitive behavior of banks. Therefore, it is proposed to analyze the level of the competition in the banking market of Ukraine according to the non-structural models. In such models, the competitive environment is determined not by the structure of the market, but by the strategic decisions of market participants. The non-structural models, measure competition without the use of clear information on the structure of the market, and are based on obtaining a market impact assessment based on observations of bank behavior. The non-structural approach to measure the competition level uses such indexes as: the Lerner's index[2], the Boone's indicator of "effective competition"[3], indicators of price and quantitative reaction of the bank to competitors, developed by Bresnahan T.[4], and Lau[5], indicators of the bank interchangeability for consumers, proposed by Barros and Mudesto[6], H-Statistics or the Panzar-Rosse approach[7] and others.

Among the above non-structural models, the article calculated the Lerner's index and H-Statistics for the banking market of Ukraine.

The Lerner index is calculated on the basis of information about the activities of an individual bank and measures its power in the market depending on the excess over marginal costs, it can set interest rates on deposits or loans. The Lerner index is calculated by the following formula:

$$L = \frac{P - MC}{P} \quad , \tag{1}$$

where L – the Lerner index, P – interest rates on deposits or loans; MC – marginal cost.

As the value of P (price) the value of the average interest rate on loans has been used, because the main interest income for Ukrainian banks is interest income on loans:

$$P = \frac{\text{Interest income}}{\text{Loans and receivable s}} \quad , \tag{2}$$

---

[1] Beck, T. (2008). Bank competition and Financial stability: Friends or Foes? *World Bank* <https://openknowledge.worldbank.org/bitstream/handle/10986/6863/wps4656.pdf?sequence=1&isAllowed=y> (2021, January, 25); Feldkircher, M., Sigmund, M. (2017). Comparing market power at home and abroad: evidence from Austrian banks and their subsidiaries in CESEE. Focus on European economic integration. *Oesterreichische National Bank*, 59-77.

[2] Lerner, A. (1934). The concept of monopoly and the measurement of monopoly power. *Rev. Econ. Stud.*, *1*, 157-175.

[3] Boone, J. (2000). Competition. *CEPR DP, 2636.*

[4] Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics Letters, 10 (1)*, 87-92.

[5] Lau, L. J. (1982). On identifying the degree of competitiveness from industry price and output data. *Economics Letters*, *10 (1)*, 93-99.

[6] Barros, F., Modesto, L. (1999). Portuguese banking sector: A mixed oligopoly? *International Journal of Industrial Organization*, *17 (6)*, 869-886.

[7] Panzar, J. C., Rosse, J. N. (1987). Testing for "monopoly" equilibrium. *The Journal of Industrial Economics*, 443-456.

As the value of the marginal costs (MC) the value of the average cost of the borrowed funds has been used, weighted by the cost of reserves and administrative costs, because the Lerner index must also include an adjustment for the credit risk, ie when calculating marginal costs must include not only general administrative costs, but also the costs of the credit risk coverage[1]:

$$MC = \frac{\text{Interest expenses} + \text{Deductions to reserves} + \text{Administra tive and other costs}}{\text{Customer deposits}} \quad , \qquad (3)$$

The Lerner index value can be between 0 and 1 (0% and 100%). The higher Lerner index, the stronger influence of an individual bank and, consequently, the lower competition level. It is worth noting that there is no consensus among the scientists and practitioners on the best indicator for the assessing the competition level. Moreover, sometimes different studies for one country and for one study's period get different conclusions about the level and dynamics of the competition level. As a rule, the bank's assets or loan portfolio are used, but in some cases the bank's deposit portfolio is used.

Non-structural models take into consideration, that bank's performance indicators are used to approximate competition, this assesses the competition level in the banking sector. Panzar-Rosse model is based on the assumption that banks operate in the ong-term equilibrium. The following parameters are observed: the banks interact between each other, influencing each other's actions, the elasticity of demand exceeds 1, a homogeneous cost structure is maintained. For banks, H-Statistics is defined as the elasticity of the bank's interest income at three factor prices: the cost of funding, staff costs and other costs.

The classic model of Panzar-Rosse is:

$$\ln(R) = a + \beta \ln(FIP) + \gamma \ln(ETA) + \delta \ln(TA) + \varepsilon \quad , \qquad (4)$$

where R – the bank's income (dependent variable); FIP – variables that reflect cost prices in the activities of the banks; ETA – variables that describe specific factors; TA – total assets; ε – the remainder of the model.

The value of H-Statistics is defined as the sum of the coefficients β for the variables included in the FIP component. If $H \leq 0$, then there is a monopoly in the market, $0 < H < 1$ – monopolistic competition; $H = 1$ – perfect competition.

Note, that the stability of the banks is a necessary condition for the development of banking competition. Therefore, we propose to include such explanatory factor variables as the level of capitalization and liquidity in the modified Panzar-Rosse model. Building econometric models based on annual data for the banking system of Ukraine for the period of 1999 to the present indicating the importance of maintaining banks at a sufficient level of liquidity and solvency to ensure their viability[2].

Thus, such explanatory variables as the level of liquidity and capitalization, which are a necessary condition for financial stability and security of banks, have been included to the Panzar-Rosse model. That means that the level of competition in the banking system is determined not only by the scale of banks' cost efficiency, but also by the stability of their activities. A troubled bank cannot be competitive in the market.

Given the above, the following indicators were included in the modified Panzar-Rosse model:

– to the FIP component: the value of liabilities; salary costs of bank employees; other expenses, including administrative operating expenses, expenses for the formation of reserves (the last two indicators are calculated in relation to the assets);

– to the ETA component: the level of capitalization and liquidity that ensure the stability of the bank. Note, that exclusion of liquidity from the model led to a decrease in H-Statistics value, which indicates the feasibility of including this explanatory variable in the Panzar-Rosse model.

[1] Beck, T. (2008). Bank competition and Financial stability: Friends or Foes? *World Bank* <https://openknowledge.worldbank.org/bitstream/handle/10986/6863/wps4656.pdf?sequence=1&isAllowed=y> (2021, January, 25).

[2] Карчева, Г. Т. (2020). Фінансовий стан банків та розвиток механізмів стимулюючого банківського регулювання. *Сучасні тенденції стійкого фінансово-економічного розвитку та механізми їх реалізації в глобальному вимірі.* Дніпро: Університет імені Альфреда Нобеля, 148-167.

To build and analyze the above models the indicators of financial performance of all banks in Ukraine were used for this study's period, taken from the official website of the National Bank of Ukraine[1].

Some scientists include in the components of the FIP the deduction of banks in reserves to cover the risks of active operations, as these costs are a significant part of the costs of Ukrainian banks. Our inclusion of this variable in the Panzar-Rosse model led to the construction of an incorrect mathematical model, according to which the increase in the cost of formation of reserves affected the growth of interest and operating income, while it should cause their reduction due to the growth of problem assets. Therefore, the provisioning cost was excluded from the model as a separate variable.

Results. In the calculations of the non-structural indicator – the Lerner index – for the banking system of Ukraine, some banks, and sometimes all banks in some years (2017) had a negative value of the indicator, which may indicate unprofitable activities, increased risks, unprofessional financial management. In some cases, its value was higher than 1, which may indicate the maximization of profits of the banks while minimizing their marginal costs. To obtain more accurate result, those values of the Lerner index that are not included in the interval [0; 1] were not taken into account (Table 1).

Table 1

**The results of the calculation of the Lerner index for the banking system
of Ukraine, for 2012-2019**

Year	2012	2013	2014	2015	2016	2018	2019
Average	0,37	0,52	0,50	0,47	0,34	0,37	0,46
1at quartile (25%)	0,19	0,62	0,36	0,47	0,29	0,50	0,41
Median	0,19	0,62	0,36	0,47	0,29	0,50	0,41
2nd quartile (75%)	0,46	0,76	0,82	0,75	0,49	0,52	0,61
Number of banks within the [0;1] interval of the Lerner Index	9	7	7	6	4	7	67
Total number of banks being tested	175	180	158	111	99	77	75

Source: Developed by the authors on the basis of[2]

The dynamics of the average value of the Lerner index is shown in *Fig. 1.*
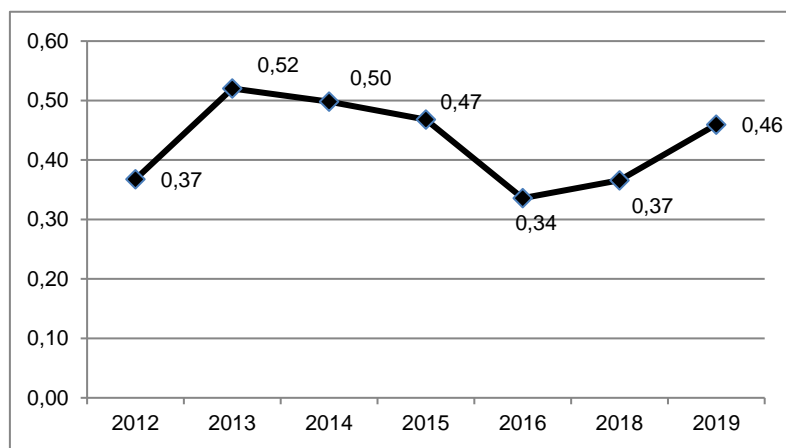
**Fig. 1. The dynamics of the average value of the Lerner index
for the banking market of Ukraine, for 2012-2019**

Source: Developed by the authors on the basis of[3]

---

[1] Офіційний сайт Національного банку України (2020). *Головна сторінка* <http://www.bank.gov.ua>
(2020, November, 18).

[2] Там само.

[3] Там само.

Note that during the reformation of the banking system the average value of the Lerner index in 2018 was 0.37 and in 2019 – 0.46. This indicates that the problem of the excessive power of the individual banks is not typical for the Ukrainian banking market, but the level of the competition has decreased due to the increased power of the state banks and the banks of foreign banking groups, as well as some private banks, which have conducted aggressive policy within the market of the banking services of Ukraine (Table 4). At the same time the level of the competition in 2019 is lower, than it was before the reformation processes of the banking system of Ukraine in 2013-2014 (the average value of the Lerner index in 2013 was 0.52 and in 2014 – 0.50), which indicates some improvement in the banking competition in Ukraine (Table 2).

Many experts suggest privatizing the state-owned banks as a measure needed for increasing the competition level in the banking market. However, it is unlikely that the privatization of state-owned banks will lead to the increased competition. Suggesting that, privatized state-owned banks are likely to start a more aggressive expansion for the sole purpose of maximizing profits. Instead, state-owned banks contribute to the achievement of the strategic economic goals and perform a number of social functions. In addition, it should be borne in mind that, reaching a certain level, competition begins to have a destructive effect on the stability of the banking system. Therefore, the presence of the state-owned banks in the banking system of Ukraine helps to increase public confidence. However, the high share of the state-owned banks in the banking services market of Ukraine leads to a decrease in the competition, low-quality loan portfolios, and a high share of non-performing loans formed in the banking sector, threatening the financial stability of the country and hinders the economic financing.

Table 2

Banks with the highest value of the Lerner index in 2019

Group of banks	Name of the bank	Value of the Lerner index
Banks with state share	JSC CB "PrivatBank" [AT KB "PryvatBank"]	0.83
	Oschadbank JSC [AT "Oshchadbank"]	0.68
	JSC "Ukreximbank" [AT "Ukreksimbank"]	0.48
	JSB UKRGASBANK [AB "UKRHAZBANK"]	0.65
Banks of foreign banking groups	Raiffeisen Bank Aval JSC [AT "Raiffaizen Bank Aval"]	0.58
	JSC "UKRSIBBANK" [AT "UKRSYBBANK"]	0.61
	CITIBANK JSC [AT "SITIBANK"]	0.93
	JSC "ING Bank Ukraine" [AT "INH Bank Ukraina"]	0.67
	JSC "PRAVEX BANK" [AT "PRAVEKS BANK"]	0.62
	Deutsche Bank DBU JSC [AT "Doiche Bank DBU"]	0.84
	SEB CORPORATE BANK JSC [AT "SEB KORPORATYVNYI BANK"]	0.86
	JSC "CREDIT EUROPE BANK" [AT "KREDYT YeVROPA BANK"]	0.78
	JSC "BTA BANK" [AT "BTA BANK"]	0.66
Banks with private capital	JSC "FIRST INVESTMENT BANK" [AT "PERShYI INVESTYTsIINYI BANK"]	0.78
	JSC "City Bank" [AT "Misto Bank"]	0.69
	JSC "ALTBANK" [AT "ALTBANK"]	0.72
	JSC "UNEX BANK" [AT "IuNEKS BANK"]	0.71
	JSC "BANK AVANGARD" [AT "BANK AVANHARD"]	0.89
	PJSC "FAMILY BANK" [PrAT "BANK FAMILNYI"]	0.98
	JSC "ALPARI BANK" [AT "ALPARI BANK"]	0.78

Source: Developed by the authors on the basis of[1]

---

[1] Там само.

Regarding another non-structural model, the Panzar-Rosse, or H-statistics, it should be noted, that there is currently no consensus on the performance variable in the Panzar-Rosse model. Some authors use interest income as an effective variable, others – operating income or return on assets. When developing this model according to the general summation as of 01.01.2020 using the MS Excel editorial analysis package, three calculation options were made with different result variables: interest income, operating income (interest income + commission income + trading result) and net gross income (net interest income + net commission income + trading income). Data on coefficients of determination and H-statistics for models with different dependent variables are presented in Table 3.

Table 3

**H-statistics and the coefficients of determination for models
with different dependent variables**

Dependent variable (Y)	Coefficient of determination (R2)	H-statistics
Net gross income	0,689	0,5631
Interest income	0,970	0,3499
Operating income	0,970	0,3499

Source: Developed by the authors on the basis of[1]

According to Table 3 it does not matter which variable is chosen – interest income or "operating income", the accuracy of the models, H-statistics values and regression coefficients take the same values when calculating H-statistics according to the Panzar-Rosse model.

The use of the indicator "net gross income" as an effective variable significantly increases the value of H-statistics, but the accuracy of this model is slightly lower.

The modified Panzar-Rosse model in this study in contrast to the generally accepted models, takes into account the stability factor, namely the presence of a bank of sufficient capital and highly liquid assets for timely settlement of its liabilities, and as a result of net income, on which depends the competitiveness and efficiency of banks.

The Panzar-Rosse model is based on the financial statements of all operating banks in Ukraine using the indicators shown in Table 4.

Table 4

The indicators used to build a modified Panzar-Rosse model

Xi/Yi	Indicator	Characteristics of the indicator
Y1	Interest income	The amount of interest income received by the bank on all active operations of the bank
Y2	Operating income	Interest income + Commission income + Trading result
Y3	Net gross income	Net interest income + net commission income + trading result
X1	Total assets	Characterizes the volume of the bank, its market position
X2	The cost of interest liabilities	The ratio of interest expenses to average interest liabilities
X3	Staff costs	Wage costs of bank employees to average assets
X4	Other expenses	(Administrative expenses + operating expenses + expenses for formation of reserves + other expenses) to average assets
X5	Capitalization level	The ratio of balance capital to assets
X6	Liquidity level	The ratio of highly liquid assets to total assets

Source: Developed by the authors on the basis of[2]

---

[1] Там само.

[2] Там само.

The developed Panzar-Rosse model for the banking system of Ukraine according to the data as of 01.01.2020 for the effective variable "interest income" of banks is as follows:

$$LnY_1 = -3.582 + 1.052 * \ln X_1 + 0.165 * \ln X_2 + 0.110 * \ln X_3 + 0.075 * \ln X_4 + 0.029 * \ln X_5 - 0.062 * \ln X_6 , \quad (5)$$

$$R^2 = 0.970 .$$

The value of H-Statistics is 0.350 (0.165 + 0.110 + 0.075).

The low vale of H-statistics indicates the strengthening of monopolistic competition within the banking sector of Ukraine.

Note, that the Panzar-Rosse model built for the effective variable "operating income" of banks, has exactly the same form and look, as the value of regression coefficients, the coefficient of determination and H-statistics, which allows us to state the following.

To build a Panzar-Rosse model, it does not matter which variable to take – "operating income" or "interest income". The models will be identical.

The modified Panzar-Rosse model assumes the use of net gross income as an effective variable, which is a better and more objective financial indicator of banks' performance and efficiency of competitive position management, coherent management of assets and liabilities, income and expenses of banks.

The Panzar-Rosse model looks like this:

$$LnY_3 = -10.349 + 1.279 * \ln X_1 - 0.319 * \ln X_2 + 0.117 * \ln X_3 + 0.765 \ln X_4 + 0.822 * \ln X_5 + 0.822 * \ln X_6 , \quad (6)$$

$$R^2 = 0.689 .$$

The value of H-Statistics is 0.563 (-0.319 + 0.167 + 0.765).

Note, that the accuracy of this model is slightly lower than the previous ones. Instead, H-statistics (0.563) are much higher, which indicates an improvement in the competitive environment in the banking sector of Ukraine, a decrease in the level of monopolistic competition, despite the growing influence of the four largest state-owned banks.

Conclusions. According to this study using the Lerner Index, the banking market in Ukraine is characterized by monopolistic competition, as most of the market is owned by several large state-owned banks, which restricts the competition in the banking market. Privatization of some state-owned banks will increase competition in Ukraine's banking sector and its development.

The study of the non-structured Panzar-Rosse model confirmed the hypothesis that reforming the banking system not only improved its stability but also improved banking competition. However, this situation within the banking sector of Ukraine is ambiguous – according to the classical model of H-statistics the level of banking competition decreased slightly compared to the pre-crisis period and is 0.350, which indicates the strengthening of monopolistic competition in the banking sector of Ukraine. However, according to the modified model of Panzar-Rosse, which takes into account explanatory variables on the stability of banks,there was an increase in H-statistics, which indicates a tendency to reduce monopolistic competition and improve banking competition.

References:

1. Beck, T. (2008). Bank competition and Financial stability: Friends or Foes? *World Bank* <https://openknowledge.worldbank.org/bitstream/handle/10986/6863/wps4656.pdf?sequence=1&isAllowed=y> (2021, January, 25). [in English].
2. Feldkircher, M., Sigmund, M. (2017). Comparing market power at home and abroad: evidence from Austrian banks and their subsidiaries in CESEE. Focus on European economic integration. *Oesterreichische National Bank*, 59-77. [in English].
3. Lerner, A. (1934). The concept of monopoly and the measurement of monopoly power. *Rev. Econ. Stud.*, *1*, 157-175. [in English].
4. Boone, J. (2000). Competition. *CEPR DP,* 2636. [in English].
5. Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics Letters*, *10 (1)*, 87-92. [in English].
6. Lau, L. J. (1982). On identifying the degree of competitiveness from industry price and output data. *Economics Letters*, *10 (1)*, 93-99. [in English].
7. Barros, F., Modesto, L. (1999). Portuguese banking sector: A mixed oligopoly? *International Journal of Industrial Organization*, *17 (6)*, 869-886. [in English].

8. Panzar, J. C., Rosse, J. N. (1987). Testing for "monopoly" equilibrium. *The Journal of Industrial Economics*, 443-456. [in English].
9. Karcheva, G. T. (2020). Finansovyi stan bankiv ta rozvytok mekhanizmiv stymuliuiuchoho bankivskoho rehuliuvannia [Financial condition of banks and development of mechanisms of stimulating banking regulation]. *Suchasni tendentsii stiikoho finansovo-ekonomichnoho rozvytku ta mekhanizmy yikh realizatsii v hlobalnomu vymiri.* Dnipro: Universytet imeni Alfreda Nobelia. [in Ukrainian].
10. Ofitsiynyy sayt Natsionalnoho banku Ukrayiny (2020) [Official site of the National Bank of Ukraine (2020)]. *Holovna storinka* [Home page] <http://www.bank.gov.ua> (2020, November, 18). [in Ukrainian].