CHAPTER 1
CURRENT TRENDS IN ECONOMIC DEVELOPMENT

FACTOR ANALYSIS OF PROFITABILITY (LOSSES) CONSTRUCTION ENTERPRISES IN 1999-2019

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Abstract. *Decomposition of Return on Equity (ROE) after Return on Assets (ROA), Return on Sales (ROS), Total Assets Turnover (TAT) and Equity Multiplier (EM) provides an analytical framework appropriate for observing factors that make and influence profitability. An analysis of the literature makes it clear that classic and modified DuPont models are widely used to analyze the profitability of many industries, including construction. Despite critical feedback from some scientists, this method remains a useful tool for identifying factors influencing the effectiveness of an enterprise, industry, or region. Aims - to calculate the profitability indicators of the "construction" activity enterprises in 1999-2019, to analyze their dynamics and to identify the reasons for the changes. Methods is a widely used Dupont profitability analysis method that involves decomposing the outputs into components in order to identify the effects of those components on the outcome. The profitability indicator analysis of "construction" activity enterprises in 1999-2019 revealed that the construction industry operated at a loss for a decade in a row (2008-2017), which is reflected primarily in the capital structure. During these years, equity decreased to a critical level; in 2015, uncovered losses exceeded the amount of authorized and reserve capital. Only in 2018 the situation started to level off. Factor analysis of profitability indicators has revealed the in depth factors that affect them, namely: loss of the main activity of construction enterprises for ten consecutive years, which caused a decrease in equity to a critically low level and, accordingly, high values of financial leverage. It can be seen that while in the 2000s, the volume of general sources of financing (the amount of liabilities) was 3.65 times higher than the amount of construction capital, in 2009 - 5.2 times, it was 15.5 times in 2019. Therefore, the reverse direction of the financial lever should also be considered. In the case of profitable activity, the financial lever will allow to reach high values of return on equity. But in times of crisis or continuation of a downward trend, this can lead to a loss of financial sustainability in the construction sector.*

Keywords: *DuPont model, Return On Equity (ROE), Return On Assets (ROA), Return on Sales (ROS), construction industry, construction enterprice.*

JEL Classification: G17, G32, L74

Formulas: 4; fig.: 8; tabl.: 1; bibl.: 29

Introduction. According to the State Statistics Service in Ukraine there are about 30 thousand enterprises of "construction" activity, which is 8.3% of the total number of them. For ten years in a row, these enterprises operated at a loss, and only in 2018 they made a net profit of UAH 4,414.1 million.

This situation requires an in-depth analysis of the causes of poor construction efficiency. At present, there is a need for retrospective analysis of the features of the functioning of construction enterprises, as well as for identifying trends in their development and factors affecting the profitability of

construction based on the use of widespread financial instruments, including factor analysis, which makes the study relevant.

Literature review. The negative generic indicator of the industry, namely the long-term loss-making of its activity, causes the relevance of factor analysis of a set of profitability indicators, in particular, using deterministic models. They are characterized by the fact that each non-random value of the resultant variable (function) corresponds to each factor (factor) value.

The profitability (loss) analysis method became widespread in economically developed countries. It was proposed by Donaldson Brown, who, back in the 1920s, worked at DuPont (Blumenthal, 1998). Due to its advantages, such as simplicity, speed of obtaining the result, the ability to choose the depth of analysis, etc, this method is quite widespread nowadays. It is based on an equation that shows the relationship between return on equity and performance: return on sales, asset turnover and financial dependency ratio.

The DuPont method is used in various fields. Profitability analysis with this method was used in banking (Almazari, 2012, McGowan and Stambaugh, 2012, Kirikal, Sorg & Vensel, 2011, Hossain and Hossain, 2008, Zahidur Rahman and Mia Rubel, 2018), railway (Ivanilov, Peretyatko & Bozhiday, 2012), pharmaceutical (Sur & Chakraborty, 2006), Sheela and Karthikeyan, 2012) and steel industry (Maji, Sumit, 2014), in construction (Mărginean, Mihălţan & Tepeş Bobescu,2014, Bielienkova,2005, Babayev & Cech, 2016, Sozanski, 2012, Bielienkova, 2010). At the same time, the authors note different performance, approaches, indicators and structure for different types of economic activities, industries, sectors of the economy (Soliman, 2003, Selling & Stickney,1989). (Soliman, 2004), for instance, proposes to use industry model DuPont, in this case the focus of the researcher will be on factors that affect profitability, not their industry specificities.

Some authors criticized Dupont's method (Filatov & Rudykh, 2014, Angell & Brewer, 2003, Wet & Toit, 2006, Filatov & Nechaev, 2014) for proposing alternative factor analysis methods. (Hawawini & Viallet, 1999, Nissim & Penman, 2001, Palepu & Healy, 2008, Soliman, 2008, Brigham & Houston, 2001), proposed various modifications to the method, arguing that the prediction model, based on the decomposition of the resultant metric, can improve its quality depending on a number of different factors. An important result of the research of these scientists was the statement that the use of the Dupont method makes sense only when the factors have different dynamics of change over time, otherwise the use of decomposition does not make sense.

Aims. Aims is a comparative analysis of the profitability of construction companies in different years using the Du Pont method.

Methods. The author used the DuPont methods of profitability analysis, which involve decomposing the resulting indicators into components in order to identify the effects of these components on the result. This method, which is widely used to derive an impact of various factors of an individual enterprise on

profitability, can be applied to analyze the profitability indicators of individual groups of enterprises or the construction industry as a whole.

The initial data of the study are the calculations of the State Statistics Service on indicators of enterprise development of the "construction" activity type in 1999-2019. Data for 2019 was used for the first half of the year. The following indicators were selected for the stydy (State Statistics Service of Ukraine, 2019): indicators of enterprises by constructions (non-negotiable assets, current assets, assets, equity capital, current liabilities and provision, liabilities, undistributed income (pending loss), net profit (loss) of enterprises by their size by type of economic activity, financial results of enterprises, production value). Building a " hierarchy tree " helps to reveal the impact of these indicators on the result – return on equity.

Results. A major business goal is to operate at a profit. The main indicator of a business effectiveness is its profitability. There exist a large number of profitability indicators and their opposite – loss indicators in the world. Profitability measurement is the subject of interest to creditors, investors, managers and all other enterprise stakeholders. The most appropriate tool for this measurement is the analysis of profitability ratios, the productivity of which consists in numerous calculations and the interpretation of business ratios in order to draw conclusions on a firm's ability to generate profit.

Dynamics of construction profitability (loss) indicators in 1999-2018 are given in Table. 1 and Fig. 1 They are calculated by the authors according to data (State Statistics Service of Ukraine, 2019).

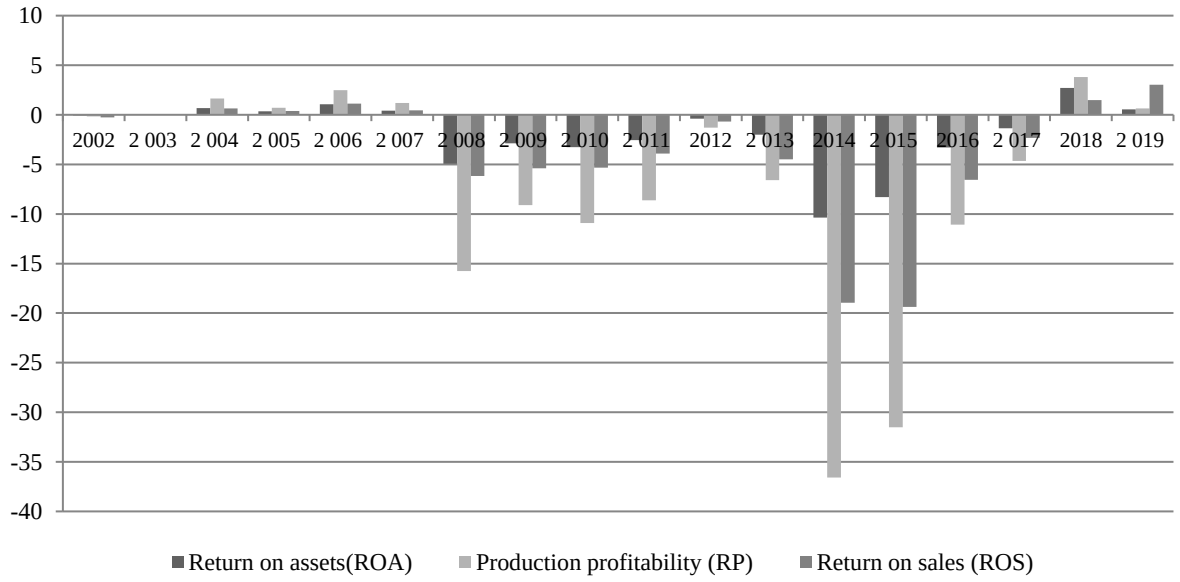

Figure 1. Dynamics of construction profitability (loss) indicators in 1999-2019

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

Table 1. Dynamics of construction profitability (loss) indicators in 1999-2018

indicator		years										
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
ROE	%	1,03	0,11	2,74	-0,14	0,05	2,15	1,26	3,81	1,72	-29,08	-15,05
ROA	%	0,67	0,07	1,47	-0,07	0,02	0,01	0,00	0,01	0,00	-0,05	-0,03
RP[1]	%	3,53	0,26	4,27	-0,17	0,06	0,02	0,01	0,02	0,01	-0,16	-0,09
ROS	%	3,46	0,33	4,79	-0,26	0,07	0,07	0,00	0,01	0,00	-0,06	-0,05
indicator		years										
		2010	2011	2012	2 013	2014	2 015	2016	2017	2018	2019[2]	
ROE	%	-18,62	-17,69	-3,33	-18,31	-	-	-	-	36,78	8,29	
ROA	%	-0,03	-0,03	0,00	-0,02	-0,10	-0,08	-0,03	-0,01	0,03	0,005	
RP[1]	%	-0,11	-0,09	-0,01	-0,07	-0,37	-0,32	-0,11	-0,05	0,04	0,01	
ROS	%	-0,05	-0,04	-0,01	-0,04	-0,19	-0,19	-0,07	-0,02	0,01	0,03	

1. Production profitability
2. Indicators for 2019 use the data for the first six months hereafter

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

The graph helps to identify three periods of rise and fall, which coincide with the cycles of Jugler (7-10 years) and Kuznets (15-20 years), namely:
1) 1999-2007 (the industry operated at a profit, with profitability gradually decreasing);
2) 2008 - 2017 (the industry operated at a loss, gradually forming the imbalance in the sources of financing, which in 2015-2017 led to the "leaching" of equity, etc.);
3) 2018-2019 (there is a profit again, but the imbalance of liabilities, namely a significant lack of equity, remains).

1. Analysis of return on assets by two-factor model (Izmailova, 2005):

The indicator of return on equity (another name of the indicator - economic return, return on assets) is determined by the formula:

$$ROA = \frac{NP}{\overline{A}} = \frac{NP}{(A_1 + A_2)/2}, \qquad (1)$$

where NP – net profit; A1, A2 (Assets1 and Assets2) - assets at the beginning and end of the reporting period.

If the numerator and the denominator are multiplied by the net proceeds from the volume of products (goods, services) sold by the economic entities by types of economic activity – V, then the return on assets can be considered as the product of two indicators, multipliers, namely: the profitability of the realized products ROS and total asset turnover – TAT. The economic substance of the TAT shows how much revenue is attributable to each monetary unit that has been invested in the assets.

$$ROA = \frac{NP}{\overline{A}} \times \frac{V}{V} = \frac{NP}{V} \times \frac{V}{\overline{A}} = ROS \times TAT, \qquad (2)$$

The relationship between the impact of two factors: profitability of realization and turnover of capital on the capital profitability is shown in Fig. 2.

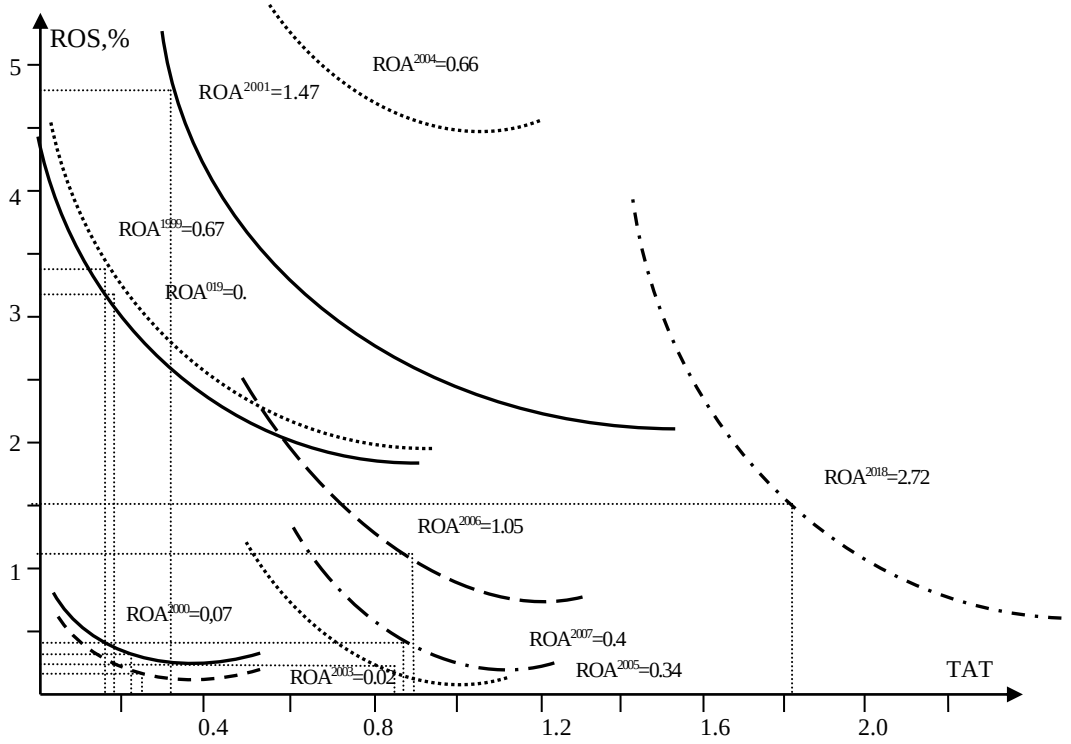

Figure 2. Analysis of return on assets by two-factor model

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

Each point of the transformation curve shows what the combination of the return on sales of the product and the return on capital can look like, so that the return on assets is at a certain level. In our example - in 2008 - 2.72%%, while in 2001 - 1.47% and so on.

According to the initial data of the construction activity (averaged over 1999-2003) (Bielienkova, 2005):

$$\text{ROA} = \frac{265.7}{17800} \times \frac{16205}{16205} = \frac{265.7}{16205} \times \frac{16205}{17800} = 0.016 \times 0.91 = 0.0146 \text{, or } 1.46\%.$$

According to the initial data of the construction activity in 2009 (State Statistics Service of Ukraine, 2019):

$$\text{ROA} = \frac{-4439}{153663} \times \frac{82370.9}{82370.9} = \frac{-4439}{82370.9} \times \frac{82370.9}{153663} = -0.054 \times 0.536 = -0.029 \text{, or } -2.9\%.$$

According to the initial data of the construction activity in 2019 (State Statistics Service of Ukraine, 2019):

$$\text{ROA} = \frac{828.2}{154687.9} \times \frac{27427.7}{27427.7} = \frac{828.2}{27427.7} \times \frac{27427.7}{154687.9} = 0.0054 \times 0.177 = 0.005, \text{ or } 0.5\%.$$

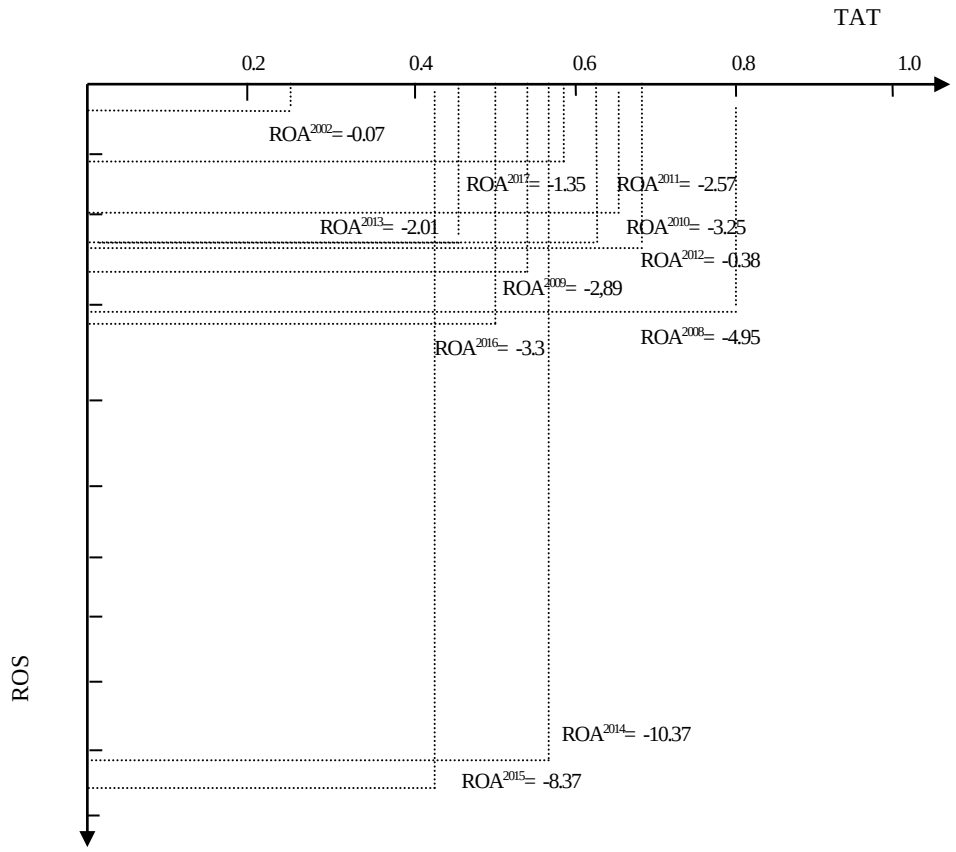

Figure 3. Analysis of loss of assets by two-factor model

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

In Fig. 3 it can be seen that the loss of capital of construction enterprises is caused by the negative profitability indicators of the sold products as a result of the loss of all activity. The most challenging for the industry were years 2014-2015 - the years of political and structural transformation of the economic system. However, since 2016, the construction industry has adapted to economic changes, as evidenced by the loss reduction.

2. Analysis of return on equity on a three-factor model.

More than 100 years ago, DuPont's managers proposed to consider return on equity (ROE) as a product of the following three indicators: return on sales (ROS), asset turnover (TAT) and debt ratio io (ratio of total capital to equity) - DR that is:

$$\text{ROE} = \text{ROS x TAT x DR} = \frac{NP}{EK} = \frac{NP}{V} \times \frac{V}{\overline{A}} \times \frac{\overline{A} = \overline{L}}{EK}, \qquad (3)$$

where NP is net profit; V — Volume of products (goods, services) sold by the economic entities by types of economic activity; EC- equity capital, A — assets; L — Liabilities.

These three indicators respectively characterize the operational, investment and financial performance of the entities. Therefore, in the developed countries the most important final indicator in the financial analysis practices is return on equity which focuses the results of all enterprise activities.

Each of the three mentioned factors, the multipliers, in turn, depends on the other indicators. For example, sales profitability depends on the amount of profit from the sale, which, in turn, depends on the prices, costs, volumes and structure of sales of products. In turn, the costs depend on the prices of the used resources and the amount of their expenditure and so on. Consistently, considering level by level, you can build an extensive hierarchical "tree" of relationships of indicators. The top of this tree is the return on equity. By changing the values of indicators at any level, including even the farthest from the top, one can trace their effect on the resultant (criterion) indicator, that is, the “top of the tree”. Computer technologies enable to quickly calculate the totality of options for influencing the final measure and to choose the best option for implementation.

We will calculate the average return on equity for the period 1999 - 2003 (Bielienkova, 2005):

$$\text{ROE}=\frac{267.5}{8255}=\frac{265.7}{16205}\times\frac{16205}{30163}\times\frac{30163}{8255}=0.016\times0.54\times3.65=0.0324 \text{ or } 3.24\%.$$

The return on equity for the 2009 (State Statistics Service of Ukraine, 2019):

$$\text{ROE}=\frac{-4439}{29499.8}=\frac{-4439}{82370.9}\times\frac{82370.9}{153662.2}\times\frac{153663.2}{29499.8}=-0.054\times0.54\times5.2=-0.15 \text{ or } 15\%.$$

The return on equity for the 2019 (State Statistics Service of Ukraine, 2019):

$$\text{ROE}=\frac{828.2}{9994.6}=\frac{828.2}{27427.7}\times\frac{27427.7}{154687.9}\times\frac{154687.9}{9994.6}=0.0302\times0.177\times15.48=0.0829$$

or 8.29%.

From the above three-factor model of return on equity, it follows that its value is significantly affected by the increase in the share of borrowed funds, i.e. the so-called financial leverage (leverage), which is accompanied by an increase in the risk of financial independence loss. In view of this risk, the financial analyst determines and regulates the level of financial leverage, that is, determines how much percent will change the return on equity when changing the financial result (before payment of interest on credit and income tax) by 1% with different loan capital shares in liabilities.

It can be seen that while in the 2000s the volume of general sources of financing (the amount of liabilities) exceeded 3.65 times the amount of own

capital of construction, in 2009 - 5.2 times, in 2019 - 15.5. times. Therefore, the reverse direction of the financial lever should also be taken into consideretion. With a slight decrease in the financial result, return on equity will decline substantially in enterprises with high financial leverage and, insignificantly, with low ones.

3. Analysis of return on equity by five-factor model.

The list of multiplier factors that determine return on equity can be expanded. These are important indicators of financial condition such as liquidity, current assets turnover, ratio of urgent liabilities and capital of the construction organization.

The expanded formula for determining the effect of factors on the return on equity is (Bielienkova, 2005):

$$\text{ROE} = \frac{NP}{EK} = \frac{NP}{V} \times \frac{A = L}{EK} \times \frac{CL}{A} \times \frac{CA}{CL} \times \frac{V}{CA}, \qquad (4)$$

where PA, PE are respectively current assets and current liabilities according to the balance of construction.

The five-factor model includes the following indicators: profitability of realization, coefficient of financial dependence, share of time commitments in the currency of balance, ratio of general coverage (current solvency), turnover of current assets.

The return on construction equity for the period 1999 - 2003 is calculated as the product of the following indicators (Bielienkova, 2005):

$$\text{ROE} = \frac{265.7}{8255} = \frac{265.7}{16205} \times \frac{30163}{8255} \times \frac{10093}{30163} \times \frac{10737}{10093} \times \frac{16205}{10737} = 0.016 \times 3.65 \times 0.33 \times 1.06 \times 1.51 = 0.0324,$$

or 3.24%, where 10093, 10737 are average annual current liabilities and current assets.

The return on equity for the 2009 (State Statistics Service of Ukraine, 2019):

$$\text{ROE} = \frac{-4439}{82370.9} \times \frac{153662.2}{29499.8} x \frac{75089.6}{153662.2} \times \frac{87868.2}{75089.6} x \frac{82370.9}{87868.2} = -0.054 \times 5.2 \times 0.49 \times 1.2 \times 0.94 = -0.15$$

The return on equity for the 2019 (State Statistics Service of Ukraine, 2019):

$$\text{ROE} = \frac{828.2}{27427.7} \times \frac{154687.9}{9994.6} \times \frac{108872.6}{154687.9} \times \frac{120894.9}{108872.6} \times \frac{27427.7}{120894.9} = 0.0302 \times 15.48 \times 0.7 \times 1.11 \times 0.227 = 0.0829,$$

From the obtained calculations it can be seen that the indicator of profitability of production activity has a significant impact on the return on equity (Fig. 5). The inability of construction companies to adapt to the changes caused by the global economic crisis of 2008 increased as a result of the events of 2014, which resulted in the long-term loss of production activity of construction enterprises, which only gradually began to emerge from the crisis in 2018.

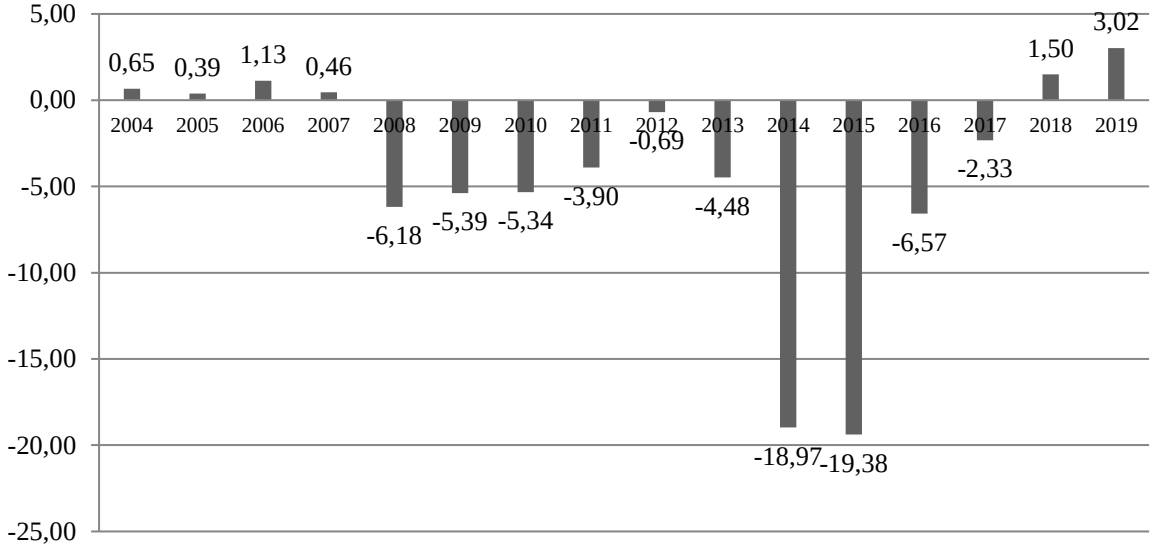

Figure 5. Profitability (loss) of production activity of enterprises of the construction industry

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

Another factor that has influenced the efficiency of the industry is the asset turnover ratio. Asset turnover characterizes the efficiency of use of all resources available in construction enterprises, regardless of their sources. The normative value of this indicator is absent, but the faster the resources of enterprises are rotated, the better. Reduced resource rotation indicates a decrease in the financial well-being of the enterprise. The turnover of assets of the construction industry since 2004 has been gradually declining, with the exception of 2018 (Fig. 6).

While in 2004 1 UAH assets of the construction industry was accounted for 1 UAH 01 kop. net sales revenue, in 2015 it was only 43 kopecks. This indicates a significant decrease in business activity of construction companies in the years 2009 - 2017. However, in 2018, 1 UAH assets of the construction industry is accounted for 1.82 UAH sales revenue. For the first quarter of 2019, it is 18 kopecks, reaching almost half of 2015. That is, there is a tendency to increase business activity.

From the three factor model of Dupont it follows that the value of profitability (loss) of equity of the enterprises of the industry is also significantly influenced by the coefficient of financial dependence (financial leverage). It

shows the ratio of debt to equity and signals an increasing risk for construction companies to lose their financial independence.

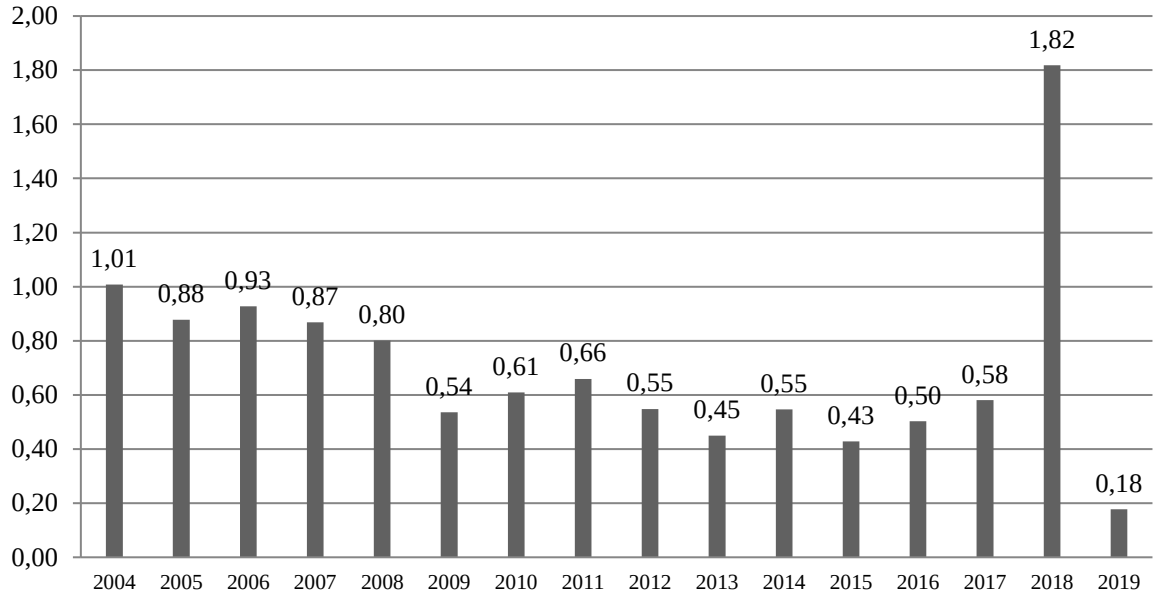

Figure 6. Turnover of assets of construction industry enterprises

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

The level of financial leverage makes it possible to determine how much interest will change the return on equity when the financial result (before payment of interest on credit and income tax) is changed by 1% in the case of different loan capital shares in liabilities.

Since construction companies operated at a loss for 10 consecutive years, uncovered losses reached a critical value in 2014, and in the years 2015-2017 exceeded the equity of construction enterprises (Fig. 7).

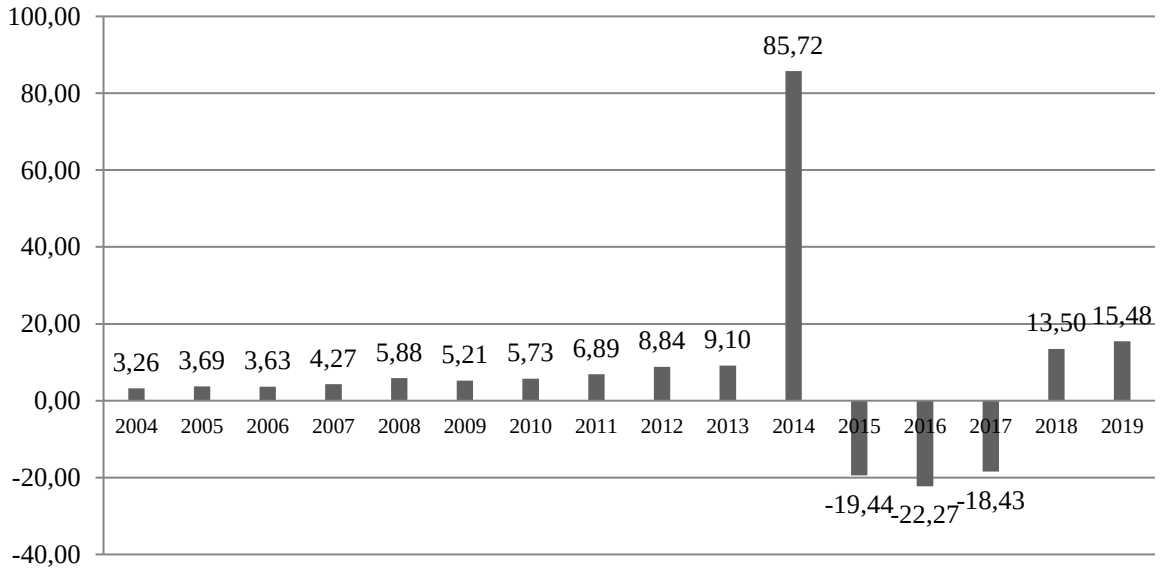

Figure 7. Increase in the level of financial dependency (CFF) of construction companies from 2005 to the first half of 2010

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

Since these years are not typical for the industry, we will analyze the financial dependence of the industry, excluding atypical values, namely data for 2014-2017 (Fig. 8).

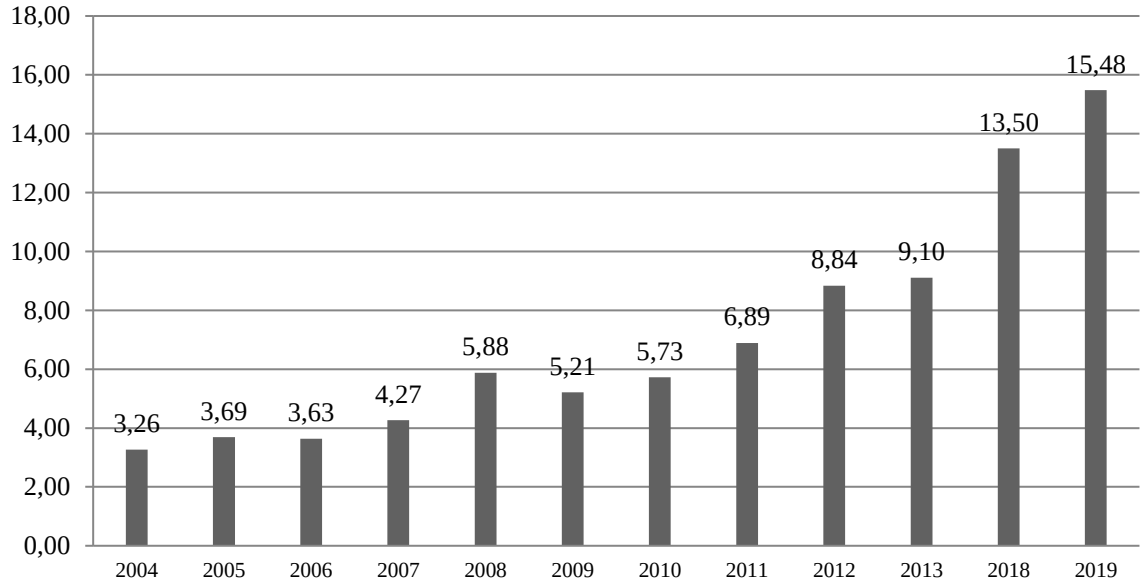

Figure 8. Increase in the level of financial dependency (CFF) of construction companies from 2004 to the first quarter of 2019

Sourse: calculated by the authors according to data (State Statistics Service of Ukraine, 2019)

In 2004-2007, the ratio was less than 5, which means that the loan capital exceeded its own one less than 5 times, in 2008 1 UAH of own capital was accounted for UAH 5.58 of all sources of financing, and this indicator is gradually increasing, indicating a critically low share of equity in funding sources.

The increase in the share of borrowed capital has its advantages in many cases, as debt is profitable in the period of economic development, expansion of the activity of enterprises, and while increasing inflation. In addition, the borrowing fee is gross and not taxed.

However, with the increase in the share of borrowings in the capital structure, there is an increase in the amount of payments with a fixed term and the likelihood of failure to pay interest and the principal amount of debt during adverse market conditions. This leads to an increase in the level of financial risk. That is, with the increase in the volume of work performed, the profits will more effectively work, develop, receive greater return on invested capital by those enterprises that have more importance of financial leverage. Conversely, in times of falling, sharply declining work, these businesses will suffer greater losses per unit of equity than those pursuing a more moderate borrowing policy. Thus, a significant share of borrowed funds in the structure of the balance sheet of construction enterprises, which were one of the main sources of growth of the construction industry in the period of development, significantly reduces the stability of enterprises in the industry during the crisis period.

Discussion. The results of the analysis confirmed the conclusion that the main cause of damage to construction companies is a sharp decrease in business activity in the country due to the global financial and economic crisis and military actions in the east. The obtained imbalances of economic development were completely overcome only in 2018. The growth trends are also observed in 2019, however, the resulting growth is not yet stable enough and may be affected by many external and internal factors.

The use of Dupont models for the profitability (loss) analysis of the construction industry allowed us to more thoroughly analyze the factors that influenced this indicator. The financial analyst, using MS Excel, can see how any changes to individual factors or their totals affect the value of the final indicator.

Conclusion. Analysis of the profitability indicators of the "construction" activity enterprises in 1999-2019 revealed that the construction industry worked at a loss for a decade in a row (2008-2017). This was reflected primarily in the capital structure. During these years, equity decreased to a critical level; in 2015, uncovered losses exceeded the amount of authorized and reserve capital. Only in 2018 the situation started to level off. Factor analysis of profitability indicators allowed to identify in depth the most influential factors, namely: loss of the main activity of construction enterprises during ten consecutive years, which led to a decrease in equity to a critically low level and correspondingly high financial leverage (in the 2000s - 3.65; in 2009 - 5.2 times, in 2019 - in 15.5 times.) Therefore, the reverse direction of the financial lever should also be considered. In the case of profitable activity, the financial lever will allow to reach high values of return on equity. But in times of crisis or continuation of a downward trend, this can lead to a loss of financial sustainability in the construction sector.

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