

# The Construction Market Monopolization: Identification of the Threats to the Economic Security of Ukraine

Olha Pavelko, Inna Lazaryshyna, Olena Doroshenko, Yulia Vashai, Oksana Zinkevych

**Abstract:** *The degree of the construction market monopolization of Ukraine is assessed. Threats to the economic security of the state are identified, considering that monopolization causes significant public losses related to the establishment of monopoly prices, the slowdown in scientific and technological progress, the irrational allocation of resources. According to data on the net income of enterprises in the construction industry of Ukraine, the authors calculated Market concentration ratio, Herfindahl-Hirschman index, Dispersion of market shares, Coefficient of variation, Gini index, Entropy of market shares, that indicate a low level of the construction industry monopolization in Ukraine. Defined indicators allowed to form a matrix, which characterize the level of market concentration and its dynamics. According to the values of the variation index and the Gini index, the market studied belongs to highly monopolized, and due to the tendency of the Gini index to increase, it falls into the "red zone".*

*This means the emergence of threats to national economic security associated with a decrease in GDP, increased income differentiation, reduced state budget revenues, and the like and indicates the need for macroeconomic measures that would restrain the development of monopoly phenomena in the construction market. This approach to identifying economic security threats resulting from market monopolization will allow the state to respond to negative trends in a timely manner, counteracting the threatening factors.*

**Keywords:** *construction, competition, concentration level, economic security, monopolization.*

## I. INTRODUCTION

The problems of maintaining the economic security of a state are quite acute for all countries of the world, without exception, regardless of their size and level of development.

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In modern conditions of military-political instability in Ukraine, each component of economic security is heavy and is influenced by a significant number of factors that may create threats to economic security or increase its level.

The basis of the economic development of any national economy is production in the context of various types of economic activity. One of the indicators of the directions of economic processes in the state is the development of the construction market. The intensity of construction processes in Ukraine has increased significantly in recent years. To a wide extent, it depends on the type of competition in the construction market, which affects pricing, real estate sales, and through a chain reaction affects other economic and social indicators. Despite this, the construction market monopolization can create direct and indirect threats to the economic security of the state. Therefore, along with the study of the main indicators of economic security, attention should be paid to indicators that characterize the level of monopolization of markets, and in the case of threats, macroeconomic management decisions in the field of antitrust regulation can be made.

## II. THEORY/CALCULATION/METHODOLOGY

### A. Literature review

The risk for the ensuring the economic security of the country is not only in increasing the tendencies of de-industrialization of the national economy, but also in the lack of formation of new competitive, innovative drivers of its development. An additional factor is the deterioration of the conditions of competition and access to foreign financial markets. The traditional dominance of foreign investment in the financial sector and real estate markets is currently limited to the objective problems of development of such sectors of the economy and does not meet the interests of the state in the modernization of the national economy [1].

The study of the American economist M. Porter showed that the intensity of internal competition is of paramount importance among all factors of the national business environment for the competitiveness of companies on the world market [2]. As Jeremy I. Bulow say, the monopolist is led to producing goods less durable than those produced by either competitive firms or monopolist returns. A reverse Averch-Johnson result--that monopolist sellers may invest less in fixed costs (including plant modernization and research and development) than would the renters--is shown. It is also shown that, even though sellers have less monopoly power than renters and nondurable-goods monopolists, it is possible that the seller will cause a greater deadweight loss

than the other types of monopolies [3].

In the ranking of global competitiveness for 2018, Ukraine ranked 83rd among 140 countries studied in the world [4]. According to indicators characterizing the level of competition in the Ukrainian markets, in particular, such as: "Distorting impact of taxes and subsidies on competition", "Market dominance", and "Competition in the service sector", Ukraine ranked 114; 110; 80 places. This indicates the existence of threatening phenomena in the economy that require careful analysis and adequate macroeconomic management decisions.

Rash and wide build-in of the world-commercial connections into the global network might bring damage for economic security and suppress "growing points" of any homeland industry. The problem of harmonization of relations between foreign and domestic commodity producers in the absence of macroeconomic procedure for their settlement is barely decidable with sufficient reliability. The theory of systems and commercial practice suggest that in order to save competitive advantages and to protect a perspective commodity producers facing coming out of transnational companies' threats can protect themselves with the help of deliberate policy, which integrates the state support of the enterprises (protectionism, state orders, custom duties, tax concessions, investments etc.) and the collaboration with foreign corporations, which possess scientific and innovative potential [5].

As Filyuk (2015) rightly points out, "... the monopolization of the domestic economy negatively influences stability and economic growth in the country, creates obstacles for increasing national competitiveness. The negative influences of monopolization include: significant loss of society from monopoly power; reduction of state budget revenues from monopolistic industries due to the use of shadow schemes, transfer pricing, political influence, etc. by monopolists limits the growth of the country's GDP; growth of the economy's corruption due to the desire to retain monopoly power at any cost or to increase it; deterrence of innovation and investment development of the Ukrainian economy; conservation of environmentally hazardous industries (instead of modernizing production, investing in replacing worn-out and outdated equipment of enterprises, oligarchs manage to get super-profits in spite of high material intensity and energy intensity of production by reducing wage costs of an employee); facilitating capital outflows from the national economy through the use of transfer pricing schemes; significant impact on the course of the national currency; interest of individual monopolists in the destabilization of the Ukrainian economy" [6].

Among the most negative features of the influence of monopoly on economic security the researchers Babich and Kasianova distinguish such: positive features of free competition can not fully manifest themselves; there is a deformation of competitive relations (flexibility changes, adaptability to the market), the stability of reproduction mechanisms decreases, and it can lead to a severance of economic ties; prices lose market flexibility, react insufficiently to fluctuations in supply and demand, are characterized by low elasticity; monopoly suppresses the impulses that go from demand to production, which disorients investment flows, while consumer needs remain unmet [7]. Andrienko considers the monopolization of the market by large construction enterprises to be one of the threats to the

economic security of construction enterprises. Large construction enterprises due to lower output, compared with medium and small business entities, can offer lower prices for their services, and therefore have a better chance of receiving an order. Such situation is a threat to the existence of small and medium enterprises [8].

Miniaylo and Burian analyze the monopolization of the construction market using indicators such as market concentration ratio; Herfindahl-Hirschman index; dispersion of market shares; entropy of market shares; Gini index [9]. These coefficients are used by scientists Kunhui Ye, Weisheng Lu & Weiyan Jiang [10] and to assess the level of market concentration of the international construction market, Pulaj (Brakaj) and Kume [11] - to assess the monopolization of the Albanian construction market. However, the authors have not analyzed exactly what consequences this or that level of monopolization may entail according to the results of calculating the reduced coefficients. A detailed analysis of competition in the primary residential construction market in Ukraine was conducted in the monograph by Pavlov [12].

As evidenced by the results obtained in an empirical study by Cosman and Quintero, a higher degree of concentration in local housing construction markets leads to a decrease in housing production volume, a decrease in construction speed and greater price volatility. Construction markets are a central component of macroeconomic cycles [13]. The authors [13], based on their own research, demonstrate the influence of the concentration of the local housing market on the dynamics of the housing market cycle. Chalenko and Riabchun [14] pay attention to unfair competition as a threat to the economic security of enterprises and argue that in order to effectively protect the interests of business entities from unfair competition, it is necessary not only to deal with it with regulatory and administrative methods, but to create conditions under which it would be unprofitable to break the rules of fair competition.

Research by British scholars led them to conclude that construction remains a highly competitive sector in United Kingdom and there is little to be gained by regulation other than the work currently being undertaken on collusion in bidding, and on mergers and acquisitions. The key point is to ensure that competitive bidding is free from collusion [15].

The core dilemma is whether the effects of the economic concentration were perceived to be a loss of social equality or a loss of economic efficiency. Obviously, different policy makers put a different accent and had a particular focus but we could still wonder which the dominant perspective was. Modern antitrust literature still intensely debate the reasons and the motivations of the political and economic actors that lead to the adoption of the Sherman Act in 1890, the first competition policy in the world [16].

We will analyze the concentration of construction enterprises in Ukraine using statistical data on the volume of net income and profits for 2015-2017, which allow us to numerically assess the degree of concentration and intensity of competition in construction.

### B. Methods

For a long period of time, different economic schools have been analyzing the phenomena of market monopolization using both quantitative and qualitative methods, some of which are officially approved at

the level of national legislation of the states. Modern economic modeling allows to measure the levels of market concentration, in particular, using the following indicators: market concentration ratio; the Herfindahl-Hirschman index; dispersion of market shares; entropy of market shares; the Gini index. The indicated indices successfully characterize the level of monopolization of different markets - from financial [17] to the markets of the real sector of the economy to the markets of the real sector of the economy [18].

The paper calculated the *market concentration ratio*  $CR_n$  for three, four, five and seven largest enterprises, which defined as the sum of market shares of the largest enterprises operating in the market. It characterizes the share of several largest enterprises in the total market volume, however, does not take into account the activities of enterprises remaining in the number of the largest [19]. This indicator is calculated by the ratio:

$$CR_n = \sum_{i=1}^n S_i, i=1,2,\dots,n \quad (1.1)$$

where  $n$  – the number of largest enterprises in the industry for which the indicator is calculated;  $S_i$  – the share of the  $i$ -enterprise in the industry; the values of  $S_i$  are sorted by descending.

In order to assess the ratio between the largest enterprises that belong to the “core” of the primary real estate market, the Linda Index (IL) is calculated, which, unlike the concentration index, allows to assess the differences in the “core” of the market and allows to determine what number of enterprises dominate in the market. For this, the Linda index is calculated in stages: first for the two largest firms, then for the three, and so on, until the condition of monotony of the function is violated (the tendency for the index to decrease is followed by a tendency to increase). This change in tendency shows that the company that was added to the calculation last, has a significantly smaller market share than all previous ones.

In order to assess the distribution of “market power” among all the subjects of the construction market in Ukraine, we calculated the Herfindahl-Hirschman index (HHI), which is also a concentration index, but does not characterize the market share controlled by several major enterprises, but the distribution of “market power” between all subjects of this market. The indicator is calculated as the sum of squares of market shares (in percent) of all market participants in its total volume:

$$HHI = \sum_{i=1}^n S_i^2, \quad (1.2)$$

where  $S_i$  – the share of the  $i$ -firm in the industry, %;  $n$  – the number of firms in the industry.

The higher the value of the Herfindahl-Hirschman index is, the higher the concentration of sellers in the market becomes, and vice versa, a decrease in the value of the Herfindahl-Hirschman index means increased competition in the market, a decrease in the concentration and market power of enterprises [19].

The indicator of the dispersion of market shares assesses the degree of deviation of the market share of each developer from the average market share. The dispersion of market shares is calculated by the formula (1.3).

$$\sigma^2 = \frac{1}{n} \sum_{i=1}^n \left( S_i - \frac{1}{n} \right)^2, \quad (1.3)$$

where  $S_i$  – the share of the  $i$ -firm,  $n$  – the total number of firms in the market.

The lower the indicator of dispersion of market shares  $\sigma^2$  is, the more homogeneous the sizes of enterprises and the shares of economic entities in the market are, and the level of concentration is lower. And vice versa - the higher the dispersion value is, the more uneven the market becomes, the weaker the competition and the stronger the power of large firms are [20]. The value of the HHI index is related to the indicator of the dispersion of the company's shares on the market by the ratio:

$$HHI = n\sigma^2 + 1/n. \quad (1.4)$$

In order to determine the degree of uneven distribution of market shares among market participants, the coefficient of variation is also used:

$$v = \frac{\sigma}{\bar{S}} \cdot 100\%. \quad (1.5)$$

where  $\bar{S} = \frac{1}{n}$  – an average market share of the enterprise.

The higher the uneven distribution of market shares is, the more concentrated the market, with other things being equal, is considered to be. The value of the coefficient of variation indicates the intensity of the variation signs and, accordingly, the homogeneity of the composition of totalities that is being studied.

If the coefficient of variation is less than 30%, the totality is considered to be homogeneous, if it is in the range of 30%-70% - of medium homogeneity, a value greater than 70% - the totality is heterogeneous.

The *entropy index* shows the average value of the logarithm of the reciprocal of the market share, measured by the market shares of the firms:

$$E = \sum_{i=1}^n S_i \ln \left( \frac{1}{S_i} \right). \quad (1.6)$$

The entropy index is an indicator reciprocal of the concentration: the higher its value is, the lower the concentration of sellers in the market and the lower their ability to influence the market price become.

In order to determine the level of monopoly power of enterprises, we use such tools as: the Gini index and the Lorenz curve. The basis of the Gini index, which is calculated using the Lorenz curve, is the idea that the extreme positions in the distribution of incomes or benefits between groups of individuals are egalitarian (everyone who participates in the distribution receives equal shares) and antiegalitarian (one participant in the distribution receives all benefits). In order to depict the Lorenz curve on the coordinate axes, the cumulative (accumulated) results of the distributions are plotted on a percentage scale from 0 to 100: on the horizontal axis - quantiles of income received by persons, on the vertical axis - quantiles of income received [21].

In construction, the low Gini index indicates a high homogeneity of market shares and high competition in the market and vice versa. The Gini index is the ratio of the area of the segment A created by the Lorenz curve and the line of





uniform distribution to the area of triangle A + B below the line of uniform distribution:  $G = A / (A + B)$ . In order to calculate the area of the lower segment B, we can use the approximate trapezoid method.

The Lorenz curve is a traditional tool for measuring the degree of inequality in income distribution or wealth distribution. Over time, this tool began to be used to assess the degree of concentration of various markets. The Lorenz curve shows which share of the total output falls on a certain share of enterprises, which are distributed in different groups depending on the size of income.

Like all economic characteristics, the company's net income is the basis for determining market shares, is a random variable, the prevailing characteristic of which is the law of distribution.

In order to verify the conformity of the logarithmic income values to the normal distribution law, we used the Kolmogorov-Smirnov criterion and the Jacques-Beer's test. Output data for the calculation of the above indicators was generated according to the financial statements of 100 enterprises, which make a sample of the total population of 27468 construction enterprises of Ukraine. The statistical error of this sample is 0,098.

The idea of the article is that the calculated indicators of concentration and their dynamics are ranked in order to form a matrix divided into 9 quadrants, which depending on the level of monopolization and the value of the growth rate of the concentration indexes are divided into the green, yellow and red zones.

The "red zone" of the threat map implies an immediate response in the form of antimonopoly regulation in order to limit the market power of monopolists or oligopolists and restrain its growth. If the market is in the "yellow zone", this indicates the average level of threats and requires in-depth analysis and a situational reaction to the evidences of the deterioration of the competitive environment. If according to the concentration indicators, the market is referred to the "green zone" of the quadrangle, then the threats associated with monopolization do not require increased attention from the government, depending on the permissible limits of risk.

### III. RESULT

Analysis of the concentration of the construction market of Ukraine in order to identify the availability of threats to the economic security of the state was carried out on the basis of information on the total income of enterprises in the industry. The share of the company in the market is assessed by us as the ratio of its annual income to the total income of all analyzed enterprises. The total number of enterprises analyzed is 100 units.

The calculation of the concentration indexes on the construction market according to the ration (1.1) allowed the following values to be obtained:

$$CR_3 = 43.1\%; CR_4 = 47.5\%; CR_5 = 51.5\%; CR_7 = 59\%.$$

The value of CR3 = 43.1% means that the market share of 43.1% is occupied by the three largest construction companies – Kyivmiskbud Private Joint Stock Holding Company, Trust Zhytlobud-1 Private Joint Stock Company, House-building Combine No. 4 Private Joint Stock Company. The five largest enterprises occupy 51.5% of the market, and seven - 59% of the Ukrainian construction market. Since the

condition of  $40\% < CR_4 < 60\%$  is fulfilled, according to the classification of Shepherd [22], this indicates the absence of a monopoly and a high level of competition in this market.

For the two largest enterprises, the Linda index is equal to the percentage of their market shares (Li):

$$IL_2 = \frac{S_1}{S_2} \cdot 100\% \quad (1.10)$$

$$\text{If } S_1 = 50\%, S_2 = 25\%, \text{ then } IL_2 = 200\%.$$

For the three largest enterprises, the Linda index is determined by the formula:

$$IL_3 = \frac{1}{2} \left[ \frac{S_1}{(S_2 + S_3)/2} + \frac{(S_1 + S_2)/2}{S_3} \right] \cdot 100\% \quad (1.11)$$

For four enterprises, the Linda index is:

$$IL_4 = \frac{1}{3} \left[ \frac{S_1}{(S_2 + S_3 + S_4)/3} + \frac{(S_1 + S_2)/2}{(S_3 + S_4)/2} + \frac{(S_1 + S_2 + S_3)/3}{S_4} \right] \cdot 100\% \quad (1.12)$$

The decrease in the Lind index when adding enterprises means that the core has not yet been formed. According to ratios (1.10) - (1.12), we get:

$$IL_2 = 286,2\%; IL_3 = 145,3\%; IL_4 = 214,4\%.$$

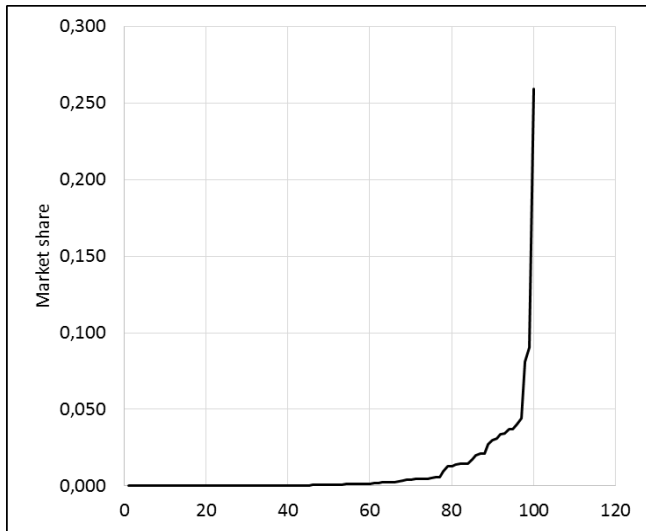
Since the addition of the fourth enterprise causes a break in the descending tendency, thus it can be argued that the three largest enterprises form the "core" of the construction market of Ukraine: Kyivmiskbud Private Joint Stock Holding Company, Trust Zhytlobud-1 Private Joint Stock Company, House-building Combine No. 4 Private Joint Stock Company.

Using the HHI value calculated for each construction company when determining the Herfindahl-Hirschman index, we will get the values: HHI = 963. Since the index is less than 1500, the market is considered to be a low-concentrated, therefore, the construction market under study is a market of perfect competition.

Using the ratio (1.3) and the value of the dispersion index, calculated for each construction company, we will get the value  $\sigma^2 = 0,00086$ . The result suggests that the construction market in Ukraine is low dispersed. This means tough competition and the absence of one or two firms dominating.

The higher the value of the coefficient of variation is, the more varied the value of the indication around the mean value and the higher the heterogeneity of the totality become. The coefficient of variation for this market is:  $V = 294\%$ .

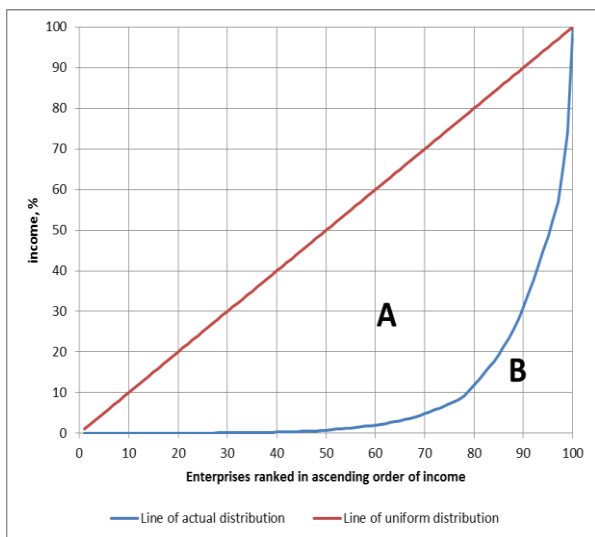
The obtained coefficient of variation indicates a high heterogeneity of construction: there are both large leading enterprises and small ones that serve one or two objects. It should be noted that the number of such small enterprises is 75 (75%) out of 100 enterprises analyzed by us (Fig. 1). That is, three-quarters of enterprises are small, 21 enterprises are large, four are particularly large.



**Fig 1. Distribution of enterprises by the share of participation in the construction market**

Source: calculated by the authors based on their own sample of net income of construction enterprises

Using the ration (1.6) and the values of  $S_n$ , calculated for each construction company, we calculate the entropies of market shares of construction companies. On the basis of the calculations we will get:  $E = 3,03$ . According to the classification given above, the result obtained indicates a high level of competition in the construction market. The Lorenz curve for the construction market of Ukraine is shown in Fig. 2.



**Fig. 2. Lorenz Curve for the Ukrainian Construction Market**

Source: created by the authors based on their own sample of net income of construction enterprises

Using the available data and ratios (1.8), we obtain the value of the Gini index:  $G = 0,911$ .

Such a value of the Gini index indicates a very significant differentiation of market shares held by various enterprises in the construction industry and, accordingly, a significant differentiation in their incomes. In addition, it can be concluded that the average difference in the market shares of enterprises operating in this market is equal to the average value of this share.

The calculation of the concentration of the construction industry of Ukraine for 2017 is shown in Table I.

**Table – I: Calculation of the concentration of the construction industry of Ukraine for 2017**

| No. in seq.  | Enterprise  | Si           | HHI            | Disper-sion index | Entrop-y index | Sn            | Fn                | Gn                 |
|--------------|---|--------------|----------------|-------------------|----------------|---------------|-------------------|--------------------|
| 1.           | Kyivmiskbud-1 PJSC  | 0,00000<br>0 | 0,00000<br>0   | 0,0001            | 0,0000         | 0,0000        | 0,01<br>0         | 0                  |
| 2.           | Specialized mechanized mobile carriage No.6 Ukrmilbud PJSC                      | 0,00000<br>0 | 0,00000<br>0   | 0,0001            | 0,0000         | 0,0000        | 0,02<br>0         | 0,000<br>0         |
| 3.           | Kyiv Specialized Repair and Construction Company PJSC                           | 0,00000<br>0 | 0,00000<br>0   | 0,0001            | 0,0000         | 0,0000        | 0,03<br>0         | 0,000<br>0         |
| 4.           | Construction and installation department number 20 PJSC                         | 0,00000<br>0 | 0,00000<br>0   | 0,0001            | 0,0000         | 0,0000        | 0,04<br>0         | 0,000<br>0         |
| 5.           | Ukrmasomolma shtehremont Poltava Specialized Repair and Construction Department | 0,00000<br>1 | 0,00000<br>0   | 0,0001            | 0,0000         | 0,0000        | 0,05<br>0         | 0,000<br>0         |
| 6.           | ...   | ...          | ...            | ...               | ...            | ...           | ...               | ...                |
| 95.          | Interbudtonel PJSC  | 0,03729<br>5 | 0,00139<br>1   | 0,0007            | 0,1227         | 0,4845        | 0,95<br>0         | 0,030<br>6         |
| 96.          | Zhytlobud - 2 ALC   | 0,04018<br>8 | 0,00161<br>5   | 0,0009            | 0,1292         | 0,5247        | 0,96<br>0         | 0,033<br>3         |
| 97.          | Khmelnytsk Road Construction Department No. 56 PJSC                             | 0,04425<br>4 | 0,00195<br>8   | 0,0012            | 0,1380         | 0,5690        | 0,97<br>0         | 0,037<br>2         |
| 98.          | Trust Zhytlobud - 1 PJSC  | 0,08128<br>4 | 0,00660<br>7   | 0,0051            | 0,2040         | 0,6503        | 0,98<br>0         | 0,073<br>2         |
| 99.          | Domobudivny combine number 4 PJSC   | 0,09054<br>8 | 0,00819<br>9   | 0,0065            | 0,2175         | 0,7408        | 0,99<br>0         | 0,162<br>7         |
| 100          | Kyivmiskbud Private Joint Stock Holding Company                                 | 0,25918<br>9 | 0,06717<br>9   | 0,0621            | 0,3500         | 1,0000        | 1,00<br>0         | 0,249<br>2         |
| <b>Total</b> |   | <b>1,000</b> | <b>0,09628</b> | <b>0,0863</b>     | <b>3,0267</b>  | <b>8,9929</b> | <b>50,5<br/>0</b> | <b>0,910<br/>6</b> |

Source: calculated by the authors

Ensuring the completeness of the analysis is possible by studying the distribution of profitability of these enterprises. The basis for the analysis is the performance of construction companies for 2017 in the context of net income, net profit and profitability of their main activities, obtained from the officially published financial statements of the 100 largest enterprises in the industry. The value of net income the most fully describes the activities of the enterprise, which is closely related to the volume of construction product sales. We will conduct a statistical analysis of the income of construction companies in Ukraine (Table II).

Table – II: Results of the previous statistical analysis of the net income sample \*

| No. in seq. | Indicators         | Value   | Indicators    | Value   |
|-------------|--------------------|---------|---------------|---------|
| 1.          | Sample volume      | 100     | Minimum value | 0       |
| 2.          | Mean value         | 120599  | Maximum value | 3125808 |
| 3.          | Median             | 11649,5 | Asymmetry     | 6,59    |
| 4.          | Standard deviation | 356033  | Pointedness   | 52,4    |

Source: calculated by the authors based on their own sample of net income of construction enterprises

The significant difference of the mean sample from the median, the large asymmetry and pointedness give reason to doubt the normal law of the distribution of profitability of the above enterprises. In order to check the hypothesis of the correspondence of the enterprise income to the normal distribution law, we used the Kolmogorov-Smirnov criterion, implemented in the Statistica 6.0 program (Fig. 3). Since the probability  $p < 0.20$ , the hypothesis about the normal distribution is rejected.

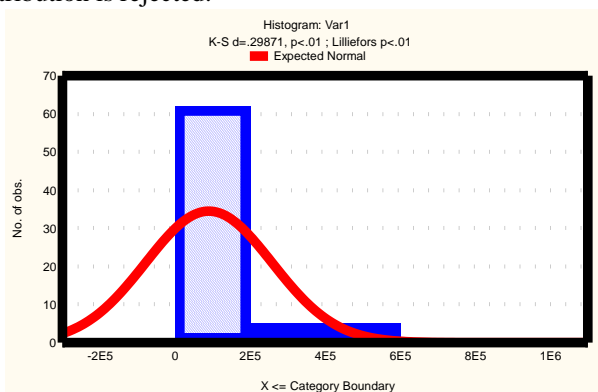


Fig. 3. Cheking the hypothesis of a normal distribution by the Kolmogorov-Smirnov criterion

Source: made by the author using the program "Statistica"

The asymmetric form of the distribution shown in Fig. 3 can correspond to a lognormal distribution law. By definition, a continuous inherent random variable  $r$  has a log-normal (log-normal) distribution if the value  $X = \ln r$  has a normal distribution. In order to check the hypothesis of a log-normal distribution of enterprise income in the construction industry, it is necessary to log the value of income, and for logarithmic values, check the hypothesis of a normal distribution.

In order to apply the Jacques-Beer's criterion, it is necessary to calculate the distribution asymmetry  $k_3$  and the pointedness of the distribution  $k_4$  by ratios:

$$k_3 = \frac{\sum_{i=1}^n (x_i - \bar{x})^3}{n\sigma^3}, \quad k_4 = \frac{\sum_{i=1}^n (x_i - \bar{x})^4}{n\sigma^4} - 3 \quad (1.13)$$

After that, we need to calculate the statistics of Jacques-Beer by the formula (1.14):

$$JB = n \left( \frac{k_3^2}{6} + \frac{k_4^2}{24} \right) \quad (1.14)$$

It is advisable to compare it with a critical value  $JBc(\alpha)$ . For the level of significance  $\alpha = 0.05$   $JBc(\alpha) = 5.991$ . Thus, we have:

$$k_3 = -0,390; k_4 = -0,652; JB = 3,142$$

Since  $JB \leq JBc$ , the hypothesis of a normal distribution is not rejected. We make the same conclusion using the Kolmogorov-Smirnov criterion, which we implemented in the Statistica 6.0 program (Fig. 4).

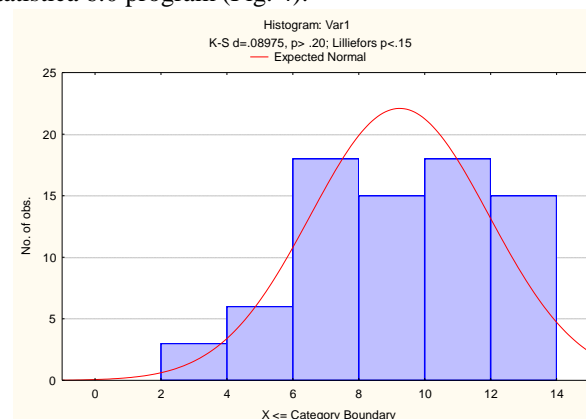


Fig. 4. Cheking the hypothesis of a normal distribution by the Kolmogorov-Smirnov criterion

Source: made by the author using the program "Statistica"

Since  $p > 0.20$ , the hypothesis of a normal distribution is not rejected. Thus, we have confirmed the hypothesis about the lognormal distribution of the values of profitability of enterprises of the construction industry. The density function of the distribution of logarithmic values of profitability has the following form:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \quad (1.15)$$

where  $x = \ln r, \mu = 9,224, \sigma = 2,709$ .

The law of income distribution we have constructed allows us to obtain several practically useful results:

- 1) the most likely value of the enterprise income is UAH 10.1 million;
- 2) 50% of enterprises have an income that is in the range from UAH 1.63 to UAH 63.0 million;
- 3) 90% of enterprises have an income that is in the range from UAH 0.12 to UAH 873 million.

A more detailed description of the income distribution of enterprises, obtained using the distribution function (1.15), is given in Table. III.

Table - III: Intervals of profitability of Ukrainian construction enterprises

| No. in seq. | Indicator s                 | Value   |        |        |        |       |       |       |       |       |       |
|-------------|-----------------------------|---------|--------|--------|--------|-------|-------|-------|-------|-------|-------|
|             |                             | 0,95    | 0,90   | 0,80   | 0,70   | 0,60  | 0,50  | 0,40  | 0,30  | 0,20  | 0,10  |
| 1.          | Reliability level           | 0,95    | 0,90   | 0,80   | 0,70   | 0,60  | 0,50  | 0,40  | 0,30  | 0,20  | 0,10  |
| 2.          | Minimum limit, thousand UAH | 50      | 118    | 315    | 612    | 1037  | 1631  | 2449  | 3570  | 5104  | 7213  |
| 3.          | Maximum limit, thousand UAH | 2049265 | 872785 | 326230 | 167947 | 99083 | 63007 | 41959 | 28788 | 20135 | 14248 |

Source: calculated by the authors

The lognormal distribution law we identified is quite close, and for large values of profitability almost coincides with the Pareto distribution law obtained for the distribution of personal incomes of citizens [24]. Both laws argue that most of the large revenues are concentrated in the hands of a small group of individuals. Sometimes this law is interpreted in the following simplified way:

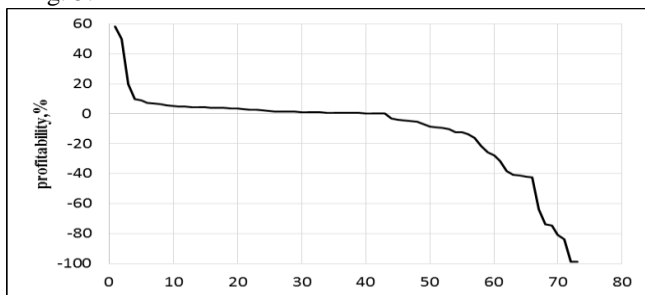
- 80% of capital is concentrated in the hands of 20% of people. This is due to their extraordinary behavior, so that they could get rich from scratch;
- 80% of production is provided by 20% of the enterprises.

The above interpretation is called **the Pareto principle** (principle 20/80). This principle is often applied to the correct solution of various situations in the economic and social sphere. For example, one of the principles of effective management sounds like this: 80% of the result is achieved at the expense of 20% of all spent efforts, and the remaining 80% of efforts yield only 20% of the total result.

Using the value of net income and net profit, we can calculate the profitability of the main activities of enterprises by the ratio:

$$R = \frac{P}{D - P} \cdot 100\% \quad (1.16)$$

Distribution of the calculated profitability values is shown in fig. 5.



**Fig. 5. Distribution of profitability values of the main activities of construction enterprises**

Source: created by the authors

According to the profitability values all the enterprises studied by us can be divided into four groups:

1. Profitable enterprises with a profitability of 15% and above. This group includes the first five enterprises.

2. Profitable enterprises with profitability of 0%-15%. This group includes 48 enterprises.

3. Unprofitable enterprises with profitability of 0%-15%. This group includes 17 enterprises.

4. Unprofitable enterprises, the level of profitability of which is less than 15%. There are 30 such enterprises in the sample.

A large variation in profitability can be explained by the specifics of the construction industry. An enterprise can build a house for several years, and all these years its activity will be unprofitable. After construction is completed, the phase of the living space sale begins and the main activity becomes highly profitable. This cyclical profitability is typical for small enterprises that maintain one construction project. The economic stability of such enterprises is low, because unforeseen additional expenses during the construction period may become unacceptable for the enterprise and lead to its bankruptcy. The statistics of income confirms our considerations. The first two companies from the studied list and the last twenty (with a small exception) occupy the last positions in the list of enterprises grouped by profitability. Consequently, a very high or very low value of profitability is a direct evidence of the low economic sustainability of the enterprise. Large-scale enterprises have somewhat diversified production due to the maintenance of several facilities. At the same time, the unprofitability of one object is covered by the profitability of another and, thanks to this, the profitability of the main activity ranges from + 10% to -20%. Such enterprises are more economically sustainable. Thus, a relatively low value of profitability (positive or negative) is evidence of the economic sustainability of the enterprise.

#### IV. DISCUSSION

The calculated concentration indicators for the period of 2015-2017 according to the methodology described in this study (with the exception of the coefficient of variation and the Gini index) indicate a low level of monopolization of the construction industry of Ukraine, and therefore, the monopolization of the specified market does not belong to significant threats to national economic security (Table IV).

**Table – IV: Level of concentration of enterprises in the construction industry of Ukraine for 2015-2017**

| Coefficient name           | Normative value   | Indicators Value |       |      | Level of concentration depending on the actual value of the indicator | Growth rate |           | Average increase |
|----------------------------|---|------------------|-------|------|---|-------------|-----------|------------------|
|                            |   | 2015             | 2016  | 2017 |   | 2016/2015   | 2017/2016 |                  |
| Market concentration ratio | 1. Pure monopoly (CR4 ≈ 100%). 2. Dominant firms (50% <CR4 <90%) 3. Limited oligopoly (CR4 > 60%) 4. Effective competition (CR4 <40%) | 46,4             | 47,98 | 47,5 | Average   | 103,41      | 99,00     | 1,20             |

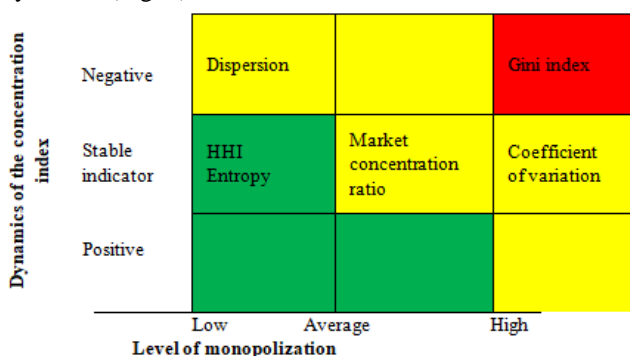


## The Construction Market Monopolization: Identification of the Threats to the Economic Security of Ukraine

|                             |   |         |        |         |      |        |        |        |
|-----------------------------|---|---------|--------|---------|------|--------|--------|--------|
| Herfindahl-Hirschman index  | 1. HHI < 1000 weakly concentrated market;<br>2. 1000 < HHI < 1800 medium concentrated market;<br>3. HHI > 1800 – highly concentrated market   | 871     | 1075   | 963     | Low  | 123,42 | 89,58  | 6,50   |
| Dispersion of market shares | The higher the value of the dispersion is, the more uneven and, therefore, the more concentrated the market becomes.  | 0,00098 | 0,0001 | 0,00086 | Low  | 10,20  | 860,00 | 335,10 |
| Coefficient of variation    | The coefficient is less than 30% - a homogeneous totality;<br>30% - 70% - a totality of average homogeneity; more than 70% - a totality is heterogeneous  | 276%    | 309%   | 294%    | High | 111,96 | 95,15  | 3,55   |
| Entropy of market shares    | Values from 0 to 0.5 - the market is monopolized;<br>from 0.5 to 2, - oligopolistic market, the sole monopolization of which is unlikely;<br>above 2 - quite high degree of market competitiveness                      | 3,15    | 3,05   | 3,03    | Low  | 96,83  | 99,34  | -1,92  |
| Gini index                  | The higher the Ginny index is, the higher the uneven distribution of market shares between sellers becomes and, therefore, with all other things being equal, the probability of concentration in the market is higher. | 0,540   | 0,577  | 0,911   | High | 106,85 | 157,89 | 32,37  |

Source: calculated by the authors

The analysis of the level of concentration in the construction market of Ukraine, as well as statistical analysis of the distribution of income and profitability of enterprises of this type of economic activity allows to form the prerequisites for identifying threats to the national economic security of Ukraine. The urgency of taking economic measures as a response to identified threats can be assessed using a matrix, the idea of which is to rank the threats to economic security depending on the level of market concentration and its dynamics (Fig. 6).



**Fig. 6. Map of threats to the economic security of the state depending on the level and dynamics of indicators of monopolization of the construction market in Ukraine for 2015-2017**

Source: created by the authors

The “red zone” of the threat map implies an immediate response in the form of antimonopoly regulation in order to limit the market power of monopolists or oligopolists and restrain its growth. If the market is in the “yellow zone”, this

indicates the average level of threats and requires in-depth analysis and a situational reaction to the evidences of the deterioration of the competitive environment. If according to the concentration indicators, the market is referred to the “green zone” of the quadrangle, then the threats associated with monopolization do not require increased attention from the government, depending on the permissible limits of risk.

According to the results of the analysis, it can be concluded that the values of the Herfindahl-Hirschman indices and the entropy of the market frequencies of the construction market of Ukraine indicate a high level of competition, and refer the market to the “green zone”, do not pose a threat to the national economic security of Ukraine.

According to the market concentration ratio, the market has an average level of monopolization and is in the “yellow zone”, which requires more detailed attention in terms of leveling threats to economic security. The value of the two coefficients — the coefficient of variation and the Gini index — attribute the market under study to highly monopolized, and due to the tendency for the Gini index to increase, it falls into the “red zone”. This means the emergence of threats to national economic security associated with a decrease in GDP, increased income differentiation, reduced state budget revenues, and the like. Such situation requires a more in-depth analysis of the reasons that led to such values of this coefficient, and in the case of the identification of potential threats to the development of a competitive market, the adoption of administrative and economic regulatory measures.





## V. CONCLUSION

Analysis of indicators characterizing the level of monopolization of the construction market in Ukraine in the context of identifying threats to the state's economic security has led to the following conclusions.

1. Monopolization of individual markets in a country can have significant consequences for the economy and national security, which consist in reducing revenues to the budget, reducing the volume of national production with an increase in the price level, deepening income differentiation, restraining innovation and investment development. This poses the threats to national security, from minimal impact to substantial enough and requires the development of a clear methodology for identifying these threats.

2. Analysis of current market concentration indicators, such as: the market concentration ratio; the Herfindahl-Hirschman index; the Linda index, the dispersion of market shares; the coefficient of variation, the entropy of market shares; the Gini index applied to the construction market showed the existence of certain differences in determining the level of competition according to various indicators. In particular, the overwhelming majority of calculated indices indicate a fairly high level of competition in construction. However, the characteristic values of the coefficient of variation and the Gini index indicate the opposite situation, which requires a deeper analysis. In particular, the coefficient of variation indicates a high heterogeneity of construction: there are both large leading enterprises and small ones that serve one or two objects. A value of the Gini index indicates a very significant differentiation of market shares held by various enterprises in the construction industry. The average difference in the market shares of enterprises operating in this market is equal to the average value of this share.

3. The law of distribution of income of construction companies built in the work is sufficiently close to the law of distribution of Pareto, which allows us to make a conclusion that a very high or very low value of profitability is a direct evidence of the low economic stability of an enterprise. Large-scale enterprises have a more diversified production due to the maintenance of several objects. At the same time, the unprofitability of one object is covered by the profitability of another and, thanks to this, the profitability of the main activity ranges from + 10% to -20%. Such enterprises are more economically sustainable. Thus, a relatively low value of profitability (positive or negative) is evidence of the economic sustainability of the enterprise.

4. The identification of threats to the economic security of the state associated with monopolization can be carried out using a matrix, divided into "red", "yellow" and "green" zones depending on the level of market concentration and its dynamics. The results of the construction market positioning indicate that the Herfindahl-Hirschman index and the entropy of the market frequencies of the construction market of Ukraine are indicators of a high level of competition, and refer the market to the "green zone" that does not pose a threat to the national economic security of Ukraine. According to the market concentration ratio, the market has an average level of monopolization and is in the "yellow zone", which requires more detailed attention in terms of leveling threats to economic security. The value of the two coefficients — the coefficient of variation and the Gini index — attribute the

market under study to highly monopolized, and due to the tendency for the Gini index to increase, it falls into the "red zone". This means the emergence of threats to national economic security. There is a need to take macroeconomic measures that would restrain the development of monopoly phenomena in the construction market.

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