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New solutions for assessing insolvency risk in comercial organizations

Новые решения для оценки риска неплатежеспособности в коммерческих организациях

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Abstract

In the context of continuous crises that have occurred in the last decade, effective solutions to reduce risks and introduce effective controls into the financial management process in commercial organizations are extremely important. In order to give a new impetus to sustainable economic growth, it is necessary to prioritize the implementation of large-scale reforms, the difficult fiscal situation in a large number of countries, the problems associated with a decrease in the solvency of commercial organizations in the real sector of the economy also require a comprehensive regulatory solution. The main purpose of this article is to offer solutions for controlling financial risks, in particular, for predicting the risk of insolvency, in the context of new ideas of financial management. Alternative methods for assessing the financial condition of commercial organizations, which also include the assessment of solvency, are based on more complex calculations, algorithms and the principle of joint application of a number of methods. From this point of view, a number of researchers in modern conditions prefer cluster analysis. A new approach to assessing and predicting insolvency risks, proposed as a scientific innovation, provides an opportunity to implement new progressive ideas of financial management in commercial organizations.

Keywords: risk management, bankruptcy risk, business risks, financial indicators, solvency, model, forecast, range, variable.

Аннотация

В условиях непрерывных кризисов, которые происходили в последнее десятилетие, эффективные решения по снижению рисков и внедрению эффективного контроля в процесс финансового управления в коммерческих организациях чрезвычайно важны. Для того чтобы придать новый импульс устойчивому экономическому росту, необходимо расставить приоритеты в реализации масштабных реформ, сложная фискальная ситуация в большом количестве стран, проблемы, связанные со снижением платежеспособности коммерческих организаций в реальном секторе экономики, также требуют комплексного нормативного решение. Основная цель данной статьи - предложить решения для контроля финансовых рисков, в частности, для прогнозирования риска неплатежеспособности, в контексте новых идей финансового менеджмента. Альтернативные методы оценки финансового состояния коммерческих организаций, к которым также относится оценка платежеспособности, основаны на более сложных расчетах, алгоритмах и принципе совместного применения ряда методов. С этой точки зрения ряд исследователей в современных условиях отдают предпочтение кластерному анализу. Новый подход к оценке и прогнозированию рисков неплатежеспособности, предложенный в качестве научной инновации, предоставляет возможность реализовать новые прогрессивные идеи финансового менеджмента в коммерческих организациях.

Ключевые слова: управление рисками, риск банкротства, бизнес-риски, финансовые показатели, платежеспособность, модель, прогноз, диапазон, переменная.

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Introduction

In the period of 2010-2020, the development of financial management, from the point of view of handling the problems faced, is characterized by the development of information technologies and the use of new innovative approaches related to it. In this phase, methods of expert analysis of asset price changes were created. At the same time, the new financial technologies in the digital economy, such as blockchain (MacKendrick, 2016), cryptocurrencies (Korechkov & Tselishchev, 2017), which are considered as a type of digital currency, began to be widely used.

Without undermining the significant advantages of the financial technology of the digital economy, it should not be ignored the fact that, in particular, the intangible nature of cryptocurrencies leads to significant deviations in their value assessment, which can lead to a number of problems in the assessment of the value of Internet organizations. We do not also exclude the fact that at a certain stage of development of the world economy, the inadequate overvaluation of digital currencies may cause a new global financial crisis. According to predictions (Tebekin, 2019), handling of the global economic crisis caused by 2020-2021 COVID-19 will be accompanied by an increase in the role of human capital in the economy. Therefore, during the financial management processes, improvement in the accounting tools of the value of the human capital and increase in the efficiency of capital management within the framework of capital management of the organization are envisaged.

Currently, in the conditions of the crisis caused by the Russian-Ukrainian war, finding new solutions for sustainable development based on financial risk management and corporate social responsibility is considered one of the key priorities of the financial management philosophy.

Manifestations of specific types of risks are related to time and probability. The major criticism of quantitative risks by the high-level specialists is that the scope of risk results is not represented by probability distribution. (Ashley, 2020)

In the conditions of market economy, solvency is one of the most important standards for strengthening relations between organizations connected with each other by economic ties. According to different approaches to solvency assessment, it is interpreted as the ability of a business to pay off its current liabilities on time with the liquid current assets.

An insolvent organization is attractive to neither suppliers nor investors, as it creates a threat of losing both its resources and the resources involved. Effective management of organization's solvency enables to quickly address the problem of survival in a competitive environment, and furthermore, to be able to receive and pay off the borrowed funds on time and in the necesssary amount.

The analysis of the practice of conducting bankruptcy procedures shows that their rehabilitation potential is not used effeciently enough, and the bankruptcy procedures are, in many cases, considered as a means of liquidating organizations (Skripichnikov, 2009).

The recent developments in the world economy have affected the solvency of commercial organizations, and it is the imperative of the time to implement new solutions aimed at the restoration thereof. Unstable international markets, economic restrictions, changes in tax policy and gradual digitization in the business cause certain problems in the process of managing the solvency of organizations and require new solutions.

Literature Review

The literature review shows that financial risk management in the conditions of a crisis has been highly pivotal in various studies. (Yankovskaya et al., 2022) have proved that investments and corporate social responsibility separately do not contribute positively to sustainable development and they linked the philosophy of financial risk management to corporate social responsibility.

(Van Staveren, 2009) has proposed five stages for making the risk management process more efficient, they are: goal determination, risk identification, risk assessment, consideration of alternative options and risk diagnostics.

The development of financial stability assessment approaches requires the use of financial and operational risk assessment coefficients. The financial coefficients, which the analysts use to determine the uncertainty of the organization's income formation process, are included in the group of coefficients characterizing the risk. They, in turn, are divided into 2 groups:

- operational risk assessment coefficients;
- financial risk assessment coefficients.

Operational risk assessment coefficients reflect the quantitative measurement of the uncertainty related to the receipt of operating income of the organization.

Operational risk management (ORM) is crucial to any organization, and in the era of big data, analytical tools of operational risk management are evolving faster than ever (Araz et al. 2020).

As a rule, the magnitude of the operational risk is related to the state of the organization's scope of activity, which makes it necessary to carry out scope analysis in the process of operational risk assessment. The maximum operational risk occurs at the beginning of the organization's life cycle or at the innovative stage of its development, in which case the volume of uncertainty in terms of income guarantees reaches its maximum size. A high level of operational risk is also observed during the growth and development of the organization's life cycle. If the organization experiences a crisis and decline during its life cycle, there occurs a decrease in the operational risk.

There are two ways of measuring the operational risk. In the first case, it is measured as the ratio of the standard deviation of operating profit to its mean value, by representing the coefficient of covariance of operating profit, and in the second case, the operational risk is measured as the ratio of the standard deviation of net revenue from sales and its mean value, by representing the coefficient of sales covariance.

Determination of the share of the borrowed capital in the total capital structure is one of common approaches to determination of financial risks; the higher the share of the borrowed capital, the higher the financial risk. The operational and financial risks are inversely related to each other; hence financial risks occur at the upper limit of operational risks. Based on this, we can note that maximum operational risks are accompanied by minimum financial risks, an argument for this is currently the venture financing, which is used at the beginning of the life cycle of the organization.

Around the world, the pandemic has exacerbated the risks posed by the increase of debt levels. At the current stage, the containment of the spread of the virus, provision of assistance to the vulnerable groups of population and solving the problems related to vaccines are the priority tasks to be addressed.

Solvency is one of the most important standards for strengthening the relations between organizations connected with each other by economic ties. Therefore, according to different approaches to solvency risk assessment, it is interpreted as the ability of a business to pay off its current liabilities on time with the liquid current assets.

In order to evaluate the long-term solvency of organizations, (Van Horne, 1996) proposed four ratios.

(Savitskaya, 2015) highlights the unreasonable and non-targeted management of the current assets of the organization as one of the reasons for the decrease in solvency, noting, in particular, the accumulation of unsubstantiated receivables, the high share of their overdues and the large volume of unsubstantiated inventory reserve balances.

(Dantsova, 2015) states in her viewpoint that the insolvency of the organization can be significantly dependent on the non-payment of tax liabilities within the specified periods, which leads to additional costs for the payment of penalties and fines.

According to (Smirnov, 2015), the solvency of the organization is quite variable. For example, in the case of occurrence of a maturity date of payables and the lack of funds in the organization's bank accounts, the organization is assessed as insolvent, which is a result of the financial indiscipline of accounts receivable payers, even if the organization has a liquid balance sheet and opportunities to attract new borrowed funds.

(Kudryavtsev, 2015) defines the solvency of the organization as the ability of the corporate debtor to pay off the liabilities within the defined periods.

It should be noted that chronic insolvency is one of the most fundamental impulses of manifestation of bankruptcy risk in commercial organizations. At the current stage, the prediction of the probability of insolvency and bankruptcy risks is considered to be a very important economic problem for commercial organizations that requirs effective solutions, because the sooner the negative trends are identified, the greater will be the opportunities for the organization to restore solvency. The first attempts to assess the financial position of organizations were made at the beginning of the

19th century. Creditworthiness was the first indicator used for this purpose.

However, only in the 20th century, financial and economic indicators began to be widely used to predict not only insolvency, but also various financial problems. (Altman, 1968; Beaver, 1966) have made a great contribution to this process.

Canadian researcher (Springate, 1978) proposed its approach to predicting the probability of bankruptcy risk based on discriminant analysis.

Discriminant analysis based on multiplicative relationship is one of the crucial directions of improvement of regression analysis methods in the approaches to evaluating the solvency of organizations.

Using the latter, evaluating the solvency of organizations has gained special importance when discussing bankruptcy issues. Such a complete system was proposed by (Bastensi, Van Den Berg, & Woody, 1997), In Neural Networks Based Conjoint View.

Among the discriminant models, which are also important in predicting the potential risk of bankruptcy, special importance is given to the approach proposed by (Zaitseva, 1998).

The approaches based on regression formulae for assessing the potential risk of solvency and bankruptcy of commercial organizations, mainly characterize the situation with high accuracy and neutralize many drawbacks of analytical methods. However, it should be noted that the approaches to predicting the probable risk of bankruptcy are mainly focused on the assessment of long-term solvency or financial stability.

The logistic regression analysis is considered to be the most effective regression method for predicting the probable risk of insolvency and bankruptcy, which is an extension of the multivariate regression analysis methodology and is applied to situations where the predicted parameter accepts a true or false value. Among the solutions to logistic regression analysis proposed by the western researchers, let us note the model proposed by (Ohlson, 1980) and the joint approach by (Begley et al., 1996).

One of the researchers, (Voiko, 2019), studying the mechanisms of predicting the probability of bankruptcy based on the use of logit models, proposed a mathematical model for calculating such probability for small and medium-sized construction organizations.

(Dahiyat et al., 2021) in the coauthored article assessed the performance of companies listed on the Amman Stock Exchange in 2010-2019. liquidity and solvency with data. Return on assets (ROA) and earnings per share (EPS) were highlighted in the developed model. Current liabilities and total debt to total assets were considered by these researchers as indicators of liquidity and solvency. Within the framework of the developed approach, correlation and multiple regression analyzes were used for data analysis, the results of which proved a statistically significant relationship between liquidity and solvency management and company size.

Using data from 244 out of 323 companies listed on the Dhaka Stock Exchange, Mohammad (Abdullah, 2021) developed a solvency prediction model using artificial intelligence to help banks effectively classify their customers based on their solvency.

The development and practical application of a new approach to forecasting solvency risk for alcoholic beverage companies will be quite useful for financial management professionals of commercial organizations. Therefore, it was considered as the main objective in this paper.

Methodology

Analytical approaches require assessment of the correlation of the financial stability with financial risks comparing their assessments and making conclusions on the feasibility of the policy of attracting funds.

The research was carried out by RA NAS at the M. Kotanyan Institute of Economics. During the research, commercial organizations of the RA real sector were studied, the total number of observations of which was 32. The methods of matrices, least squares, correlation analysis, combining financial ratios and logit analysis were applied. The LOGIT-probit models for assessing the insolvency and bankruptcy risk of organizations are statistical predictive models by their nature, which make it possible to estimate the occurrence of bankruptcy of the organization for a period of 1-3 years. When building similar models, 2 groups of organizations are selected: the first group includes organizations declared bankrupt by the court's decision, and the second group includes financially stable organizations. In the process of building the model, financial coefficients are calculated for those 2 groups of

organizations, after which, using them, a regression model is built with the help of the logistic regression toolkit, which more accurately describes the 2 groups of the sample of organizations.

In the first step for this purpose, we offer the following set of financial risk assessment indicators:

- long-term debt /equity;
- long-term debt /total liabilities;
- gross assets/equity;
- total debt/equity;
- (total debt on loans+finance costs)/equity;
- profit before tax/(total debt on loans+finance costs).

In the second step.

- In the context of correlation of the proposed coefficients and the following macroeconomic indicators: the AMD/USD exchange rate ($T_{AMD/USD}$), the money multiplier (T_{MM}), and the M_1 money supply aggregate (T_{M1}), and the impact of the relative growth rates on the selected variables, we offer a logit regression analysis approach. Development of the mathematical model pursues 2 important goals:

- prediction of the value of the result indicator for the new values of the predicted variables;
- determination of the degree of impact of each predicted variable included in the model on the the basis of determination of the result indicator.

The most popular methods for addressing this problem are multivariate linear regression (Nikonov, 2021), discriminant analysis (Borovsky et al., 2018) and logit regression (Luchinin & Lyanguzov, 2022).

The multivariate linear regression is mostly used in situations where the dependent (result) variable is considered to be a continuous parameter and it coincides with the predicted variables by size. In this case, the main condition for the effectiveness of this method is the theoretically very close linear dependence of the result indicator and the predicted variables.

The discriminant analysis is effective to use in situations where it is necessary to classify the relevant subject into a specific group or class.

- As a rule, the logit regression is used in situations where the dependent (outcome) variable has a binary value: one true or zero false. In this case, the result indicator can be both discrete and continuous.
- of developing the proposed model, adjustment of selected variables with macroeconomic indicators is performed.:
- a table of standardized coefficients is built using the matrix method (Goldman & Schmalz, 2004).
- the table of squares is built based on the data of the table of standardized coefficients.
- we develop the regression formula for determining $\mathbf{Y}^*$, the prediction of the bankruptcy risk.

In the third step.

- applying the formula $P = 1/(1 + e^{-y})$, we calculate the value of P according to the observations made.
- we determine the ranges of P, the model (1) of bankruptcy risk assessment of commercial organizations.

In the fourth step, we determine the bankruptcy risk assessments of randomly tested commercial organizations of the Republic of Armenia.

Results and Discussion

Step 1. The analysis made for "Yerevan Champagne Wines Factory" OJSC for 2010-2020 shows the following trends concerning the proposed indicators characterizing the financial risk:

- in terms of long-term debt/equity ratio, the mean value for 2010-2020 was 0.945, the maximum value was 1.428 in 2010, and the minimum value for the studied period was in 2019 – 0.523.
- in terms of long-term debt/total debt ratio, the mean value for 2010-2020 was 0.725, the maximum value was 0.798 in 2010, and the minimum value was 0.511 in 2019.
- in terms of gross assets/equity ratio, the mean value for 2010-2020 was 2.291, the maximum value was 2.789 in 2010, and the minimum value was 1.831 in 2017.
- in terms of total debt/equity ratio, the mean value for 2010-2020 was 1.291, the maximum value was 1.789 in 2010, and the minimum value was 0.831 in 2017.
- in terms of (total debt on loans+finance costs)/equity ratio, the mean value for 2010-2020 was 0.372, the maximum value was 0.8

in 2020, and the minimum value was 0.230 in 2016.
- in terms of profit before tax/ (total debt on loans+finance costs) ratio, the mean value for 2010-2020 was 0.185, the maximum value was 0.680 in 2017, and the minimum value was -0.181 in 2020.

The analysis made for "Plant of Pure Iron" OJSC for 2010-2020 shows the following trends concerning the proposed indicators characterizing the financial risk:

- in terms of long-term debt/equity ratio, the mean value for 2010-2020 was 0.018, the maximum value was 0.06 in 2018, and the minimum value for the studied period was in 2019 – 0.
- in terms of long-term debt/total debt ratio, the mean value for 2010-2020 was 0.345, the maximum value was 0.896 in 2016, and the minimum value was 0 in 2019.
- in terms of gross assets/equity ratio, the mean value for 2010-2020 was 1.077, the maximum value was 1.196 in 2020, and the minimum value was 1.010 in 2015.
- in terms of total debt/equity ratio, the mean value for 2010-2020 was 0.077, the maximum value was 0.196 in 2020, and the minimum value was 0.010 in 2015.
- in terms of (total debt on loans+finance costs)/equity ratio, the mean value for 2010-2020 was 0.031, the maximum value was 0.156 in 2014, and the minimum value was 0 in 2016-2017 and 2019-2020.
- in terms of profit before tax/ (total debt on loans+finance costs) ratio, the mean value for 2010-2020 was 6819.255, the maximum value was 51519,47 in 2020, and the minimum value was 0.903 in 2014.

The results of the developed bankruptcy risk assessment model are as follows:

Step 2. We have created the regression formula for determining **Y***, prediction of bankruptcy risk which is as follows:

Y*= 0.29*(long-term debt /equity) +0.064*(long-term debt /total liabilities) - 0.007*(gross assets/equity) +0.075*(total debt/equity) +0.031*((total debt on loans+finance costs)/equity) +0.028*(profit before tax/ (total debt on loans+finance costs)), (1).

The developed regression formula reveals that total debt / equity coefficient has made a negative impact on $\mathbf{Y_1}$, which will require use of effective mechanisms of internal control in the financial management process in respect of equity.

Step 3, We propose the following ranges of P, the model (1) of bankruptcy risk assessment of commercial organizations:

- If $0.869<P<1$, the solvency of the organization has a chronic nature;
- If $0.566<P<0.869$, the organization has a problem of restoring current solvency;
- If $0.222<P<0.566$, the solvency of the organization is assessed as normal;
- If $0<P<0.222$, , the solvency of the organization is assessed as very good.

Step 4. We have below presented the brunruptcy risk assessments of randomly tested commercial organizations of the Republic of Armenia:

- **"Armenian Mining Contractor" LLC**
  - 2019: the company needs to restore current solvency;
  - 2020: which shows the solvency of the company is assessed as very good.

"Gazprom Armenia" CJSC
  - 2019: the solvency of the company is assessed as normal;
  - 2020: which shows the solvency of the company has a chronic nature.
- **"Bacon Product" LLC**
  - 2019: which shows the solvency of the company is assessed as very good;
  - 2020: which shows the solvency of the company has a chronic nature.
- **"TEX" CJSC**
  - 2019: which shows the solvency of the company has a chronic nature;
  - 2020: which shows the solvency of the company is assessed as very good.
- **"Chaarat Kapan" CJSC**
  - 2019: which shows the solvency of the company is assessed as normal;
  - 2020: which shows the solvency of the company is assessed as very good.
- **"Vedi Alco" CJSC**
  - 2019: the company needs to restore current solvency;
  - 2020: which shows the solvency of the company is assessed as very good.
- **"Beer of Yerevan" CJSC**
  - 2019: the company needs to restore current solvency;
  - 2020: which shows the solvency of the company is assessed as very good.
- **"Alex Textile" LLC**
  - 2019: which shows the solvency of the company has a chronic nature;

- 2020: which shows the solvency of the company is assessed as very good.

- **"MAP" CJSC**

- 2019: which shows the solvency of the company has a chronic nature;
- 2020: which shows the solvency of the company is assessed as very good.

- **"AMP Holding" LLC**

- 2019: which shows the solvency of the organization is assessed as normal;
- 2020: which shows the solvency of the company has a chronic nature.

Conclusions

1. The impact of financial risks on "Yerevan Champagne Wines Factory" OJSC in respect of the maximum and minimum values of the calculated coefficients makes it possible to distinguish the period of 2010-2011 as mainly a stable period of activity in the organization, and the year of 2019 – as unstable, which is directly conditioned by the COVID-19 crisis.
2. The impact of financial risks on "Plant of Pure Iron" OJSC in respect of the maximum and minimum values of the calculated coefficients makes it possible to distinguish the years of 2014, 2018, 2020 as a stable period of activity in this company and the years of 2015 and 2019 as unstable, due to the negative impact of devaluation of the Armenian dram in 2014 and the COVID-19 crisis in 2019.
3. The study of the practical situation shows that the external environment and the renderred financial decisions are highly important in establishing sufficient stock of financial stability and necessary conditions for economic development of commercial organizations, which become rather essential within the framework of anti-crisis management.
4. In the conditions of increasing competition in commercial organizations, there regularly occurs a need to attract borrowed funds both to finance current activities and to implement new investment programs. On the one hand, the borrowed funds are very necessary, but on the other hand, their excess amount beyond the permissible limits leads to the loss of solvency and financial stability of the organization.
5. Based on the study of current bankruptcy risk prediction methods, an assessment of the potential risk of bankruptcy of the studied and randomly selected commercial organizations of the Republic of Armenia has been made, which has served as a ground for proposing a logit regression analysis model for predicting bankruptcy risk based on the financial risk assessment indicators and marginal ranges for determining its value.
6. Based on the results of the testing, we discovered that manifestations of insolvency risk were observed in the randomly selected commercial organizations of the Republic of Armenia in 2019, which was conditioned by the global crisis caused by COVID-19. It should be noted that among the randomly selected organizations, "Armenian Mining Contractor" LLC, "TEX" CJSC, Chaarat Kapan" CJSC, 'Vedi Alco" CJSC, "Beer of Yerevan" CJSC, "Alex Textile" LLC and "MAP" CJSC have brought the solvency to the required level due to the measures taken, which is not the case in "Gazprom Armenia" CJSC and "Bacon Product" LLC. As for "AMP Holding" LLC, there was a decline in the level of solvency in this company in 2020 comparing to 2019, which received the maximum insolvency risk assessment according to the logit regression analysis model (1).
7. In order to mitigate bankruptcy risk in commercial organizations, any program for restoration of solvency should simultaneously take into account both the legal and economic aspects, which is due to the fact that solvency has not only economic but also legal grounds. In this regard, when developing solvency restoration programs in practice, in addition to the financial and economic grounds, it is necessary to take into account the existing legal grounds as well. If only the economic aspects are taken into account when developing solvency programs, the process will, in fact, lead to business planning. Without undermining the importance of business planning, in our opinion, in order to obtain more complete solutions, it is always necessary to correlate the legal grounds for the restoration of solvency as well. In practice, the steps of business planning are appropriate to carry out in accordance with the following algorithm:

- grouping of the most significant analytical results for justifying the opportunities of solvency restoration;
- identification of the main causes of insolvency, which is very important for developing specific measures to restore normal solvency;
- analysis of the resources and assessment of restrictions on their acquisition, which is due

to the fact that in a crisis situation there is almost always a problem of resource limitation, which should necessarily be taken into account when developing a solvency restoration program;

- the conditions and procedure for implementing solvency restoration measures, planning and prediction of the financial and economic results of the organization, which is important for justifying the opportunities of solvency restoration;
- determination of the solvency restoration period, which is essential during the bankruptcy procedure, so that these periods can be fitted within the framework of the recovery plan;
- feasibility and coherence of the opportunities of solvency restoration within the framework of the program developed.

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