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INVESTING IN RESOURCE-SAVING MEASURES AS A TOOL OF ANTI-CRISIS FINANCIAL MANAGEMENT AT ENTERPRISES

Abstract: The article developed and tested methodological principles for evaluating the effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises. It is planned to carry out such an assessment by forecasting the values of the proposed indicator of the depth of the financial crisis at enterprises. The calculation of this indicator is based on comparing the minimum acceptable value of the financial result of the company's activity for the fulfillment of debt obligations with the actual value of such a result. The application of the proposed indicator makes it possible, among other things, to carry out a qualitative gradation of the depth of the financial crisis at enterprises by distinguishing them into six classes depending on the value of the indicator of this depth. At the same time, four of these classes refer to business entities already in a state of financial crisis or with signs of the possibility of approaching this state. Accordingly, by assessing the forecast or actual change in the number of such enterprises after they implemented resource conservation investment projects, it is possible to establish the effectiveness of investing in resource conservation measures as a tool of anti-crisis financial management at enterprises. To correctly calculate the predictive value of the indicator of the depth of the financial crisis at the enterprise, among other things, the simulation of this indicator was carried out. Such modeling provided, in particular, an opportunity to better understand the mechanism of influence of several factors on the value of the indicator of the depth of the financial crisis. It was established that the main factors include the structure of sources of financing resource-saving investment projects, the length of the crediting period, the capital intensity of products, and the share of expenses related to the consumption of specific production resources, etc. Based on the conducted theoretical studies, a method was developed for evaluating the effectiveness of investments in resource-saving measures as a tool of anti-crisis financial management at enterprises. This method was successfully tested on a sample of enterprises that belong to three industries and are characterized by a significant share of loan capital in the structure of asset financing sources. The results of the

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empirical analysis showed that implementing energy-saving projects at the studied enterprises will significantly reduce the number of enterprises in a crisis or pre-crisis state. It was also proven that the forecast value of the indicator of the depth of the financial crisis after the implementation of energy-saving projects decreases with an increase in the crediting period and the initial share of costs for the purchase of energy resources. However, the value of this indicator increases with an increase in the capital intensity of the enterprises' products and the share of loan financing of the corresponding energy-saving projects.

Keywords: Enterprise, financial crisis, anti-crisis management, depth of the crisis, investment, resource-saving project, energy saving.

1. Introduction

In recent years, the economies of many countries worldwide have been characterized by an increase in uncertainty about the results of economic activity and the deterioration of the conditions for its implementation. Such changes are the consequences of negative phenomena that have recently occurred in various spheres of social life, starting with the COVID-19 epidemic and ending with extreme tension in relations between many countries and the background of the military conflict in Ukraine. In such a situation, the external environment of business entities becomes particularly unfavorable for ensuring the proper efficiency of their functioning, which, in turn, increases the probability of enterprises falling into a state of the financial crisis.

In general, there are many reasons why companies are in a financial crisis. In particular, one of these reasons is often the need for soundness of the lending policy of firms, which is carried out by their managers, attracting too large amounts of loan funds. At the same time, the significance of this reason increases significantly if the unsuccessful credit policy of companies is combined with a significant deterioration of the market conditions in

which these companies operate. At the same time, this applies to the markets of products produced by enterprises and to the needs of those production resources used by enterprises during their activities.

About the markets of production resources, many such markets are currently characterized by significant price volatility and the presence of a risk of their long-term increase. In particular, these properties are inherent in the markets of agricultural raw materials, metals, energy carriers, etc. Therefore, such production resources are characterized by a significant price level or a high probability of an increase in the future. Accordingly, enterprises in the structure of the cost of production, of which expenses for purchasing such resources occupy a considerable share, may be especially prone to the onset of a financial crisis.

However, business experience shows that, for certain types of production resources of enterprises, there is a possibility of significantly reducing their consumption and, as a result, reducing the probability of such enterprises falling into a state of financial crisis. These opportunities are because, for many types of resources, there are technologies for producing the same products with lower specific costs of the related resources. In particular, this applies to energy resources consumed by

enterprises.

Although several countries worldwide are implementing various measures to increase production's energy efficiency, this level is still high in many enterprises, particularly in Ukrainian enterprises. This situation is mainly due to multiple barriers that inhibit the implementation of measures to reduce the energy intensity of the company's products. One of the essential barriers is the need for significant amounts of investment, which must be invested in implementing most large-scale energy-saving projects.

The need to make significant investments applies not only to energy-saving projects but also to most projects that involve implementing technical and technological measures to save any production resources of enterprises. For example, this applies to projects on automation and mechanization of production, the implementation of which reduces the specific costs of human resources (Nestorov et al., 2023) of enterprises. However, any resource-saving investment projects require a thorough preliminary assessment of the impact of their performance on the activities of those business entities that plan to implement these projects. In particular, one of these possible consequences is a change in enterprises' financial stability level due to investing in resource conservation measures. Suppose such a change will be positive, and the relevant criteria will be sufficiently large-scale. In that case, there are reasons to consider investing in them to avoid the onset of a financial crisis or exit from it if the crisis state is already inherent in particular enterprises. In other words, there are prerequisites for identifying investment in resource-saving measures as one of the possible and sufficiently practical tools of anti-crisis financial management at enterprises.

2. Publications review

The problem of managing the activities of

enterprises in the context of preventing them from experiencing a financial crisis or ensuring its overcoming has been the focus of attention of many scientists in recent years. In particular, scientists have established the primary factors and studied the regularities of financial crises at enterprises. Thus, in work (Akbulaev et al., 2020), its authors consider such crises through the prism of deterioration in companies' solvency level. In (Izmailova & Zapiechna, 2020), a study of the profitability crisis was carried out, which, according to many scientists, often acts as the main component of the financial crisis. At the same time, in (Yemelyanov et al., 2022), the decrease in the financial and economic results of economic activity, primarily the income and profits of enterprises, is considered among the main reasons for the deterioration of companies' financial stability. Another reason is the presence of an excessive amount of loan capital among business entities (Korepanov et al., 2020). In general, the probability of a financial crisis at enterprises will increase significantly if the reduction of financial and economic results of economic activity is combined with the presence of unreasonably large volumes of loan sources of financing their assets. At the same time, there is a need to consider the specific limited capabilities of many enterprises to ensure they can maintain the profitability of their activities. This is due, first of all, to the fact that such a decrease is often caused by the deterioration of the situation in the product sales markets and the action of other factors external to enterprises (Cheong & Hoang, 2021). In contrast to profitability, another factor affecting companies' financial stability, namely, the process of forming their loan capital, is mainly internal (Gajdosikova et al., 2023). Therefore, from these points of view, the regulation of the structure of the loan capital of companies should be recognized as the most effective tool for early warning of the onset of a financial crisis at enterprises (Dinh & Pham, 2020).

However, at the appearance of the first signs of a financial crisis at enterprises and, even more so, at the stage of its development, implementing measures to reduce the amount of loan capital quickly is significantly complicated. This difficulty is caused, in particular, by the need for more volume of income streams that enterprises can use to repay previously received loans. Therefore, it is necessary to timely manage the processes of obtaining, servicing, and returning loan funds at enterprises.

One of the possible objects of such management is financial leverage since the effect of such leverage can be considered a potential tool by which the influence of debt financing of companies' activities on their profit and profitability indicators occurs. At the same time, the opinions of different scientists regarding the external manifestations of this effect often do not coincide. For example, in (Gill et al., 2012), the primarily positive nature of the impact of financial leverage is noted. In contrast, in (Javed et al., 2015), the inevitable negative consequences of this effect on the financial condition of companies are revealed. After all, in some works, particularly in (Hoque, 2017), this effect's influence on enterprises' activity was not detected at all. However, in other publications in which financial leverage is considered from the standpoint of managing the financial condition of companies, particularly in (Adenugba et al., 2016), it is proposed to apply an optimization approach to financial leverage.

At the same time, it should be noted that there is a close relationship between financial leverage and the level of riskiness of companies' activities. Reducing the risks of companies losing their creditworthiness is one of the main tasks of anti-crisis financial management. This, in turn, requires a preliminary assessment of the risks of business activity (Fu, 2022) and the development of measures to manage them (Arshi, 2022).

It should be noted that scientists have

developed many anti-crisis financial management tools at enterprises. These tools include both tactical and strategic tools (Masharsky et al., 2018). At the same time, different scientists consider the process of anti-crisis management of enterprise activities from slightly different positions. In particular, scientists propose such consideration through the prism of managing the financial potential of enterprises (Tanklevska, & Miroshnichenko, 2019), from the standpoint of ensuring their financial sustainability (Bondarenko et al., 2020), in the context of the implementation of financial and economic innovations (Cherba, et al., 2019), etc. Investment's important role in enterprises' activity is also indisputable (Kniaz et al., 2023). However, investment as one of the potentially possible tools of anti-crisis financial management is often not considered among the priorities, which is explained by the fact that financially unstable enterprises often need help to obtain the necessary investments. At the same time, limited financial opportunities are generally inherent in entrepreneurial activity. Thus, the study of the peculiarities of the economic activities of several small European firms in (Angori & Aristei, 2018) showed that it is quite common for these firms to need help accessing the appropriate amount of credit services. Similar results, as evidenced by the data presented in (Rostamkalaei & Freil, 2016), are also characteristic of companies in countries with a transition economy. At the same time, it was established in (Bhalli et al., 2017) that companies with smaller assets are characterized mainly by internal financing of their activities. Larger enterprises will attract significantly more funds from their external sources.

However, among the investment projects, the implementation of which is envisaged by enterprises in implementing the program of anti-crisis management measures, there may also be those projects characterized by a high level of efficiency at an acceptable degree of riskiness. Then, under certain conditions, the

problem with the financing of such projects can be solved as long as it is convincingly established that the tangible positive impact of these projects on the financial stability of the enterprises in which they will be implemented. It is possible only if the mentioned projects have a substantial effect on at least one of the main reasons that led to the deterioration of the financial stability of the respective enterprises. In particular, one of these reasons can be the high resource intensity of production.

In general, the importance of implementing resource conservation measures is noted by many scientists, in particular in their work (Mohsin, M., Kamran, H. W., Nawaz, M. A., Hussain, M. S. & Dahri, A. S., 2021). Increasing the energy efficiency of production processes is especially relevant for many enterprises in current economic conditions. To achieve such an increase, enterprises must implement investment projects aimed at reducing the energy intensity of products (Trianni et al., 2013) and increasing the consumption of renewable energy sources (Opeyemi, 2021). However, as the experience of implementing energy-saving projects shows, their implementation often requires significant effort. It is because on the way to the implementation of energy-saving measures, like many projects, the performance of which is aimed at saving other types of production resources, there are often various obstacles (Hui et al., 2017). In particular, among these obstacles, an exceptionally high level is inherent in barriers of a financial nature (Trianni et al., 2013). It especially applies to enterprises with a low level of financial stability. At the same time, as noted in (Al Sharari et al., 2022), the implementation of energy-saving investment projects at enterprises can significantly impact their financial stability. However, such implementation requires the creation of adequate financial and organizational mechanisms (Tsurkan et al., 2017), first of all, the availability of the appropriate amount of their economic potential at enterprises (Lesinskiy et

al.,2021) and optimization of the financial management process (Ren, 2022). It will make it possible to overcome the financial barriers that arise on the way to the implementation of energy-saving investment projects by enterprises (Dong & Huo, 2017).

When considering the consequences of implementing resource-saving investment projects at enterprises, it is essential to consider the possibility that this implementation will lead to an improvement in the competitiveness of these enterprises. Accordingly, under such conditions, the need for the amount of the type of resources that are expected to be saved may turn out to be greater than expected since it will be profitable for enterprises to increase the output of their products, which will require additional amounts of resources (Zhang & Lawell, 2017). However, it should be noted that not all researchers share their opinion about the significant influence of this phenomenon, which is called the rebound effect, on the financial results of enterprises. In particular, in (Howarth, 1997), this effect was not detected, and in (Orea et al., 2015), it is noted that this effect is insignificant. At the same time, from the point of view of overcoming the state of the financial crisis, the presence of the rebound effect has a positive character, as it makes it possible to increase the size of the financial results of the enterprises' activities and thereby increase the level of their financial stability.

Thus, it is possible to hypothesize that for enterprises whose insufficient financial stability is caused by high specific costs of energy or some other production resources, implementing investment projects to reduce these costs can act as a powerful tool of anti-crisis financial management.

3. The purpose and objectives of the research

This study aims to develop and use methodological principles for evaluating the

effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises. To achieve this goal, the following main tasks were set and solved: to develop an indicator for assessing the depth of the financial crisis at enterprises; carry out modeling of the impact of the implementation of resource-saving investment projects at enterprises on the value of this indicator; assess such an impact on a sample of Ukrainian enterprises belonging to three energy-intensive industries.

4. Materials and methods

To assess the impact of the implementation of resource-saving investment projects at enterprises on the change in the value of the indicator of the depth of the financial crisis at enterprises, data on the current conditions and results of the enterprises under study are necessary. Data on the number of investments in resource-saving and the expected financial and economic outcomes from implementing planned resource-saving investment projects are also needed. In addition, information is required on other factors that affect the value of the indicator of the depth of the financial crisis at enterprises, in particular, information on the terms of their lending. When conducting this research, this information was obtained from the accounting, statistical, and management reporting materials of enterprises.

The study's theoretical basis was scientific works on issues of anti-crisis financial management at enterprises, formation, and assessment of their financial stability, and implementation of resource-saving investment measures.

The system analysis method was used to establish the regularities of the onset of the financial crisis at enterprises. Economic-mathematical modeling was used to construct an indicator for measuring the depth of the financial crisis at enterprises. To carry out empirical research, dispersion

analysis, methods of economic analysis, and the method of technical and economic calculations were used. A tabular method was used to display the obtained empirical results. The abstract-logical method was used when forming conclusions from the conducted research.

5. Results

5.1. The indicator of the depth of the financial crisis as a means of qualitative gradation of the level of financial stability of enterprises

In the future, the case of an insolvency crisis at enterprises will be considered, caused both by the low level of profitability of economic activity and by the presence of excessive amounts of previously borrowed loans, particularly bank loans, at enterprises.

It is obvious that the prevention of the occurrence of a financial crisis at enterprises and, even more so, its overcoming should be based on the results of assessing the extent of crisis phenomena at enterprises. For this purpose, it is worth using the following indicator for measuring the depth of the financial crisis in which a particular company found itself:

$$I = \frac{P_m - P_f}{P_m} \quad (1)$$

where: I is an indicator of measuring the depth of the financial crisis at the enterprise, unit share; P_m is the minimum acceptable value of the financial result of the enterprise's activity before interest and income taxes, at which the enterprise will be able to fulfill its obligations to creditors, monetary units; P_f is the actual (forecast) value of the financial result of the enterprise before paying interest and taxes on profit, monetary units.

In the general case, estimating the value of the indicator P_m , which appears in formula (1), involves the following sequence of actions:

- 1) forecasting the flow of funds necessary for the enterprise in each period to fully fulfill its debt obligations (that is, to pay interest for using received loans and repaying their principal amount);
- 2) forecasting the flow of funds needed by the enterprise in each period to fully fulfill its debt obligations, with a growing total since the beginning of the forecast period;
- 3) determination of the minimum value of the financial result of the enterprise's activity, at which this result, calculated as a growing sum from the beginning of the forecast period, in any interval of this period will not be less than the corresponding value of the forecast flow of funds calculated at the previous stage.

It is possible to have a situation in which the time distribution of the number of payments on the company's debt obligations implies the presence of sufficiently long time intervals, during which a part of the company's financial results is not immediately used but is accumulated for future payments. In such a situation, it is possible to consider the case of short-term reinvestment of this part of the company's financial results, particularly by investing them in short-term bank deposits.

When forecasting the flow of funds the enterprise needs in each period to fully fulfill its debt obligations, and it is necessary to re-evaluate the possibilities available to the enterprise to reduce and (or) postpone part of this flow in time. At the same time, three main directions for solving this task are possible, namely:

- 1) reduction of the company's available loan capital due to the simultaneous decrease in the value of certain types of assets of this company. It is possible to achieve such a reduction, in particular, thanks to the sale of excess fixed

assets available in the company and the acceleration of the turnover of its working capital, which will make it possible to produce the same volume of products with a smaller amount of current assets;

- 2) postponement of payments related to the company's fulfillment of its debt obligations if this postponement does not lead to such an increase in the corresponding payments in future periods that the value of the indicator P_m , which appears in formula (1), will increase. At the same time, one of the possible tools for such postponement is the replacement of part of the short-term debt obligations of the enterprise with long-term ones;
- 3) replacement of part of the enterprise's loan capital with its capital. One of the main ways of such relief is to increase the authorized capital of the business entity.

Based on the analytical expression of indicator (1), it can be noted that the sign of the onset of a financial crisis at the enterprise exceeds the zero value of this indicator. At the same time, as the value of indicator (1) increases, the depth of the financial crisis at the enterprise grows. Taking into account these considerations, it is possible to present the following qualitative gradation of the degree of depth of the financial crisis at the enterprise:

- a high level of the enterprise's creditworthiness and the absence of signs of a possible onset, at least in the short term, of a financial crisis in the economic entity (provided that the value of the indicator of the depth of the financial crisis at the enterprise is less than -0.5);
- the average level of creditworthiness of the enterprise and the absence of signs of a possible onset, at least in the short

term, of a state of the financial crisis in the economic entity (provided that the value of the indicator of the depth of the financial crisis at the enterprise is more significant than -0.5, but less than -0.25);

- the insufficient level of creditworthiness of the enterprise (from the point of view of obtaining by it additional oversized enough volumes of loan funds) and the presence of symptoms of a possible onset of a financial crisis in the economic entity (provided that the value of the indicator of the depth of the financial crisis at the enterprise is greater than -0.25, but less than 0);
- an unsatisfactory level of creditworthiness of the enterprise (from the point of view of the possibility of obtaining additional loan funds) and the presence of symptoms of a moderate financial crisis (provided that the value of the indicator of the depth of the financial crisis at the enterprise is greater than 0, but less than 0.25);
- an unsatisfactory level of creditworthiness of the enterprise (from the point of view of the possibility of obtaining additional loan funds) and the presence of symptoms of an acute financial crisis (provided that the value of the indicator of the depth of the financial crisis at the enterprise is more significant than 0.25, but less than 0.5);
- an unsatisfactory level of the enterprise's creditworthiness (from the point of view of the possibility of it obtaining additional loan funds) and the presence of symptoms of an intense financial crisis (provided that the value of the indicator of the depth of the

financial crisis at the enterprise is greater than 0.5).

5.2. Modeling the influence of factors on the value of the indicator of the depth of the financial crisis at enterprises

Improving the understanding of the regularities of investing in resource-saving projects of enterprises for anti-crisis financial management requires consideration of two partial cases of the process of repayment by the enterprise of its debt obligations, namely:

1. Case A, when a constant amount of interest is paid on loans taken by the company without repayment of their principal amount. So, in such a case, it is assumed that the company maintains a certain amount of credit obligations on its balance sheet, particularly by carrying out periodic reborrowing. Of course, this case is rarely encountered in practice. Still, its consideration has theoretical value since, at the same time, the relevant models of the process of the company repaying its debt obligations are simplified as much as possible.

2. Case B, when the company repays its debt obligations evenly. In this case, the company pays the same amount for the return of principal sums of loans and interest for their use at each time interval. This case is more realistic than the previous one. In particular, it can happen if there is a uniform flow of funds over time, which the company can direct to repaying its debt obligations. At the same time, the business entity is interested in accelerating the process of such repayment as much as possible. At the same time, this case is described by relatively simple models with both theoretical and applied significance.

Let's consider each of these cases separately in the context of the possible implementation by the enterprise of a particular resource-saving investment project (projects) as a tool of anti-crisis financial management. At the

same time, let's first assume that this project is fully financed without borrowing. Its implementation will keep the loan capital available to the enterprise. Then, in the case of A, the condition of the maximum acceptable value of the indicator (1) from the point of view of ensuring the appropriate level of financial stability of the enterprise (that is, the condition of its zero value) can be presented as follows:

$$P_m = C \cdot r_c = P_0 + \Delta P \quad (2)$$

where: C is the available amount of the company's loan capital, monetary units; r_c – is the average level of loan interest for all loans taken by the enterprise, unit share; P_0 – is the initial value of the company's financial results before paying interest on loans and income taxes; ΔP is the forecast growth of the financial results of the enterprise before the payment of interest on loans and income taxes due to the implementation of a particular resource-saving investment project, monetary units.

At the same time, the value of the forecast growth of the financial results of the enterprise before the payment of interest on loans and income taxes due to the implementation of a particular resource-saving investment project can be determined using the following formula:

$$\Delta P = C_{r0} \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4 \quad (3)$$

where: C_{r0} is the essential (current) value of costs associated with the consumption of a specific type of production resources of the enterprise, as part of the total value of its operating costs; k_1 – the coefficient corresponding to the share by which the consumption of this type of production resources of the enterprise will be reduced in case of implementation of the planned project to reduce the consumption of this resource; k_2 is a coefficient that takes into account expected price changes for this type of production resources (determined by dividing the average forecast level of such prices by its current level); k_3 – a coefficient that takes into account the possible presence

of additional current expenses related to the implementation of the planned project, for example, other costs for the operation of the equipment; k_4 is a coefficient that takes into account the possibility of expanding product sales as a result of increasing the competitiveness of the enterprise after the implementation of a resource-saving investment project (that is, it takes into account the rebound effect).

Taking formula (3) into account, formula (2) will take the following form:

$$P_m = C \cdot r_c = P_0 + C_{r0} \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4 \quad (4)$$

The indicator (1) for case A will have the following form:

$$I_A = \frac{C \cdot r_c - P_0 - C_{r0} \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4}{C \cdot r_c} \quad (5)$$

where I_A is an indicator of the depth of the financial crisis at the enterprise for case A, unit share.

It should be noted that expression (5) can be transformed into the following:

$$I_A = \frac{C \cdot r_c - C_s \cdot (p_0 - \alpha \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4 / \beta)}{C \cdot r_c} \quad (6)$$

where: C_s is the current value of the total capital of the enterprise, monetary units; p_0 – profitability of the enterprise's total capital (the ratio of the initial value of the enterprise's financial results P_0 to its current total capital C_s), unit shares; α is the current share of the company's expenses related to the consumption of this type of production resources in the structure of income from the sale of products (defined as the ratio of the current amount of the specified expenses to the recent amount of revenue from the sale of products), unit share; β is the capital intensity of the company's products (the ratio of the current total capital of the company C_s to the amount of income from the sale of products).

Since the depth of the financial crisis at the enterprise is smaller, the smaller the value of the indicator (6), then, as follows from the analytical expression of this indicator, other

things being equal, the indicated depth decreases with an increase in the value of the indicator α and with a decrease in the value of the indicator β .

Concerning the case B described above, when modeling the repayment process of the loans taken by the company in this case, the following condition for timely repayment of these loans should be taken into account:

$$\sum_{t=1}^T \frac{P_1}{(1+r_c)^t} = \frac{P_1}{r_c} \cdot \left(1 - \frac{1}{(1+r_c)^T} \right) \geq C \quad (7)$$

where: T is the average value of the total repayment duration of all loans taken by the enterprise, time intervals; P_1 is the average value of those revenues that the company can use to fulfill its obligations to creditors and monetary units.

Therefore, as follows from expression (7), the company will timely return the loans taken if the company's income stream, discounted at the average level of loan interest, aimed at such return, is not less than the current amount of debt obligations of this company.

Let's transform the expression (7) into equality and express P_1 from this equality. Then we get:

$$P_{m1} = \frac{C \cdot r_c \cdot (1+r_c)^T}{(1+r_c)^T - 1} \quad (8)$$

where P_{m1} is the minimum amount of cash flow in case B, which the company must receive to fulfill its debt obligations and monetary units fully.

By substituting formula (8) into formula (6) instead of the expression Cr_c , we obtain:

$$I_B = \frac{(C \cdot r_c \cdot (1+r_c)^T) / ((1+r_c)^T - 1) - C_3 \cdot (p_0 - \alpha \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4 / \beta)}{(C \cdot r_c \cdot (1+r_c)^T) / ((1+r_c)^T - 1)} \quad (9)$$

where I_B is an indicator for measuring the depth of the financial crisis at the enterprise for case B, unit share.

Based on the above models of the indicator for measuring the depth of the financial crisis at the enterprise, it is possible to propose the following sequence of evaluating the effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises (Fig. 1): formation of a sample of enterprises of a particular industry and selection of the type (types) of production resources, the possibility of reducing the specific costs of which will be considered; collection of raw data necessary for analysis; assessment of the current value of the indicator of the depth of the financial crisis for each enterprise and the division of enterprises into classes according to the level of this indicator; carrying out (provided that among the investigated enterprises there are those that are in a state of financial crisis or are approaching such a state) assessment of the forecast value of the indicator of the depth of the financial crisis for each enterprise after the implementation of relevant resource-saving investment projects; comparing the forecast and current values of the indicator for measuring the depth of the financial crisis for each enterprise and formulating conclusions about the effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises; assessment of the influence of individual factors on the effectiveness of investments in resource-saving measures as a tool of anti-crisis financial management at enterprises.

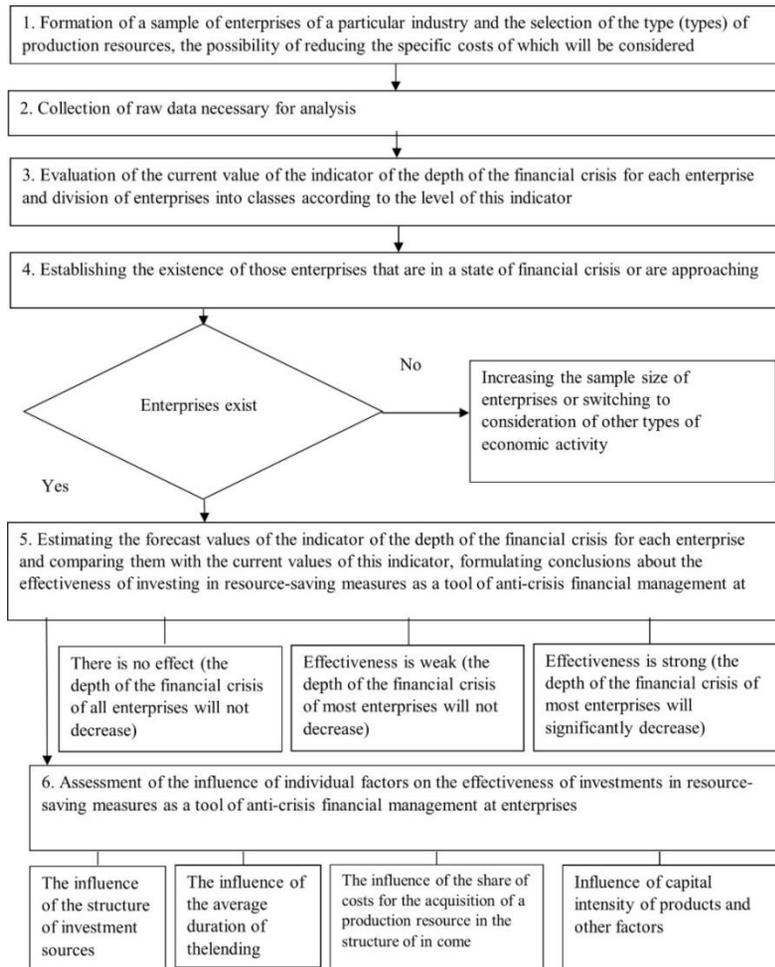


Figure 1. The sequence of evaluating the effectiveness of investments in resource-saving measures as a tool of anti-crisis financial management at enterprises

Source: developed by the authors

5.3. Results of empirical analysis: the case of natural gas consumption by Ukrainian enterprises

A sample of enterprises was created to practically apply the proposed approach to evaluating the effectiveness of investments in resource-saving measures as a tool of anti-crisis financial management. It included 74 enterprises in Ukraine with a high (over 40%) share of loan capital. These enterprises represent three types of economic activity: metal, glass, and clay products. These industries are characterized by a reasonably

high level of specific natural gas consumption. Therefore, in this study, natural gas was chosen as a production resource, and the possibility of saving will be considered.

At the first stage of the conducted empirical analysis, an assessment of the current value of the indicator measuring the depth of the financial crisis at the studied enterprises as of January 1, 2022, was performed. The results of such an assessment made it possible to divide the studied enterprises into classes according to the depth of the financial crisis (Table 1).

Table 1. The results of the division of the studied enterprises into classes according to the depth of the financial crisis in them as of the current values of the indicator of this depth as of January 1, 2022.

Enterprise-class numbers	Qualitative gradation of the depth of the financial crisis	Limits of measuring the depth of the financial crisis	Number of enterprises by types of economic activity		
			Production of metal products	Production of glass products	Production of clay products
1	A high level of creditworthiness of the enterprise and the absence of signs of a possible onset, at least in the short term, of a financial crisis in the economic entity	Less -0.5	2	5	4
2	The average level of creditworthiness of the enterprise and the absence of signs of a possible onset, at least in the short term, of a financial crisis in the economic entity	From -0.5 to -0.25	3	2	3
3	An insufficient level of creditworthiness of the enterprise (from the point of view of the possibility of it obtaining additional sufficiently large volumes of loan funds) and the presence of symptoms of a possible onset of a financial crisis in the economic entity	From -0.25 to 0	5	4	7
4	Unsatisfactory level of creditworthiness of the enterprise (from the point of view of the possibility of receiving additional loan funds) and the presence of symptoms of a moderate financial crisis	From 0 to 0.25	5	6	3
5	Unsatisfactory level of creditworthiness of the enterprise (from the point of view of the possibility of obtaining additional loan funds) and the presence of symptoms of an acute financial crisis	From 0.25 to 0.5	4	3	5
6	Unsatisfactory level of creditworthiness of the enterprise (from the point of view of the possibility of obtaining additional loan funds) and the presence of symptoms of a state of the intense financial crisis	More 0.5	5	5	3
	Together		24	25	25

Source: generated by the authors.

From the data presented in the table 1, it can be seen that the vast majority of the studied enterprises in all three sectors of the economy as of January 1, 2022, were in a state of financial crisis or were approaching this state. In particular, as of January 1, 2022, the number of investigated enterprises assigned to classes 3–6 was: in the field of production of metal products - 19 enterprises (79.2% of the total number of surveyed enterprises of this industry); in the field of production of glass products - 18 enterprises (72% of the total number of investigated enterprises of this industry); in the field of production of clay products - 18 enterprises (72% of the total number of surveyed enterprises of this industry).

At the same time, as evidenced by the data presented in the table 2, if the investigated enterprises implement projects to reduce natural gas consumption, the number of enterprises in a state of financial crisis or approaching this state will significantly decrease. In particular, under such conditions, the number of investigated enterprises assigned to classes 3–6 will be: in the field of production of metal products - 11 enterprises (45.8% of the total number of investigated enterprises of this industry); in the field of production of glass products - 11 enterprises (44% of the total number of investigated enterprises of this industry); in the field of production of clay products - 9 enterprises (36% of the total number of investigated enterprises of this industry).

Table 2. The results of dividing the studied enterprises into classes according to the depth of the financial crisis on them according to the forecast values of the indicator of this depth

Enterprise-class numbers	Number of enterprises by types of economic activity			Change in the number of enterprises by types of economic activity compared to their division by current values of the indicator of the depth of the financial crisis		
	Production of metal products	Production of glass products	Production of clay products	Production of metal products	Production of glass products	Production of clay products
1	6	8	7	4	3	3
2	7	6	9	4	4	6
3	4	3	4	-1	-1	-3
4	4	4	2	-1	-2	-1
5	2	2	2	-2	-1	-3
6	1	2	1	-4	-3	-2
Together	24	25	25	0	0	0

Source: generated by the authors

However, it should be noted that the obtained results are related to the case of financing energy-saving projects without the involvement of loan sources of funds. If such involvement occurs, the results are shown in the table as evidenced by the calculations carried out. 3, in this case, the estimated number of investigated enterprises assigned to classes 3–6 will increase. At the same time, this growth will be greater the more significant the share of loan sources in the total financing of energy-saving projects. However, from the data in the table. Three shows that even with such a 100% share,

several enterprises in each industry will still significantly increase their financial stability if they implement appropriate energy-saving projects. This conclusion follows from the fact that when financing projects exclusively through loans, the number of enterprises that will remain in a state of financial crisis or a pre-crisis financial condition will be smaller than the same number if these projects are not implemented at all.

At the same time, if the average term for which loans were granted to enterprises would be slightly longer than the current one, then under such conditions, the forecast

number of enterprises that would be in a state of financial crisis or would be approaching this state after the implementation of energy-saving projects would decrease by each industry for one or two enterprises (Table 4).

Table 3. Estimated number of enterprises that will be in a state of financial crisis or approaching this state after the implementation of the relevant energy-saving projects, depending on the share of loan funds in the structure of sources of financing of these projects.

Share of borrowed funds, %	Estimated number of enterprises by type of economic activity that will be in a state of financial crisis or approaching this state after the implementation of the corresponding energy-saving projects			The change in the number of enterprises by type of economic activity that will be in a state of financial crisis or approaching this state after the implementation of the corresponding energy-saving projects, compared to the number of these enterprises with a zero share of loan financing		
	Production of metal products	Production of glass products	Production of clay products	Production of metal products	Production of glass products	Production of clay products
0	11	11	9	0	0	0
25	12	12	10	1	1	1
50	13	14	12	2	3	3
75	15	15	14	4	4	5
100	17	16	16	6	5	7

Source: generated by the authors.

Table 4. Estimated number of enterprises that will be in a state of financial crisis or approaching this state after the implementation of the relevant energy-saving projects, subject to an increase in the average term of providing loan funds.

The amount of growth in the average term of providing loan funds, years	Estimated number of enterprises by type of economic activity that will be in a state of financial crisis or approaching this state after the implementation of the corresponding energy-saving projects			Change in the number of enterprises by type of economic activity that will be in a state of financial crisis or approaching this state after the implementation of energy-saving projects, compared to the number of these enterprises under the current average term of providing loan funds		
	Production of metal products	Production of glass products	Production of clay products	Production of metal products	Production of glass products	Production of clay products
0	11	11	9	0	0	0
1	11	11	9	0	0	0
2	11	10	8	0	-1	-1
3	10	10	8	-1	-1	-1
4	10	9	7	-1	-2	-2

Source: generated by the authors.

As mentioned above, the value of the indicator of the depth of the financial crisis at the enterprise, among other factors, can be influenced by the current share of costs associated with the consumption of this type of production resources in the income structure and the capital intensity of

products. To analyze this impact, all surveyed enterprises, which were assigned to classes 3-6 as of January 1, 2022, were divided into two groups according to the first and second indicators. Accordingly, four groups of enterprises were formed for each of the three branches of industry, data on

which are presented in the table 5.

From the data presented in the table 5, the average forecast level of the indicator of the depth of the financial crisis after the implementation of energy-saving projects differs significantly by the formed groups of enterprises. At the same time, for all types of economic activity that were considered, there is a tendency to decrease the specified level with an increase in the initial share of

costs for the purchase of natural gas in the income structure and with a decrease in the capital intensity of the enterprises' products. Using the variance analysis method made it possible to establish that the considered dependence is statistically significant since the actual value of the F-criterion exceeds its critical value with a significance level of $\alpha=0.05$.

Table 5. Indicators of assessing the impact of the share of costs for the purchase of natural gas in the structure of the enterprises' sold products and its capital intensity on the forecast values of the indicator of the depth of the financial crisis by enterprises.

Indicators	The value of indicators by types of economic activity		
	Production of metal products	Production of glass products	Production of clay products
1. The number of enterprises that, as of January 1, 2022, were in a state of financial crisis or approaching such a state and for which the following was observed:			
1.1. A low share of expenses for the purchase of natural gas in the structure of sold products and its high capital intensity	4	3	4
1.2. A low share of expenses for the purchase of natural gas in the structure of sold products and its low capital intensity	3	4	3
1.3. A high share of costs for the purchase of natural gas in the structure of sales and its high capital intensity	6	5	4
1.4. A high share of expenses for the purchase of natural gas in the structure of the sold products and its low capital intensity	6	6	7
2. The average forecast level of the indicator of the depth of the financial crisis after the implementation of energy-saving projects for those enterprises in which:			
2.1. A low share of expenses for the purchase of natural gas in the structure of sold products and its high capital intensity	0.20	0.17	0.23
2.2. A low share of expenses for the purchase of natural gas in the structure of sold products and its low capital intensity	-0.07	-0.03	-0.06
2.3. A high share of costs for the purchase of natural gas in the structure of sales and its high capital intensity	-0.19	-0.11	-0.14
2.4. A high share of expenses for the purchase of natural gas in the structure of the sold products and its low capital intensity	-0.43	-0.34	-0.39
The actual value of the F-test	5.56	6.28	5.73

Source: generated by the authors.

6. Discussion

The conducted research, among other things, showed the possibility and practicality of using the proposed indicator for measuring the depth of the financial crisis in the process of anti-crisis financial management at enterprises. The calculation of this indicator is based on comparing the minimum acceptable value of the financial result of the company's activity before paying interest and taxes for the fulfillment of debt obligations with the actual value of this result. A sign of the onset of a financial crisis at an enterprise is the value of the proposed indicator exceeding zero. At the same time, as its value increases, the depth of the financial crisis at the enterprise increases. These considerations made it possible to develop a method of qualitative gradation of the depth of the financial crisis at enterprises by dividing them into six classes depending on the indicator's value for measuring this depth. Thus, the currently existing approaches to the qualitative assessment of the level of financial stability of economic entities have been developed.

The models built in this paper for the predictive value of the indicator of the depth of the financial crisis at enterprises after their implementation of resource-saving projects allow for a better understanding of the mechanism of influence of various factors on this value. In particular, this applies to factors such as the structure of sources of financing resource-saving investment projects, the length of the crediting period, the capital intensity of products, and the share of expenses related to the consumption of specific production resources, etc. A complete consideration of such factors makes it possible to improve the existing methods of anti-crisis financial management at enterprises based on their implementation of resource-saving investment measures. Also, taking as a basis the built models of the indicator of the depth of the financial crisis at the enterprise, it was possible to develop for the first time a method of

evaluating the effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises.

The specified method was tested on a sample of Ukrainian enterprises belonging to three types of economic activity: the manufacture of metal, glass, and clay products. These industries are characterized by a reasonably high level of specific natural gas consumption. Therefore, natural gas was chosen as a production resource, and the possibility of saving was considered in this study. The calculation of the values of the indicator of the depth of the financial crisis at the studied enterprises showed that most were in a financial crisis or were approaching this state as of January 1, 2022. At the same time, it was established that in the event of the implementation of investment projects for saving natural gas, the value of the indicator of the depth of the financial crisis for most enterprises would decrease, and the number of enterprises that are in crisis or pre-crisis conditions will significantly decrease. At the same time, under other constant conditions, the value of the indicator of the depth of the financial crisis decreases with an increase in the term of crediting and the initial share of costs for purchasing natural gas. However, the value of the indicator of the depth of the financial crisis increases with the growth of the capital intensity of enterprise products and the share of loan financing of the corresponding energy-saving investment projects. Thus, the empirical analysis proved the effectiveness of investing in resource-saving measures as a tool of anti-crisis financial management at enterprises.

Further research should include the development of an optimization approach to investing in resource-saving measures as a tool for anti-crisis financial management at enterprises. In particular, it is necessary to develop methods for determining the best directions and volumes of such investment. It is also essential to establish clearer signs that a specific enterprise, which is in a crisis or pre-crisis state, has the potential to get out

of this state by investing in resource-saving projects.

7. Conclusions

The results obtained in the article have both practical significance and a specific theoretical value, as they make it possible to understand better the complex laws that underlie the processes of the onset of a financial crisis at enterprises. Also, the obtained results make it possible to deepen the understanding of the role played by investment instruments, in particular - investments in the implementation of resource-saving projects at enterprises, in the general mechanism of anti-crisis financial management of the activities of business entities. Based on the conducted theoretical studies, a method was developed for

evaluating the effectiveness of investments in resource-saving measures as a tool of anti-crisis financial management at enterprises. This method was successfully tested on a sample of enterprises that belong to three industries and are characterized by a significant share of loan capital in the structure of asset financing sources. The empirical analysis in this article showed that the vast majority of the studied enterprises are in a financial crisis or are approaching this state. At the same time, it was established that almost half of these enterprises would come out of the economic or pre-crisis state if they implemented projects to reduce natural gas consumption. This proved the positive role that investing in resource-saving measures can play in the process of anti-crisis financial management at enterprises.

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