Financial Security of Textile Enterprises During the Pandemic: In Case of Uzbekistan

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Annotation. The article considers the approaches to assessing the financial security of enterprises presented in the literature, determines the stability of the textile industry of Uzbekistan to the negative impact of the coronavirus pandemic on the basis of statistical data, and reveals a significant differentiation of textile industry enterprises in terms of financial stability. A method for assessing the financial security of an enterprise in the post-pandemic period is proposed and tested on the basis of data on small enterprises in the textile industry of Uzbekistan, taking into account the complex influence of non-financial parameters of economic security and assessing the deviations of the economic situation at a given enterprise from the patterns emerging in the relevant segment of the economy.

Keywords: Financial security, multivariate analysis, dispersion, insecurity depth, relevant group, regression model.

Abstract. **The article considers the approaches to assessing the financial security of enterprises presented in the literature, determines the resistance of the textile industry of Uzbekistan to the negative impact of the coronavirus pandemic on the basis of statistical data, and reveals a significant differentiation of textile industry enterprises in terms of financial stability. Based on data on small enterprises in the textile industry of Uzbekistan, a method for assessing the financial security of an enterprise in the post-pandemic period is proposed and tested, taking into account the complex influence of non-financial parameters of economic security and assessing the deviations of the economic situation at a given enterprise from the patterns emerging in the relevant segment of the economy.**

Keywords: Financial security, multivariate analysis, dispersion, insecurity depth, relevant group, regression model.

1. INTRODUCTION

The textile industry of Uzbekistan is one of the leading industries that determines the sustainability of industrial production in the country during the pandemic and the dynamics of industrial growth in the post-pandemic period. As follows from the data in Fig. 1, in the most acute period of the coronavirus pandemic in 2020. the textile industry of Uzbekistan has reached outpacing growth rates compared to manufacturing industries and industry as a whole. From the beginning of 2020 until mid-2021, the monthly growth rate of production in the textile industry was 2–3 times higher than the similar growth rate of industrial production in the country. At the same time, unlike manufacturing and industry as a whole, in no month during the pandemic and at the stage of exit from it, the growth rates of textile production were not negative, but had increasing positive values.[8]

The basis for this resistance of textile production to the destabilizing impact of the pandemic is the state of financial security of enterprises achieved in the pre-pandemic period, which provided the basis for maintaining and developing production during critical periods of the pandemic. [7] Positive estimates of the dynamics of production as a consequence of financial security are typical for the textile industry of Uzbekistan as a whole, but at the same time, the differentiation in the level of financial stability of enterprises in this industry is very high; they also differ significantly in their ability to maintain it in the post-pandemic period. This determines the relevance of developing methods for studying the factors of financial security of the enterprises of the textile industry in Uzbekistan, taking into account both general economic factors and local factors that manifest themselves in certain segments of the economy. [6] This segment includes small enterprises of the textile industry, in the study of financial security factors of which the conditions of their competition in the domestic and foreign markets should be taken into account. This article is devoted to the development of new methods for analyzing the financial security of textile enterprises with its assessment in terms of "absolute" and "relative" security.[9]

The development of a mathematical apparatus for assessing and analyzing the financial security of enterprises is based on defining the content of the term "financial security" in the context of the functional components of the economic security of an enterprise, as well as the formation of an information array that allows us to explore the patterns of financial security of enterprises in the textile industry of Uzbekistan as a multifactorial phenomenon.

The financial security of an enterprise is a key functional component of the economic security of an enterprise. The functional components of the economic security of an enterprise are a set of the main directions of its economic security, which differ significantly from each other in their content [1].

The following functional components of the EBP are distinguished:

- financial;
- intellectual and personnel;
- technical and technological;
- political and legal;
- ecological;
- information;
- security guard.

Financial security is the state of protection of an enterprise from the negative impact of threats from the external and internal environment, which ensures the achievement of its goals [2. Financial security is a complex concept that is characterized by a stable financial condition, the ability of an enterprise to effectively use financial resources, fulfill its financial obligations to third parties, and ensure the development of activities in the face of internal and external threats. The financial position of an enterprise is considered safe if it covers with its own funds at least 50% of the economic resources necessary for normal economic activity, observes economic, credit and settlement discipline, in other words, is solvent [3].

2. LITERATURE REVIEW

The literature presents a large number of works devoted to methods of analyzing the financial security of enterprises. There are works on systematization of these methods. In particular, in the work of Kirilchuk N.A., Blazhevich O.G., Petrov D.V. [4, c.380] presents a diagram of a systemic presentation of methods for assessing the financial security of an enterprise.

An analysis of the methods shown in the diagram in Fig. 2 allows us to conclude that they are all based on financial indicators, such as the ratio of current assets to current liabilities, equity and balance sheet; net proceeds from sales and balance sheet; profit (loss from operating activities) and net proceeds from sales in the amount of other operating income; net proceeds from sales and debt capital; net profit (loss) and equity; net proceeds from sales and current assets and other similar financial performance indicators. At the same time, the analysis does not take into account the other above-mentioned functional components of the economic security of an enterprise related to financial security, which represent a single complex, provide mutual support and should be analyzed taking into account the mutual influence of these indicators characterizing them.

3. ANALYSIS AND RESULTS

To ensure that the analysis of the financial security of an enterprise, along with financial indicators, takes into account the complex impact of non-financial parameters of its economic security, on the basis of what was proposed in [5, p. 77-78] of the minimum required list of indicators in the context of the components of the economic security of the enterprise, the initial information array of the study was formed. This array included data on 25 small enterprises of the textile industry of Uzbekistan (for 2019-2020) for the following indicators:

1. The number of employees with work books, taken to calculate the average wage, people;
2. The average annual number of employees (including external part-time workers, as well as persons who performed work under civil law contracts), people;
3. Average monthly accrued wages of an employee, thousand soums
4. Personnel turnover rate, coefficient;
5. The share of employees with higher education (in the total number of employees, including external part-timers);
6. The share of employees with a secondary special (in the total number of employees, including external part-timers);
7. The share of employees with incomplete secondary education (in the total number of employees, including external part-timers);
8. Hours worked per employee without external part-timers, hours per year;
9. The share of material costs in the cost;
10. Share of cost in revenue;
11. Depreciation coefficient of fixed assets at the end of the year, coefficient;
12. Labor productivity (the ratio of the volume of manufactured products to the average annual number of employees), billion soums;

13. Return on assets (the ratio of the volume of manufactured products to the average annual cost of fixed assets), sum;
14. Profitability of products (the ratio of net profit to cost),%;
15. Profitability of fixed assets (the ratio of net profit to the average annual cost of fixed assets),

As a target variable for the analysis of financial security on the basis of the data on the specified set of textile enterprises, the indicator "Product profitability (the ratio of net profit to cost),%" was used.

For the purposes of maintaining information security, the analyzed enterprises are further named by symbols from "A" to "Y".

Exploratory data analysis. Assessment of the absolute depth of financial insecurity of enterprises.

The initial stage of the proposed set of methods for assessing and analyzing the financial security of textile enterprises in Uzbekistan was an exploratory data analysis [6, p. 19-58], which refers to the analysis of the main properties of data, finding common patterns, distributions and anomalies in them, building initial models, often using visualization tools.

The concept of "exploratory data analysis (EDA-exploratory data analysis)" was introduced by the mathematician John Tukey [7], who formulated the goals of such analysis as follows:
• maximum "penetration" into the data,
• identification of the main structures,
• selection of the most important variables,
• detection of deviations and anomalies,
• testing of the main hypotheses,
• development of initial models.

The initial stage of exploratory analysis is the graphical presentation of statistical data on the target variable. As follows from the data in Fig. 1, among the 25 considered small enterprises of the textile industry of Uzbekistan, 6 turned out to be unprofitable. The target indicator for these enterprises has a negative value, which indicates a lack of financial security in the assessment of the indicator "Product profitability (ratio of net profit to cost),%". The largest negative deviation for this target indicator, that is, the "absolute depth" of lack of financial security, was revealed at the enterprise "P", the number of employees of which in the period under review was 28 people.
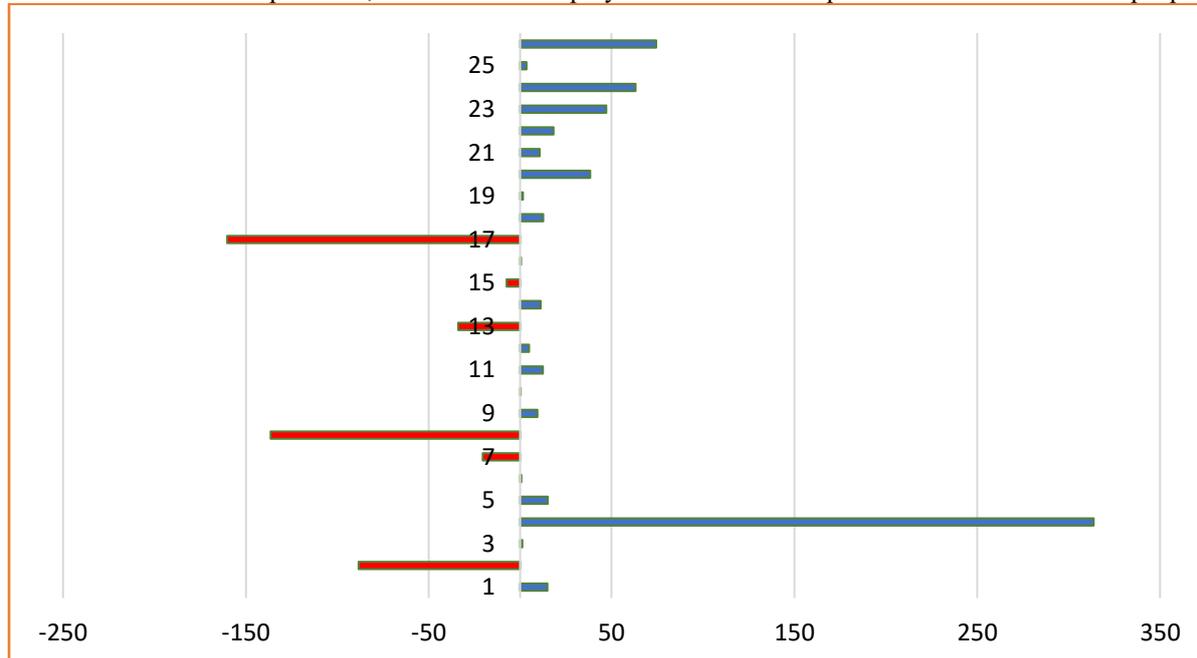

Fig.1. The level of profitability of products (the ratio of net profit to cost (%) - an indicator of financial security for 25 small enterprises in the textile industry of Uzbekistan, 2020

However, this conclusion (statistical hypothesis) requires verification, since an enterprise can be unprofitable, have a negative value of the target indicator characterizing the "absolute depth" of the lack of financial security, but at the same time, this negative value corresponds to the pattern of distribution of the target indicator values, characteristic of all enterprises of the considered relevant group under current market conditions. In this case, the outlier characterizes the "relative depth" of financial insecurity.

To test the statistical hypothesis about the anomalous value of a feature in the distribution under study, it is

advisable to use statistical criteria [8]. Most of the existing criteria for identifying units that are anomalous in the statistical concept are based on the assumption that the observed random variables belong to the normal law. Criteria of this kind include the Dixon and Grubbs criteria [9], which are used to check for abnormality of outlier measurement results. Based on the application of these criteria, it was found that, according to the considered target indicator, enterprises "P", "G" and "A" are statistically anomalous units in the studied group of small enterprises in the textile industry. Their relative unprofitability is uncharacteristic for the entire considered set of enterprises in their common market conditions. At these enterprises, a deep internal analysis of the state of extreme "relative depth" of economic insecurity should be carried out.

A multidimensional assessment of the relative level of economic security of an enterprise involves assessing the deviation (A) of the target value of the financial security indicator of a particular enterprise from its average value for the relevant group of enterprises and decomposing this deviation into two components:

deviation (B) of the actual value from the calculated ("model", "predicted") according to the multifactorial regression model of the indicator of economic security, built on the considered set of enterprises;

deviation (B) of the calculated value obtained from the specified average value.

When evaluating these deviations, it is necessary to take into account whether the target indicator of economic security is "direct" or "reverse". In the case of a direct indicator, negative values of the above deviations will indicate financial insecurity; in the case of a reverse indicator, positive deviations will testify to this.

The relative depth of the financial insecurity of an enterprise will be characterized by the ratio of the magnitude of the negative deviation (B) of the calculated value of the target indicator for this enterprise from its average value and the total deviation (A), expressed as a percentage. This means that the calculated ("model") value of the target indicator of financial security for a given enterprise corresponds to its level, provided that at this enterprise the influence of factors on this indicator corresponds to the general situation (pattern) characteristic of the entire set of enterprises and assessed with using a regression model.

The more the value of the target indicator at a particular enterprise deviates in the negative direction from the "model" value, the greater the relative depth of financial insecurity at this enterprise, associated with the specifics of its activities (the specifics of the influence of security factors) relative to the group of enterprises relevant to it.

A linear multifactorial regression model of the target indicator of the financial security of enterprises can be represented by the following equation:

$$\hat{y} = a\_0 + a\_1 \, x\_1 + a\_2 \, x\_2 + \ldots + a\_i \, x\_i + \ldots + a\_k \, x\_k,$$

Where:

$\hat{y}$ is the calculated (estimated by the model) value of the dependent variable - the target indicator of the financial security of enterprises;

$x\_1, \ldots, x\_k$ – values of independent (factorial) variables;

$a\_0, \ldots, a\_k$ – parameters of the regression equation.

The parameter of the regression equation a_i with the factor variable x_i characterizes the population average deviation of y from its average value under the influence of the deviation of the factor indicator x_i per unit of measurement.

In accordance with this definition, the total variance of the target indicator in the considered set of units (enterprises) can be represented as the sum of the variance explained using the built regression model and the unexplained variation (Fig. 5).

For a specific (i-th) enterprise, the deviation of the actual value of the target indicator from the average value for the relevant set of enterprises (F) can also be presented (Fig. 5) as the sum of the explained deviation (E) and the unexplained (U) deviation when using a two-factor regression model .

In accordance with the symbols presented in Fig. 6, the relative depth of the financial insecurity of the i-th enterprise can be estimated using the indicator d_i according to the formula:

$d\_i = U\_i / F\_i *100\% = (F\_i - E\_i)/F\_i*100\%,$

where F_i (total deviation) $= U\_i + E\_i$

As a result of applying the methods of correlation and regression analysis, the results of constructing a linear multifactorial regression model for 25 small enterprises of the textile industry of Uzbekistan for 2020 were obtained (Table 2)

Table 1. Parameters and estimates of the linear regression model of the target indicator of the financial security of small enterprises in the textile industry of Uzbekistan - "Product profitability (the ratio of net profit to cost),%, 2020

Regression Equation Options	Parameter values	t-statistic	p-value
a_0	**38,84**	0,604	0,553
a_1	**63,36**	0,322	0,751
a_2	**-0,02**	-0,653	0,521
a_3	**-18,06**	-0,476	0,640
a_4	**8,60**	2,388	0,027
R = 0,774 **R – sq. = 0,559** **F = 7,10 (F табл. n-k-1/k) = F (20/4) =2,87 (при α=0,05)**			

The multiple regression equation of the target indicator of financial security (y- "Product profitability (ratio of net profit to cost),%"), built on the considered set of small enterprises of the textile industry in Uzbekistan, has the form:

$$\hat{y} = 33,84 + 63,36\ (dVO) – 0.02(BR1rab)- 18,06\ (dCCt) + 8,60(Footd)$$

The parameters of the obtained regression equation of the target indicator "Product profitability,%" for small enterprises of the textile industry indicate a direct dependence of this indicator on the quality of personnel, characterized by the share of employees with higher education (dVO) and the level of technological equipment of production, which is confirmed by the positive value of the coefficient for the factor variable "Return on assets" (Footd) and the inverse value for the factor variable "Time worked per employee without external part-timers (hours per year)" (BR1rab). At the same time, the most significant safety risk factor is the level of product cost intensity, which is characterized by the value of the parameter with the variable "Proportion of cost in revenue" (dCCt), which has the largest negative value.

The quality of the resulting model is confirmed by its explanatory properties: the coefficient of determination is 60%. The value of this coefficient is equal to the square of the multiple correlation coefficient (R-square). This determines the significance of the model according to the Fisher criterion (F), the calculated value of which exceeds the tabular one at a 5% significance level (Table 2).

At the same time, it follows from Table 2 that the parameters for factor variables (except for Footd) have a low level of significance according to Student's t-test. However, this is important when using the model for forecasting purposes. In this example, the simulation properties of the model are used, the adequacy of which is confirmed by its rather high explanatory characteristics.

It has been established that, in accordance with the results of the assessment of relative financial insecurity, taking into account the multifactorial approach (Fig. 8), as part of the group under consideration, consisting of 25 small enterprises of the textile industry of Uzbekistan, the greatest "depth" of economic insecurity is typical for enterprise "P". This result confirms the conclusion made earlier for this enterprise about the state of "absolute" financial insecurity for this enterprise and the need for an in-depth study of the factors and conditions that affect the low level of its financial security.

4. CONCLUSIONS

The proposed and tested method for assessing the financial security of enterprises is based on two innovations. The first one is taking into account in the proposed method for assessing the impact on financial security the parameters of other functional components of economic security, which, along with financial security, represent a single system.

The second is the identification and inclusion in the analysis of financial security of assessments of deviations of the situation for individual enterprises from the general factor patterns of financial security characteristic of all enterprises in a certain segment of the economy (in this case, small enterprises in the textile industry). This approach allows us to establish and substantiate the magnitude of the absolute and relative depth of financial insecurity of enterprises by the influence of the identified factors, which creates an information basis for making decisions to overcome it.

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