MONITORING MECHANISM OF RESILIENCE OF THE ANTI-CRISIS POTENTIAL SYSTEM OF THE CONSTRUCTION ENTERPRISE IN THE LONG-TERM PERIOD

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Abstract. *The anti-crisis potential of enterprises belonging to industries with a long production cycle is unstable, as the time interval between incoming cash flows is much longer than between outgoing ones. This problem is especially actual for construction companies, whose income largely depends on the state of investment demand. Therefore, there is a need to develop an effective mechanism to control the resilience of the anti-crisis system of the construction company to environmental conditions. According to many scientists, anti-crisis potential is associated with the financial sanation. Given the undeniable usefulness of the analyzed developments, there has been noted that they are unsuitable for managing the financial sanation capacity and anti-crisis potential of construction companies. After all, most of them are suggested for agricultural or industrial ones. Given the definition of "financial sanation", the implementation of measures aimed at restoring business is impossible without investment. Investing funds in any business project, including those aimed at strengthening the financial condition of the enterprise, will be efficient only when they provide an economic effect. Thus, the requirement of return on investment is indisputable, but for high-risk activities, including construction, there is an additional condition, to get a return on investment as soon as possible: from 3 to 10 years. After all, this is the duration period of different types of macroeconomic cycles, during which the vast majority of construction companies go through all stages of economic development: from growth to decline.*

The dependence of the payback period of equity capital on other factors of the internal and external environment of business systems has been studied in order to manage the rehabilitation and anti-crisis potential of a construction company. General scientific methods such as analysis, synthesis, deduction, induction, analogy as means of studying and generalizing theoretical approaches to providing anti-crisis potential; Backward Stepwise method (construction of multifactor linear regressions Statistica 8.0), providing the sequential construction of equations in which the set of input factors decreases by removing the least significant to explain the variation of the independent variate. In order to increase the efficiency of decision-making on the feasibility of additional equity attraction by construction companies there has been developed a methodological approach to forecasting the level of financial sanation capacity of the construction company. It is a complex; a multifactor model - a linguistic scale, allows to identify changes in the payback period of equity in the medium term using quantitative and linguistic estimates and can be used as a functional module of digitized economic management of the enterprise.

Keywords: *anti-crisis potential, payback period of equity capital, level of consumption of owners' capital, capital multiplier for current liabilities, return on current assets, multifactor model, functional module of digitized economic management of the enterprise.*

JEL classification: C87, G33, L74
Formulas: 3; fig.: 1; tabl.: 1; bibl.: 30

Introduction. At the end of 2019, the construction market in Kyiv collapsed. With the withdrawal of the largest construction company Ukrbud, which declared bankruptcy at the end of 2019, the situation changed significantly. The change in the top of developers has affected not only the redistribution of weight in the market, but also the investors' attitude to developers. Due to the problems with such companies as Elita-Center, Ukrbud and others, many families who want to invest in housing construction are now focusing their attention on reliable companies and their reputation. In turn, the top management of the largest construction companies that remained afloat is increasingly drawing attention to the world practice of economic management, which has gained considerable experience in developing strategies to prevent bankruptcy, creating economic security of construction companies, crisis management and more. Despite of the researches carried out by Ukrainian and foreign scientists, the issue of developing and strengthening the anti-crisis potential of domestic construction companies requires additional research, given the critical state of most construction companies.

Literature Review. Many scientists associate the anti-crisis potential with the financial sanation one, in particular O.Yu. Andrushchenko defines anti-crisis potential and financial sanation as two main elements that form the potential for survival [1].

Effective management of anti-crisis potential should help strengthen the financial sanation capacity of enterprises. Thus, N.V. Trusova, S.V. Karman [4] note "the operational capacity of the enterprise should be considered not only as its current ability to survive, but also the ability to develop effectively in the future." Endovytsky D.A., Isaenko A.N. [5] characterize the mechanism of management of financial sanation capacity as a management tool, "aimed at systematic monitoring of financial and economic security, early detection of threats to their financial sanation capacity and development of strategic and tactical measures aimed at prompt restoration of financial sanation capacity and ensuring profitability, competitiveness and sustainable development of the enterprise." Bulovich T.V. [6] considers financial sanation capacity as a complex natural characteristic of the socio-economic system, which is based on its ability to maintain it in a balanced, stable state, which creates the preconditions for successful operation. In addition, this author notes that the remediation capacity is a kind of "economic immunity" of the enterprise, which determines its ability to counteract the negative effects of external and internal factors, forming the ability to self-reproduction [6, p. 162]. Management of the financial sanation capacity of the enterprise Lisnichuk O.A. proposes to consider as "a cyclical process that is formed as a result of the relationship of such management functions as monitoring, planning, design, implementation and control" [26].

Scientists also offer different ways of quantitative and qualitative assessment of financial sanation capacity and financial sanation potential, using indicators that differ in economic content [2-3, 8-24].

Oliynyk T.O., Shiblova A.M. [7] consider it appropriate to assess the financial sanation capacity using "traditional" models of bankruptcy prediction and SWOT-analysis. Similar methods were used by other scientists: Lisnichuk O.A. [26],

Rudenko E.M. [11], however, alongside this they suggest their own development of an integrated indicator of financial sanation capacity, and use various methods of their justification. Lisnichuk O.A. proposes to determine the integral exponent based on the multifactor linear regression equation. Instead, Rudenko E.M. considers it appropriate to calculate the integrated indicator as a weighted average assessment of liquidity and financial stability. It is assumed that one should use not the actual values of indicators, but their relationship to the normative or industry average, as well as adjust these ratios to the weights of each factor in the overall model, determined by the expert method [11]. It should be noted that all the above methods of assessing the financial sanation capacity determine a certain conditional indicator, which is impossible to interpret clearly. Some development results [8-13, 19, 22, 25, 27-30] provide for the implementation of logit-transformation of such "conditional" integrated indicators, which provides a quantitative assessment of the probability of bankruptcy, default, withdrawal from the market.

Aims - to develop a comprehensive methodological approach to forecasting the level of financial sanation capacity of the construction company. The main task is the formation of anti-crisis potential of the construction company, able to withstand existing threats in conditions of digitalization of the economy, which determines the topicality of the study.

Methods. To study the components of the anti-crisis potential of construction companies and identify threats to their economic security we used a coefficient method, correlation-regression analysis, two-input classifications. "Multifactor model - linguistic scale" as a basis for organizing a digital management system of a construction company.

Results. The payback period of equity capital (PP_{EC}) in the financial analysis is proposed to be defined as the value inverse of financial return (ROE):

$$PPEC = \frac{1}{ROE} = \frac{EC}{NP},$$

(1)

where EC, NP - respectively, the average value of equity capital and net profit for the reporting period.

According to (1), the owners' capital investment in the construction business will pay off the faster, the greater the amount of net profit received by the company in the period under review. If the company is operating at a loss, the result (1) will be negative and it will be impractical to invest in the assets of unprofitable business. After all, instead of gaining profit, there will be only a waste of capital.

The value of the payback period of equity capital according to formula (1) was calculated for a study sample of construction companies. Given the long-term nature of investment, including financial sanation, one should pay particular attention to the results of calculations for the period of four years before the crisis, shown in Fig. 1.

The diagrams and information fields (Fig. 1) present the statistical characteristics determined for the entire sample taking into account the subperiod, but without dividing the observations into crisis and non-crisis. Calculations showed that

the average payback period of equity capital is almost 8 years, subject to 95% -s boundaries reliable interval, the figure is in the range from -3 to 19 years (Figure 1).
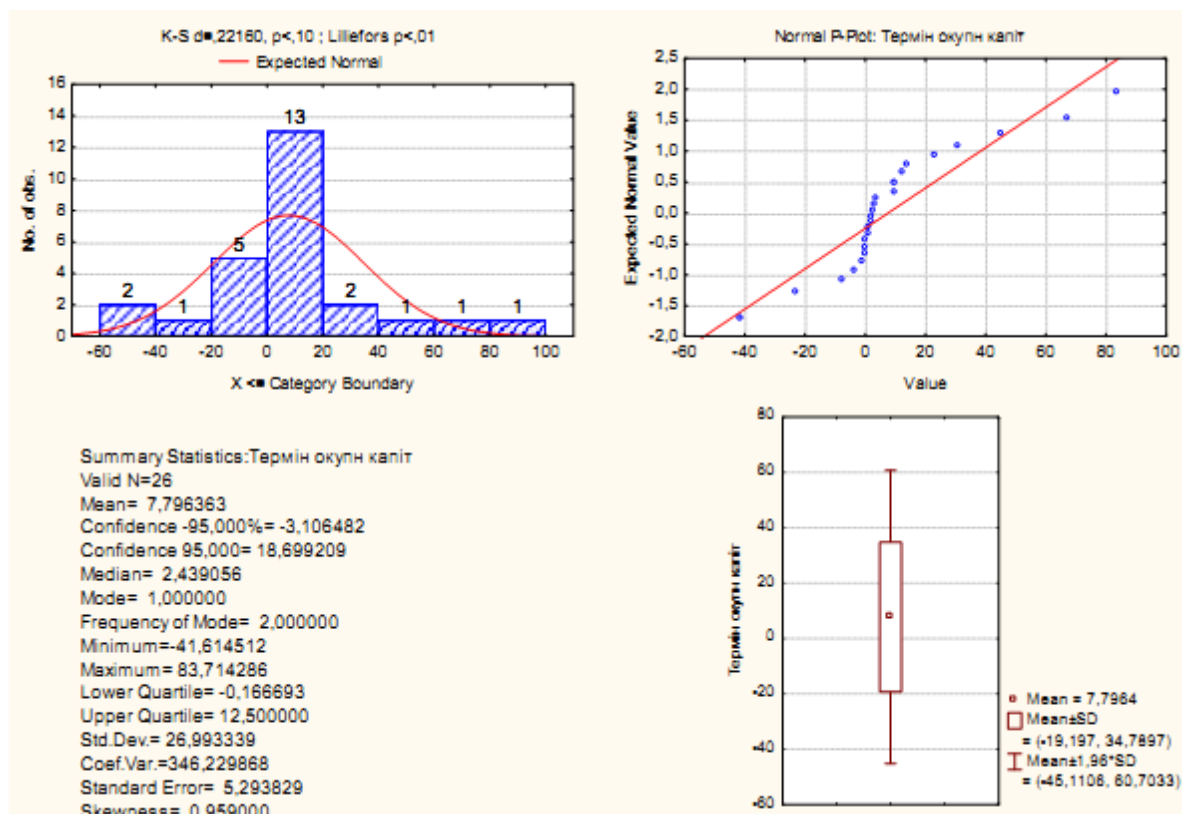
Figure 1. Statistical characteristics of the payback period of equity capital for 4 years before the possible start of the crisis

Source: developed by authours

In the analyzed sample, the minimum payback period is almost 42 years, the maximum is 84 years, the standard deviation (σ)is almost 27 years, and the standard deviation means:

$$\sigma\overline{_{PPec}} = \frac{\sigma\overline{_{PPec}}}{\sqrt{n-1}} = \frac{27}{\sqrt{5}} = 5,4 \ years \quad , \tag{2}$$

where n is the volume of the subsample.

In accordance with the results of calculations, 8 observations (Fig. 1) have a negative payback period of equity capital, i.e. investing to ensure their viability is impractical. These are the options for the contractors' work, which were achieved in Ltd CD №12. However, not all enterprises that have a positive payback period of equity capital are characterized by high financial sanation capacity, as the considerable value of the ratio (1) indicates a significant delay in obtaining the economic effect of reorganization investments.

Since the studied indicator must vary within certain reasonable limits, not all values of quartiles (Fig.1) are suitable for the development of instrumental support mechanism for controlling the resilience of the system of anti-crisis potential of the construction company in the long run. In particular, the first quartile, which separates

25% of observations with minimum values, is -0.17 years and delimits the options for contractors with low financial sanation capacity. However, these are not all the cases of inefficient equity management listed above. The second quartile, of course, is the median, it divides the sample in half according to the level of manifestation of the sign. The median payback period of equity capital of the studied sample (Fig. 1) was 2.44 years, but this result should not be considered as a benchmark for the effectiveness of crisis management of the construction business. After all, this result is caused by a significant number of negative values of the studied indicator, which is unacceptable. And only the third quartile separating the quarter of observations with the maximum value equals 12.5 years and is informative for anti-crisis resilience control capabilities. It should be considered the limit value of the financial sanation capacity of the construction business. It is doubtful that a rational investor will expect a return on investment for more than 12.5 years.

Similar calculations were performed for the whole set of enterprises, without taking into account the crisis horizon, but with the division of the sample into crisis and crisis-free subgroups. The results of calculations of the payback period of equity capital were much worse because of a number of circumstances. Enterprises in crisis, in particular, most of which were in liquidation, rapidly reduced the volume of their activity or even stopped it, as a result, the net income was close to 0 or negative. Usually the result of the formula (1) will be excessively high or negative, which is unacceptable to ensure remediation capacity. As the period under review of most crisis-free enterprises coincides with the periods of economic decline of the country, many enterprises of the crisis-free group operated at a loss, or reflected understated income and financial results in their financial statements. Therefore, the indicators of financial sanation capacity in this subgroup significantly exceed the above-mentioned limits of financial sanation capacity of the construction business.

In our opinion, the dependence of the payback period of equity capital on other factors should be studied in the dynamics, since the decisive role in making an investment decision is played by forecast indicators. After all, it is important for the investor to assess possible changes in the efficiency of investment in the period following the investment costs, taking into account the functional module of digitalized economic management of the enterprise [9-10].

The dynamic aspect of the influence of the factors on the result is reflected in the lag, or autoregressive stochastic model, i.e. such a dependence in which the explanatory and explanatory variables belong to different periods. This study used a lag model, the factor variables of which are one year ahead of the effective. The choice of such dependence was made taking into account the considerable uncertainty of the economic environment of construction companies and the desire of investors to return the capital as soon as possible [14, 16, 21, 23, 30]. Thus, in the case of reducing the profitability of a business project, it is natural to decide on premature disinvestment in order to avoid much greater losses. In our opinion, among the factors influencing the future growth of the payback period of invested capital should be those that are crucial for the implementation of advanced anti-crisis diagnostics, as evidenced by previous studies [2, 3, 12-22, 25-30].

However, we should not neglect the well-known financial indicators used in the diagnosis of bankruptcy and anti-crisis capacity. Based on the above considerations, we formulated the initial set of factor indicators, which should influence the change in the payback period of equity capital in the one-year perspective. Due to the heterogeneity of financial ratios both in the entire sample and in the context of individual subgroups, the construction of a multifactor model was preceded by numerous experiments. First, they concerned the refinement of the studied set of observations for the presence of "emissions", i.e. such variants of economic activity, whose characteristics have too high or excessively low quantitative values compared to the rest. Secondly, it was necessary to ensure the unbiasedness and efficiency of the model coefficients, first, by achieving a sufficient density of stochastic relationship between the factor and result variable, while avoiding high correlation in the middle of a set of explanatory variables.

To ensure the homogeneity of the original array of analyzed data, we removed observations of the penultimate year of some bankrupt enterprise operations from it, as well as data of those entities whose capital, assets, income, expenses exceed the 90th percentile or were less than the 10th percentile. As a result, the input array was formed according to 16 construction companies. Since the dependent variable of the model corresponds to the next period, i.e. moved by a year, compared to independent, three options are considered for each company. After all, the data for the last year before (for the crisis subgroup) exit from the market cannot be used, as there is no information about changes in return on equity capital in the future.

The criterion for substantiating the feasibility of including explanatory variables in multifactor models is the coefficient of pairwise correlation with the resultant variable. In this case, along with the numerical value of the coefficients, their statistical significance is taken into account, which is taken at the level of 0.05. The relevant indicators are underlined. According to the calculations, a priori justified factors are suitable for use in models together with factors important for advanced crisis diagnosis. In particular (Table 1), changes in the payback period of equity capital can be explained by last year's fluctuations in liquidity, quick liquidity and coverage, characteristics of the capital structure , defined by us as specific features of anti-crisis potential of construction companies, and return on working capital net income. The density of the correlation is different, depending on whether it is calculated for the entire sample, or for individual subgroups. Due to their different size, there are differences in the statistical significance of the correlation coefficients (table 1).

Construction of multi-factor linear regressions was carried out in a software environment Statistica 8.0 method Backward Stepwise, which provides consistent building of equations, where a set of inputs is decreased by removing the least significant for explanation of variations in the independent variable.

Table 1. The value of the coefficients of pairwise correlation between the indicators of the financial condition of construction companies and the payback period of their equity capital in a year

Factor variable	Coverage ratio	Quick liquidity	Multiplier	Capital consumption	RCA.
The whole sample	0.38	0.34	-0.43	0.67	0.12
Crisis-free group	0.70	0.89	0.71	-0.69	0.11
Crisis group	-0.37	-0.42	-0.53	0.45	-0.61

Source: developed by authours

Finally, the regression formulas constructed for different subgroups, as well as the entire sample, differ in the composition of the explanatory variables, and the size of the coefficients around them:

$$\hat{y} = 44{,}9x_1 + 28x_2 - 4{,}6x_3 + 58{,}6x_4 - 125{,}8 \qquad (1),$$

$$\hat{y} = 23{,}8x_1 + 22{,}3x_2 + 160{,}6x_4 - 149{,}2 \qquad (2),$$

$$\hat{y} = -22{,}4x_1 + 18{,}2x_2 - 2{,}3x_3 - 168{,}7x_5 - 3{,}8 \qquad (3),$$

where, x_1 - Coverage ratio; x_2 - Owners' capital consumption level; x_3 - Capital multiplier for current liabilities; x_4 - Quick liquidity; x_5 - Return on current assets.

Indicators of statistical significance of equations (1 - 3), given the performance of multiple determination (R-squared) and calculated based on these values Fisher criterion (F), that the higher probability in the corresponding table 0.05 can be considered dependence (1 - 3) regular, not accidental. The values of standard errors of all models do not exceed 30 years, which is acceptable given the considerable scope of variation in the payback period of equity capital.

The analysis of the coefficients for variables in the formulas (1 - 3) showed the following:

• Factors of change of financial sanation capacity differ significantly depending on the level of anti-crisis potential - in number, in direction, and in intensity of influence;

• Perhaps the most important factor for the anti-crisis diagnosis, the return on current assets, affects only the variation in the payback period of the owners of crisis subgroups, while non- crisis ones are less vulnerable to changes in such profitability, since the variable x_5 is available only in the model (3);

• Coverage and quick liquidity ratios, which are "traditional" for anti-crisis diagnostics, vary, causing changes in the payback period of equity capital in the annual perspective only for those enterprises that are not facing the threat of financial crisis. The directions of change are the same: the growth of liquidity indicators postpones the payback period of the owners' capital, as the coefficients for variables x_1 and x_4 in the formulas (1, 2) are positive. That is, the earliest possible return on investment in the construction business is not possible without the use of aggressive policies for the establishment of current assets;

- The burden of owners 'capital on operating costs, or the level of consumption of owners' capital, has a direct impact on the payback period of equity capital, i.e. increasing the ratio of the main positive components of equity to operating costs increases the dependent variable for all analyzed enterprises, regardless of their crisis potential. This conclusion is made taking into account the positive values of the coefficients at x_2 in the formulas (1-3);

- The multiplier of capital on current liabilities was a stimulating factor to accelerate the return on owners' investment in the construction business, as increasing the ratio of accumulated current liabilities to total assets reduces the value of the productive variable throughout the sample of enterprises and crisis subgroup. The inverse dependence of the payback period of equity capital is manifested through the negative values of the coefficients around x_3 in the formulas (1, 3).

Regarding the quantitative impact of the studied factors on the payback period of equity, it is advisable to dwell in more detail on the parameters of the formulas (1-3).

Throughout the sample of surveyed enterprises, the value of the dependent variable should be expected to increase by 44.9, 28.0 and 58.6 years, respectively, in the case of an increase in the coverage ratio, the level of consumption of owners' capital and quid liquidity per unit. However, such a rapid growth of all these factors is unlikely, modern construction companies should expect them to increase by no more than 0.1, or 10 percentage points. Therefore, it is more probable to assume a possible increase in the payback period of equity capital by 4.5, 2.8 and 5.9 years, respectively, due to the use of conservative financial policy as a means of crisis management. Thus, in order to manage the anti-crisis potential, it is reasonable to alternate the priority periods of conservative and aggressive working capital management policy. The first one is aimed at the current financial stabilization and elimination of the shortage of cash resources in the short term, but it does not allow obtaining a sufficient amount of net profit, which would accelerate the payback period of investment in the construction business. The application of the second type of policy is justified by high profitability, but it cannot be applied on a regular basis due to the threat of loss of solvency by the construction company. Given the level of significance of each of the coefficients of the model (1), determined by the t-testing, it should be noted that crucial indicators for determining the remediation capacity are the coverage ratio and the level of capital consumption of owners in which p-significance does not exceed 0.05. It should also be noted that these factors are characterized by the strongest influence, expressed in standard deviations: with an increase in x_1 and x_2 per sigma, the payback period of equity capital will increase by 0.4 sigma.

The value of the free constant in the formulas (1-3) reflects the dependence of the performance variable on other factors of the internal and external environment of business systems that were not included in the models. Thus, for the entire analyzed sample, factors not taken into account by the dependence (1) lead to a reduction in the payback period of equity capital by 125.8 years. This effect is explained by the presence of a large number of unprofitable enterprises in which equity capital and its

payback period have become negative. With regard to the value of R^2, we can conclude that the dependence1 explains variation payback period of equity capital in 56 cases out of 100.

The dependence of the financial sanation capacity of crisis-free enterprises on the change of anti-crisis potential is approximated by the formula (2). According to its right part, the payback period of the capital of construction companies, which are not threatened by liquidation in the near future, is affected by fewer factors, because in the model (2) there are no variables x_3 and x_5. However, all three independent variables present in this formula with their growth only lead to a decrease in financial sanation capacity. In particular, an increase by 1 of the ratios of quick liquidity, coverage and level of consumption of owners' capital will increase the payback period of equity by 160.6, 23.8 and 22.3 years, respectively. If the increase in financial indicators (x_1, x_2, x_4) will be only 0.1 times, or 10 percentage points, which is more likely, you should expect an increase in payback period of the owners' capital in addition to 2-16 years. The obtained indicators of the quantitative impact of the factors on the financial sanation capacity confirm the inexpediency of applying only a conservative policy of financing the current assets of construction companies. Given the values of the coefficients for the variables in model (2), it can be argued that the preference for conservative fiscal policy in the management of crisis-free enterprises will negatively affect their investment attractiveness. After all, a considerable payback period of the capital invested in the construction business will not stimulate new investments in technical renovation, despite the lack of cash shortages and solvency problems. Since, according to dependence (2), only the free constant is negative, stimulators of investment attractiveness of crisis-free construction companies are factors other than the level of liquidity, solvency or the ratio of a positive part of equity to operating costs. Independent variable formulas (2) are characterized by different levels of statistical significance, and, as for the entire sample, the decisive influence on the financial sanation capacity of crisis - free enterprises is exerted by only two factors. These are liquidity ratios - quick liquidity ratio and coverage ratio. In the case of variation of the respective independent variables (x_1 and x_4) in the amount of one standard deviation, the payback period of equity capital will change by 0.264 and 0.760 of their standard deviations, respectively. In this case, the direction of change of the performance indicator will coincide with the direction of change of factors. Thus, among the most significant factors in both empirical dependences, only one, coverage factor, coincided, but its influence, expressed in standard deviations, in the crisis-free subsample is slightly smaller: 0.264 sigma versus 0.389 sigma. The model of financial sanation capacity of crisis-free subsample (2) is characterized by a higher approximation reliability than the model for all observations (1), because the corresponding values of R^2 differ significantly. Thus, the formula (2) can explain 84 out of 100 cases of variation in the payback period of equity capital.

The model of financial sanation capacity for the crisis subsample (3) is slightly different from the rest of the factor set; it is the only one that contains an independent variable that characterizes the profitability of the construction business: x_5, which we

used to mark the return on current assets. In general, in terms of the set of independent variables, this empirical formula is more similar to the model (1), built on the whole sample, than to the model of crisis-free enterprises (2). In (3) there are also four factor variables, three of which are the same as in (1): coverage ratio (x_1), level of consumption of owners' capital (x_2), capital multiplier for current liabilities (x_3). The increase in the values of all factors, except x_2, has a positive effect on the reorganization capacity of the subsample, as it reduces the payback period of equity capital. Of course, construction companies in crisis should not expect increases in liquidity, profitability, the ratio of components of the capital structure in the amount of more than 10 percentage points or 0.1 times. Accordingly, with such effectiveness of crisis management, a reduction is most likely to happen in the payback period of equity capital by 16.9 years in the case of an increase in return on working capital by 10 percentage points, by 2.2 years if the coverage ratio increases by 10 percentage points, or by 0.23 years in the case of an increase in the capital multiplier for current liabilities. Instead, under conditions of increasing the ratio of the positive part of equity to operating expenses, the payback period of the owners' investments will increase by 1.8 years out of every 10 percentage points. Factors not included in the model (3) contribute to the growth of financial sanation capacity, as their impact reduces the payback period of equity capital by almost 3.8 years. The influence of independent variables, expressed in standard deviations, is noticeably weaker than for the model (1), as evidenced by the values of Beta-coefficients. Moreover, in dependence (3) the smallest of all is the indicator of the reliability of approximation, but its value exceeds 0.5, giving grounds to conclude that this formula is not accidental.

Discussion. Based on the above, the Author considers it necessary to clarify and supplement the concept of the "anti-crisis potential of a construction company". The Author's definition of the "anti-crisis potential of a construction enterprise" can be presented as a combination of all the possibilities of the construction business to resist a crisis, combining identification, analytical, protective, neutralizing subsystems, the coordinated functioning of which allows eliminating external and internal threats to economic security with continuous updating and digital support of the information control unit.

Conclusion. The correspondences obtained as a result of econometric modeling (1-3) can be used to predict the financial sanation capacity of enterprises as a functional module of digitized economic management of the enterprise, provided that the independent variables are within the same limits as in the original samples. Its effectiveness is determined by the ability to quickly accumulate, process and apply information about threats to the enterprise's activities, largely depends on the degree of informatization of activities.

Author contributions. The authors contributed equally.

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