

Development of model for forecasting and controlling the debt burden in a commercial organization

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Abstract. The COVID-19 pandemic has had a significant negative impact on the state of commercial organizations in the real sector. Therefore, the development of new solutions in forecasting and monitoring the functioning of organizations and their implementation in practice are vital to overcome the crisis. The main purpose of this article is to specify the marginal ranges of indicators of the debt burden of a particular commercial organization characterizing the correlation between the components of capital structure and indicators characterizing the level of security of liabilities with the assets of the organization on the basis of the results of prediction of the developed training model of the behavioral theory of capital by the method of matrices. One of the main advantages of the proposed approach is the determination of marginal ranges in line with the predicted preferred variants of liabilities for the sets of indicators assessing the debt burden. Within the scope of this article, this method has been carried out for an Armenian brandy company “Proshyan Brandy Factory” LLC. Using this model will, in the future, enable to determine common marginal ranges of indicators underlying the development of financial policy for a particular commercial organization in terms of the components of solvency, liquidity, business activity, profitability and creditworthiness.

1 Introduction

In the economic environment of the Republic of Armenia, in line with the current development trends of commercial organizations, special requirements are set for the financial stability as a strategic factor for the financial security of the organization, perspective development of the business and investment attractiveness.

The issue of ensuring financial stability has been strongly emphasized since the global financial crisis in 2008, which gave rise to the need to enshrine the financial stability in

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legislation. In the Republic of Armenia, the responsibility for ensuring financial stability is vested in the Central Bank of the Republic of Armenia[30].

In order to ensure systemic financial stability in the Republic of Armenia, the Central Bank of the Republic of Armenia continuously pursues a macroprudential policy, controls the risks observed in the whole economy by using assessment and testing systems. It becomes clear from the above-mentioned that ensuring a financial stability is also very important at the micro level.

2 Review of the main financial stability indicators

Various methods and approaches for calculating financial stability indicators have been developed for commercial organizations in various research works on the improvement of the financial management. At present, in a crisis economy, these figures do not often correspond to the reality, they distort the financial situation and do not reliably describe the financial stability of the organization.

Western experience in the analysis of the financial stability of organizations shows that it is not the specific financial stability that is important to the organization, but the assessment of financial risks. According to the results of the research based the data of reports of 79 organizations, the western researcher W. Beaver has distinguished 6 important financial indicators [1]:

- Net cash flow / total debt;
- Net profit / total assets;
- Total debt / balance-sheet total;
- Working capital / balance-sheet total;
- Current assets / current liabilities;
- Working capital / operating expenses.

Altman attempted to find significant differences between financially stable and not stable organizations by classifying the organizations he surveyed into financially stable ones and likely bankrupt ones on the basis of the following indicators [2]:

- Equity / total assets
- Retained earnings / total assets;
- Earnings before interest and taxes / total assets;
- Market value of the organization / total liabilities;
- Sales revenue / total assets.

The International Monetary Fund recommends the following financial stability indicators for non-financial sector organizations [3]:

- Financial leverage: borrowed capital / equity,
- Return on equity - net income / equity;
- Debt service ratio: net operating income / total debt service;
- Net open foreign exchange position / equity.

The high level of financial leverage weakens an organization's ability to repay its debt liabilities. According to the approach proposed by the International Monetary Fund, profitability is key to assessing financial stability. It affects the ability of an organization to raise funds, its operational potential, its ability to withstand adverse situations and the ability to repay its debt obligations. According to the IMF, the sharp decline in profitability is a decisive indicator for revealing the existing trends in the real sector. Therefore, in addition to the return on equity, from this point of view, the return on assets and the return on sales are also important. In the process of analysis-evaluation, the behavior of profitability indicators should be followed dynamically, as they directly depend on the sectoral affiliation of the organization and the existing competition.

According to the IMF approach, debt service indicators play a significant role, which directly reflect the deteriorating financial position of the organization. In particular, the

decline in debt service potential indicates an increase in financial risk. Another important indicator is the net open foreign exchange position equity ratio. It shows the effect of the exchange rate difference on equity, which is reflected in the financial accounting in Armenia.

M. Abryutina [4] and A. Grachev [5] identified the essence of financial stability with the solvency of the organization. According to them, the financial stability of the organization is characterized as guaranteed solvency and does not depend on the behaviour of partners and randomness of the market structure.

Other authors [6] in their joint research describe the concept of financial stability as a state of the organization that guarantees the desired solvency in the long-term perspective.

In their joint opinion, researchers V. Rodionova and M. Fedotova described the financial stability of organizations as a state of financial resources, their distribution and use, which allows to ensure the further development of the organization based on capital and profit growth, maintaining solvency and creditworthiness within the permissible risk limits [7].

In her research, A. Purtova describes the financial stability of the organization in terms of security in equity and the efficiency of its use. [8].

Another researcher emphasizes the importance of the following in ensuring the financial stability of commercial organizations [9]:

- maintaining a financial balance, which means ensuring a ratio of own and borrowed funds in which the organization retains the ability to repay its debt liabilities to creditors;
- refinancing loans and borrowings at the preferred price for the organization;
- keeping the financial risks at an adequate level.

In the mentioned research the issue of the ratio of own and borrowed funds from the perspective of assessment of debt burden in ensuring the financial stability of commercial organizations is also reviewed, the solution of which is directly related to the process of optimization of the capital structure.

A. Ionova and N. Selezneva describe the financial stability as a condition of the assets of the organization that guarantees permanent solvency [10].

Another definition of financial stability in terms of solvency relationship was given by V. Borisova. According to her, financial stability is a state of the organization's calculations that guarantees its constant solvency [11].

In his research, I. Blank describes the financial stability of the organization as a state of financial and economic activity in which the organization has sufficient resources for normal operations, liquidity balance and required solvency [12].

In their research, L. Gilyarovskaya and A. Yendovitskaya noted that the financial stability of any business entity is the ability to carry out main and other activities to maximize the material well-being of the owners in the conditions of changing external environment and business risk, as well as the strengthening of the competitive advantages of the organization by taking into account the interests of the state and society [13].

In our opinion, equating the financial stability of an organization with solvency, liquidity and profitability, as is the case in the above-mentioned researches, is not correct. Financial stability should be considered as a separate component of the financial position, assessing its potential interactions with other components of the financial position.

Within the scope of this study, importance is attached to those definitions of financial stability, which emphasize issues related to the capital structure of the organization. Particularly, in his research M. Melnik considers the financial position of the organization to be stable, if the latter has managed a sufficient volume of capital, which has ensured continuous operation and a possibility for timely and full repayment of liabilities, as well as the renewal and growth of non-current assets [14].

Some researchers link assessment of the financial stability of the organization with solvency and security in own working capital [15].

In our opinion, these researchers have risen a significant theoretical problem within the scope of financial management, the practical solutions to which will be presented within the scope this research by developing and applying own approaches.

In her research, M. Krejtnina characterizes the financial stability of an organization by the situation dependent on the own capital in the financing sources; moreover, borrowed funds for financing are used by the organization only to the extent enabling to ensure their timely return, and current liabilities must not exceed the value of resources and unfinished production [16].

In her research, G. Savickaya links the financial stability of an organization with the state of gross capital disposed of, activities of the latter and the ability to develop, proposing three types of financial stability: stable, pre-crisis and crisis [17].

Researchers have a number of issues to be clarified in the general assessment of financial stability of commercial organizations. In practice, there are almost no uniform regulatory standards observed for the indicators under consideration, or they are appropriate for not all organizations due to the fact that they are non-universal. Let us also mention that the level of regulation depends on multiple factors, such as the sectoral affiliation, lending terms, structure of sources of funds, asset turnover of the organization, etc. Although certain comparisons are possible for economic entities of same specialization, they bear a very limited nature.

In general, A. Golubovich, A. Sitnin and B. Khenkin share a common opinion that the analysis of the financial situation of organizations is presented "as a unique interpretation, in case of which the managing staff of the organization explains the reasons for the change in the financial indicators" [18].

Financial stability of an organization may be manifested in various ways, the most essential of which is considered to be the investment attractiveness. In particular, in her research, Y. Gukalova mentions that, for potential investors, from among the indicators reflecting the financial stability of an organization, the amount of own capital, monetary flows, the business image of the organization gain a primary significance [19].

Nowadays, researchers use various classifications of indicators for assessing the financial stability, which are reflected, for example [20-23].

At the current stage, the need for elaboration of a complex approach is deemed to be of priority for the analysis of separate groups of indicators for assessing the financial stability of commercial organizations. Grouping of indicators of financial stability in terms of assessment of the debt burden, the assessment of various factors impacting them will provide an opportunity to reveal the strengths and weaknesses of commercial organizations, detect hidden reserves and determine stability risk zones and, in particular, propose limit values for the indicators selected [24-25].

3 Approach for prediction of the marginal ranges of the debt burden indicators

Within the scope of this article, we have set a goal to clarify — with the use of the teaching model for forecasting the capital structure of organizations we have built [26; 27] — the limit ranges of indicators characterizing the interrelations between the capital structure of components of the debt burden of organizations and indicators characterizing the level of security of liabilities with the assets of an organization [27].

As a result, in the context of the relation of the financial stability describing the financial situation of commercial organizations, it will also be created an opportunity to regulate, in an interrelated manner the marginal ranges of the indicators assessing solvency, liquidity, business activity and profitability, which will be carried out during further research activities.

The steps for the proposed predication approach are the following:

1. In the first step, the actual values of the indicators of the debt burden of the organization(s) characterizing the correlation between the components of the capital structure and actual values of the indicators characterizing the level of security of liabilities with the assets of an organization are calculated [28].
2. In the second step, a classification is made by the matrix method (tables) [29] using sets of indicators characterizing the debt burden and the preliminary marginal ranges are determined.
3. In the third step, using the training model developed by us for the prediction of the capital structure of organizations [26, 27] the capital structure of the observed commercial organization(s) is predicted.
 $Y1$ is $((\text{Current assets} - \text{Current liabilities}) / \text{Current assets}) * 100$;
 $Y2$ is $((\text{Current assets} - \text{Current liabilities}) / \text{Equity}) * 100$;
 the P1-P5 quintet of liabilities of the observed organization(s) are predicted with the input variables (actual values), where:
 P1 is the share of equity in total liabilities;
 P2 is the share of long-term loans and borrowings in total liabilities;
 P3 is the share of short-term loans and borrowings in total liabilities;
 P4 is the share of commercial and other accounts payable in total liabilities;
 P5 is the share of other stable liabilities in total liabilities.
4. In the fourth step, according to the predicted structure of the observed organization(s), a classification of the indicators characterizing the correlation between the components of the capital structure and the indicators characterizing the level of security of liabilities with the assets of an organization is by using the matrix method.
5. In the fifth step, the actual and predicted values are combined, the marginal ranges are determined and it is carried a monitoring on the basis of mathematical trend assessments to improve the managerial decisions.

Step 1. In this phase of the research, we will present the methodological bases for the proposed approach by studying the data of 2009-2018 financial reports of "Proshyan Brandy Factory" LLC, 2010-2020 financial reports of "Yerevan Champagne Wines Factory" OJSC and 2011-2019 financial reports of "Kotayk Brewery" LLC. Based on them, the actual values of indicators characterizing the correlation between the components of the capital structure and indicators characterizing the level of security of liabilities with the assets of an organization are presented in Tables 1.1, 1.2, 1.3 and 2.1, 2.2, 2.3 below.

Table 1.1. Actual values of indicators characterizing the correlation between the components of the capital structure for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities) / Assets	Long-term liabilities/Assets	Long term liabilities/ Equity + Long-term liabilities
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2009	0.69	0.40	0.01	0.02
2010	0.91	0.47	0.01	0.02
2011	0.55	0.19	0.16	0.20
2012	0.27	0.21	0.00	0.00
2013	0.30	0.13	0.10	0.11
2014	0.44	0.19	0.12	0.15
2015	0.69	0.28	0.12	0.17

Continuation of Table 1.1.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities) / Assets	Long-term liabilities/Assets	Long term liabilities/ Equity + Long-term liabilities
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2016	0.92	0.37	0.11	0.17
2017	1.69	0.51	0.12	0.25
2018	1.90	0.12	0.54	0.61
Maximum	1.90	0.51	0.54	0.61

Table 1.2. Actual values of indicators characterizing the correlation between the components of the capital structure for “Yerevan Champagne Wines Factory” OJSC, 2010-2020.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities) / Assets	Long-term liabilities/Assets	Long term liabilities/ Equity + Long-term liabilities
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2010	1.789	0.13	0.512	0.588
2011	1.767	0.137	0.501	0.581
2012	1.447	0.131	0.461	0.53
2013	1.496	0.182	0.417	0.51
2014	1.360	0.145	0.431	0.504
2015	1.247	0.130	0.425	0.488
2016	0.939	0.113	0.371	0.418
2017	0.831	0.103	0.351	0.391
2018	0.936	0.150	0.334	0.393
2019	1.023	0.247	0.258	0.343
2020	1.369	0.193	0.385	0.477
Maximum	1.789	0.182	0.512	0.588

Table 1.3. Actual values of indicators characterizing the correlation between the components of the capital structure for “Kotayk Brewery” LLC, 2011-2019.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities) / Assets	Long-term liabilities/Assets	Long term liabilities/ Equity + Long-term liabilities
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2011	3.250315	0.063	0.701	0.749
2012	3.342479	0.105	0.664	0.743
2013	2.582427	0.096	0.625	0.691
2014	5.519022	0.085	0.762	0.832
2015	5.936898	0.069	0.787	0.845
2016	11.13382	0.107	0.810	0.908

Continuation of Table 1.3.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities / Assets	Long-term liabilities/Assets	Long term liabilities/ Equity + Long-term liabilities
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2017	-24.0844	0.129	0.915	1.050
2018	-5.78753	0.284	0.925	1.292
2019	-4.7134	0.316	0.954	1.393
Maximum	11.13382	0.315629	0.953666	1.393492

Table 2.1. Actual values of the indicators characterizing the level of security of liabilities with the assets of the organization for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	(Debt- Short-term liabilities) / Long-term liabilities	Current assets/Current liabilities	(Debt- Short-term financial investments)/Assets	Long-term liabilities / (Equity+ Long-term liabilities)
	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2009	20.30	2.29	0.41	0.02
2010	14.28	1.87	0.48	0.02
2011	1.61	3.82	0.36	0.20
2012	85.04	3.57	0.21	0.00
2013	3.26	6.01	0.23	0.11
2014	2.95	5.00	0.31	0.15
2015	2.18	3.09	0.41	0.17
2016	1.87	2.44	0.48	0.17
2017	0.48	1.80	0.63	0.25
2018	0.79	7.70	0.66	0.61
Maximum	85.04	7.70	0.66	0.61

Table 2.2 Actual values of the indicators characterizing the level of security of liabilities with the assets of the organization for “Yerevan Champagne Wines Factory” OJSC, 2010-2020

Year	(Debt- Short-term liabilities) / Long-term liabilities	Current assets/Current liabilities	(Debt- Short-term financial investments)/Assets	Long-term liabilities / (Equity+ Long-term liabilities)
	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2010	0.355	2.898	0.655	0.641
2011	0.260	2.969	0.663	0.639
2012	0.312	3.297	0.697	0.591

Continuation of Table 2.2.

Year	(Debt- Short-term liabilities) / Long-term liabilities	Current assets/Current liabilities	(Debt- Short-term financial investments)/Assets	Long-term liabilities / (Equity+ Long-term liabilities)
	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2013	0.320	2.371	0.578	0.599
2014	0.348	2.958	0.662	0.576
2015	0.445	3.379	0.704	0.555
2016	0.463	3.930	0.746	0.484
2017	0.588	4.715	0.788	0.454
2018	0.607	3.356	0.702	0.484
2019	0.495	2.139	0.532	0.506
2020	0.690	2.811	0.644	0.578
Maximum	0.689857	4.71451	0.787889	0.641463

Table 2.3. Actual values of the indicators characterizing the level of security of liabilities with the assets of the organization for “Kotayk Brewery” LLC, 2011-2019.

Year	(Debt- Short-term liabilities) / Long-term liabilities	Current assets/Current liabilities	(Debt- Short-term financial investments)/Assets	Long-term liabilities / (Equity+ Long-term liabilities)
	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2011	0.052	2.937	0.660	0.765
2012	-0.016	2.822	0.646	0.770
2013	-0.018	1.797	0.444	0.721
2014	-0.008	1.565	0.361	0.847
2015	-0.002	1.883	0.469	0.856
2016	-0.068	1.076	0.071	0.918
2017	-0.066	0.927	-0.079	1.043
2018	-0.212	0.627	-0.596	1.209
2019	-0.242	0.672	-0.488	1.269
Maximum	0.052	2.937	0.660	1.269

Step 2. This step is divided into two sub steps.

Substep 2.1. Based on the data from Tables 1.1, 1.2 and 1.3, tables of standardized coefficients of indicators characterizing the correlation between the components of the capital structure are created.

Table 3.1. Standardized values of indicators characterizing the correlation between the components of capital structure for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2009	0.364	0.786	0.021	0.031
2010	0.480	0.922	0.020	0.034
2011	0.292	0.383	0.302	0.331
2012	0.142	0.416	0.004	0.005
2013	0.156	0.261	0.180	0.183
2014	0.233	0.368	0.223	0.242
2015	0.362	0.563	0.228	0.281
2016	0.483	0.728	0.204	0.286
2017	0.888	1.000	0.227	0.405
2018	1.000	0.229	1.000	1.000

Table 3.2. Standardized values of indicators characterizing the correlation between the components of capital structure for “Yerevan Champagne Wines Factory” OJSC, 2010-2020

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2010	1.000	0.524	1.000	1.000
2011	0.988	0.556	0.979	0.988
2012	0.809	0.529	0.900	0.901
2013	0.836	0.735	0.816	0.868
2014	0.760	0.587	0.843	0.858
2015	0.697	0.526	0.830	0.831
2016	0.525	0.458	0.725	0.711
2017	0.465	0.418	0.685	0.665
2018	0.523	0.606	0.652	0.667
2019	0.572	1.000	0.505	0.584
2020	0.765	0.781	0.752	0.811

Table 3.3. Standardized values of indicators characterizing the correlation between the components of capital structure for “Kotayk Brewery” LLC, 2011-2019.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2011	0.2919	0.2005	0.7355	0.5374
2012	0.3002	0.3334	0.6968	0.5329
2013	0.2319	0.3033	0.6555	0.4961
2014	0.4957	0.2689	0.7988	0.5973
2015	0.5332	0.2183	0.8252	0.6065
2016	1.0000	0.3403	0.8495	0.6514

Continuation of Table 3.3.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2017	-2.1632	0.4078	0.9591	0.7533
2018	-0.5198	0.9008	0.9695	0.9271
2019	-0.4233	1.0000	1.0000	1.0000

Based on the data from Tables 3.1, 3.2 and 3.3, tables of squares of indicators characterizing the correlation between the components of the capital structure are created. See Tables 4.1, 4.2 and 4.3. If a negative value is obtained for a specific case in the table of the standardized coefficients, the conditional value 0.001 will be entered in the table of squares.

Table 4.1. Table of squares of indicators characterizing the correlation between the components of the capital structure for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}	Y* _{actual}
2009	0.133	0.618	0.000	0.001	0.867
2010	0.230	0.849	0.000	0.001	1.040
2011	0.085	0.147	0.091	0.109	0.657
2012	0.020	0.173	0.000	0.000	0.439
2013	0.024	0.068	0.032	0.033	0.398
2014	0.054	0.136	0.050	0.059	0.546
2015	0.131	0.317	0.052	0.079	0.761
2016	0.233	0.531	0.042	0.082	0.942
2017	0.788	1.000	0.051	0.164	1.415
2018	1.000	0.052	1.000	1.000	1.747

Table 4.2. Table of squares of indicators characterizing the correlation between the components of the capital structure for “Yerevan Champagne Wines Factory” OJSC, 2010-2020.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}	Y* _{actual}
2010	1.000	0.713	1.000	1.000	1.17818
2011	0.988	0.721	0.980	0.988	1.176763
2012	0.842	0.714	0.909	0.910	1.164264
2013	0.861	0.798	0.847	0.884	1.164836
2014	0.812	0.731	0.866	0.877	1.160316
2015	0.778	0.713	0.857	0.857	1.156706
2016	0.713	0.699	0.792	0.785	1.146667
2017	0.700	0.694	0.772	0.762	1.143761
2018	0.713	0.738	0.757	0.763	1.145808
2019	0.726	1.000	0.708	0.730	1.154899
2020	0.815	0.824	0.807	0.844	1.160499

Table 4.3. Table of squares of indicators characterizing the correlation between the components of the capital structure for “Kotayk Brewery” LLC, 2011-2019.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}	Y* actual
2011	0.698	0.725	0.798	0.716	1.713655
2012	0.697	0.693	0.777	0.715	1.69784
2013	0.713	0.696	0.758	0.706	1.695098
2014	0.706	0.702	0.836	0.735	1.726099
2015	0.715	0.717	0.853	0.738	1.739023
2016	1.000	0.693	0.871	0.756	1.822067
2017	0.001	0.694	0.961	0.808	1.569451
2018	0.001	0.910	0.970	0.932	1.677432
2019	0.001	1.000	1.000	1.000	1.732339

Substep 2.2. Based on the data from Tables 2.1, 2.2 and 2.3, tables of standardized coefficients of indicators characterizing the level of security of liabilities with the assets of an organization are created, which are as follows:

Table 5.1. Standardized values of indicators characterizing the level of security of liabilities with the assets of the organization for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2009	0.239	0.297	0.624	0.031
2010	0.168	0.243	0.728	0.034
2011	0.019	0.496	0.544	0.331
2012	1.000	0.464	0.324	0.005
2013	0.038	0.781	0.349	0.183
2014	0.035	0.649	0.468	0.242
2015	0.026	0.401	0.622	0.281
2016	0.022	0.317	0.730	0.286
2017	0.006	0.234	0.958	0.405
2018	0.009	1.000	1.000	1.000

Table 5.2. Standardized values of indicators characterizing the level of security of liabilities with the assets of the organization for “Yerevan Champagne Wines Factory” OJSC, 2010-2020.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2010	0.515	0.615	0.831	1.000
2011	0.376	0.630	0.842	0.996
2012	0.453	0.699	0.884	0.922
2013	0.463	0.503	0.734	0.934

Continuation of Table 5.2.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2014	0.504	0.627	0.840	0.898
2015	0.646	0.717	0.894	0.865
2016	0.671	0.834	0.946	0.755
2017	0.852	1.000	1.000	0.708
2018	0.880	0.712	0.891	0.754
2019	0.717	0.454	0.676	0.788
2020	1.000	0.596	0.818	0.901

Table 5.3. Standardized values of indicators characterizing the level of security of liabilities with the assets of the organization for “Kotayk Brewery” LLC, 2011-2019.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2011	1.000	1.000	1.000	0.603
2012	-0.311	0.961	0.979	0.606
2013	-0.348	0.612	0.672	0.568
2014	-0.147	0.533	0.548	0.667
2015	-0.033	0.641	0.711	0.674
2016	-1.326	0.366	0.108	0.723
2017	-1.285	0.316	-0.119	0.822
2018	-4.115	0.213	-0.904	0.952
2019	-4.687	0.229	-0.741	1.000

Based on the data from Tables 5.1, 5.2 and 5.3, tables of squares of indicators characterizing the correlation between the components of the capital structure are created. See Tables 6.1, 6.2 and 6.3. If a negative value is obtained for a specific case in the table of the standardized coefficients, the conditional value 0.001 will be entered in the table of squares.

Table 6.1. Table of squares of indicators characterizing the level of security of liabilities with the assets of the organization for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y** actual
2009	0.0570	0.0882	0.3897	0.0010	0.7321
2010	0.0282	0.0590	0.5296	0.0011	0.7861
2011	0.0004	0.2457	0.2960	0.1094	0.8071
2012	1.0000	0.2153	0.1052	0.0000	1.1491
2013	0.0015	0.6099	0.1220	0.0335	0.8757
2014	0.0012	0.4210	0.2188	0.0588	0.8365

Continuation of Table 6.1.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y ^{**} actual
2015	0.0007	0.1605	0.3871	0.0792	0.7921
2016	0.0005	0.1006	0.5333	0.0818	0.8463
2017	0.0000	0.0546	0.9181	0.1643	1.0663
2018	0.0001	1.0000	1.0000	1.0000	1.7321

Table 6.2. Table of squares of indicators characterizing the level of security of liabilities with the assets of the organization for “Yerevan Champagne Wines Factory” OJSC, 2010-2020.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y ^{**} actual
2010	0.711	0.741	0.858	1.000	1.349
2011	0.692	0.747	0.865	0.996	1.348
2012	0.699	0.779	0.897	0.928	1.348
2013	0.700	0.708	0.797	0.938	1.332
2014	0.708	0.746	0.864	0.908	1.340
2015	0.754	0.788	0.904	0.882	1.351
2016	0.765	0.859	0.949	0.809	1.356
2017	0.873	1.000	1.000	0.783	1.383
2018	0.893	0.785	0.902	0.808	1.357
2019	0.788	0.699	0.767	0.829	1.325
2020	1.000	0.735	0.848	0.910	1.367

Table 6.3. Table of squares of indicators characterizing the level of security of liabilities with the assets of the organization for “Kotayk Brewery” LLC, 2011-2019.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y ^{**} actual
2011	1.000	1.000	1.000	0.737	1.933
2012	0.001	0.962	0.979	0.738	1.637
2013	0.001	0.740	0.766	0.725	1.494
2014	0.001	0.715	0.719	0.763	1.483
2015	0.001	0.752	0.785	0.767	1.518
2016	0.001	0.692	0.787	0.791	1.507
2017	0.001	0.695	0.001	0.851	1.244

Continuation of Table 6.3.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y** actual
2018	0.001	0.719	0.001	0.955	1.295
2019	0.001	0.714	0.001	1.000	1.310

The final part of the second step constitutes determination of the marginal ranges underlying the control over financial stability by the matrix method for “Proshyan Brandy Factory” LLC, “Yerevan Champagne Wines Factory” OJSC and "Kotayk Brewery” LLC (based on the actual data). See Figures 1.1, 1.2 and 1.3.

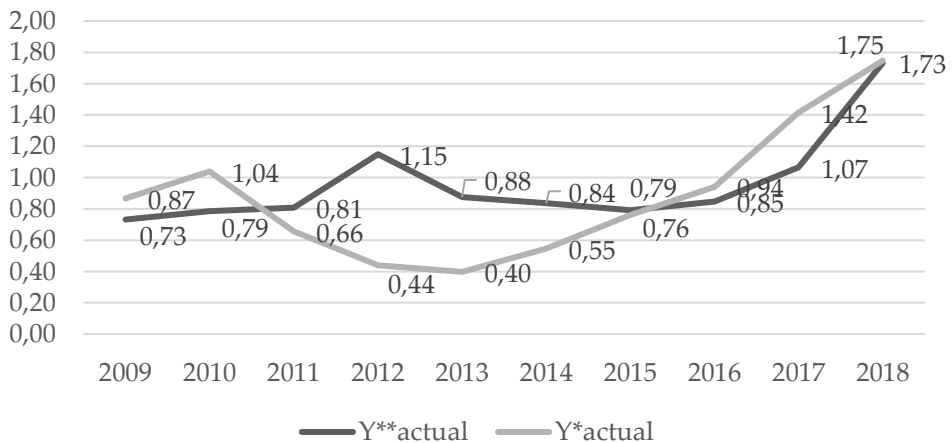


Fig. 1.1. Marginal ranges constituting the basis for control over financial stability for “Proshyan Brandy Factory” LLC according to the actual values of indicators characterizing the correlation between the components of capital structure and indicators characterizing the level of security of liabilities with the assets of an organization, 2009-2018 [31].

It should be noted that according to Figure 1.1, in 2011-2015 and 2015-2018 common intersection ranges (areas) were formed in “Proshyan Brandy Factory” LLC which has caused certain complications from the point of view of effective control over the debt burden and is conditioned by the non-preferable capital structure in the given phases. Taking into consideration the aforementioned, in the next step we will seek to offer an effective solution through the training model we built for “Proshyan Brandy Factory” LLC in terms of capital structure and solve the problem of harmonization between the two sets of indicators for the assessment of the debt burden.

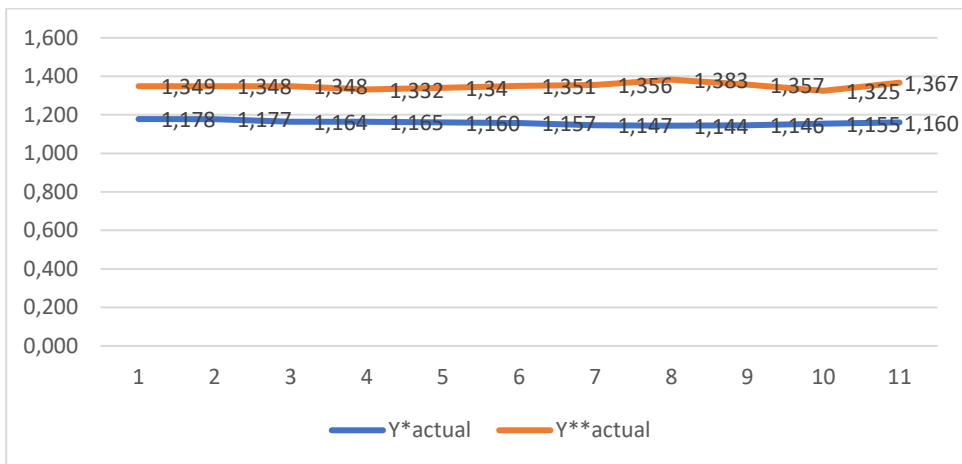


Fig. 1.2. Marginal ranges constituting the basis for control over financial stability for “Yerevan Champagne Wines Factory” OJSC according to the actual values of indicators characterizing the correlation between the components of capital structure and indicators characterizing the level of security of liabilities with the assets of an organization, 2010-2020.

Based on Figure 1.2, no common ranges (areas) of control have been established for “Yerevan Champagne Wines Factory” OJSC, therefore it is not appropriate to change the existing capital structure in this organization from the point of view of effective control of the debt burden. Hence, optimization of the capital structure for the mentioned organization based on the training model will not be envisaged in the next step.

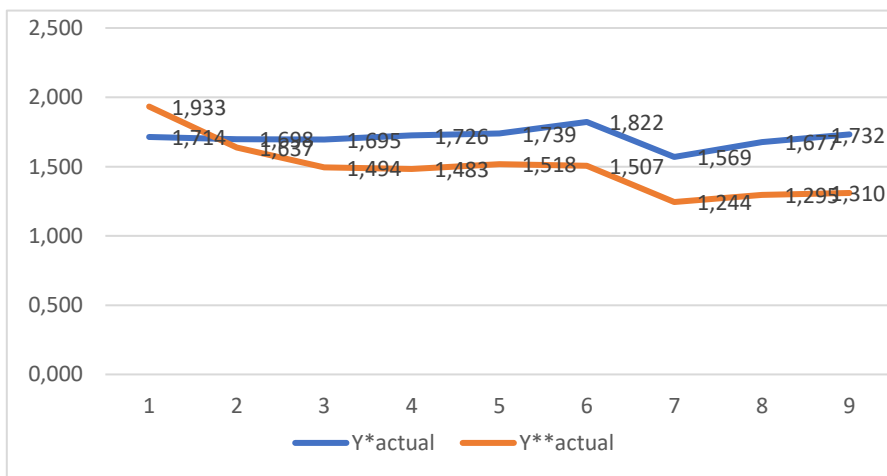


Fig. 1.3. Marginal ranges constituting the basis for control over financial stability for “Kotayk Brewery” LLC according to the actual values of indicators characterizing the correlation between the components of capital structure and indicators characterizing the level of security of liabilities with the assets of an organization, 2011-2019.

According to Figure 1.3, the problem of harmonization in terms of control of the debt burden in “Kotayk Brewery” LLC between the two sets of indicators of assessment of the debt burden was solved in 2012. Therefore, the change in the capital structure in this organization is not urgent either. Hence, optimization of the capital structure for the mentioned organization based on the training model will not be envisaged in the next step.

Step 3. The P1-P5 quintet has been predicted for “Proshyan Brandy Factory” LLC for 2009-2018 with calculated Y1, Y2 pair by using the training model developed by us within the scope of improvement of the behavioral theory of capital structure. The results are provided in Table 7.

Table 7. Prediction results of P₁-P₅ quintet for “Proshyan Brandy Factory” LLC (average) in %, 2009-2018.

Year	P ₁	P ₂	P ₃	P ₄	P ₅
2009	22.70	16.80	5.26	4.11	4.89
2010	24.17	24.28	6.49	7.32	1.83
2011	29.76	23.98	2.32	8.05	2.44
2012	31.98	24.98	3.71	7.76	2.32
2013	31.52	25.77	1.58	4.11	2.44
2014	28.58	31.15	2.32	5.14	1.96
2015	36.81	29.96	1.83	11.31	4.89
2016	28.582	52.687	12.622	4.112	0.002
2017	28.58	27.43	3.90	8.97	4.89
2018	28.582	58.649	2.808	9.253	0.002

In this step, using the average values of the determined P1-P5 quintets from among the proposed options of the training model predicting the preferred capital structure, firstly the balance sheets of the observed organization(s) to be predicted are developed. In the current case, they are the balance sheets of “Proshyan Brandy Factory” LLC for 2009-2018, the data of which have been used to make the predictions required in the fourth step.

Step 4. In this step, according to the predicted structure of the observed organization(s), classification of indicators characterizing the correlation between the components of the capital structure and indicators characterizing the level of security of liabilities with the assets of an organization is made by using again the matrix method. Let us note that this process is carried out by the same logic of actions described in the second step of the presented approach. In the fourth step, the final results predicted for the two sets of indicators characterizing the debt burden are presented in Figure 2. The calculations are presented in Appendix A.

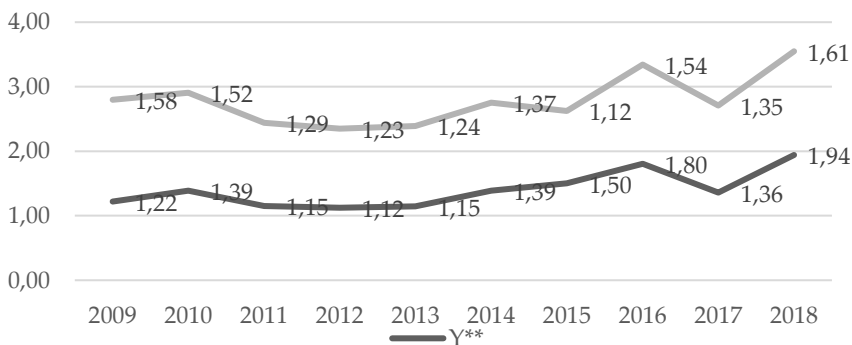


Fig. 2. Marginal ranges underlying the control over financial stability according to the predicted values of indicators characterizing the correlation between the components of the capital structure and

indicators characterizing the level of security of liabilities with the assets of an organization, 2009-2018 [31].

In case of using the preferred capital structures of "Proshyan Brandy Factory" LLC in Figure 2, it became possible to neutralize the general intersection ranges (areas) for 2011-2015 and 2015-2018 revealed in Figure 1, which allows to make the control over debt burden of the organization more targeted and effective.

Step 5. In this step, the actual and predicted values of indicators characterizing the correlation between the components of the capital structure and indicators characterizing the level of security of liabilities with the assets of the organization are combined, the marginal ranges are determined and on the basis of mathematical trend assessments, monitoring for improvement of the managerial decisions is carried out. In particular, the comparison of the actual and predicted values of the indicators characterizing the correlation between the components of the capital structure are presented in Figure 3.

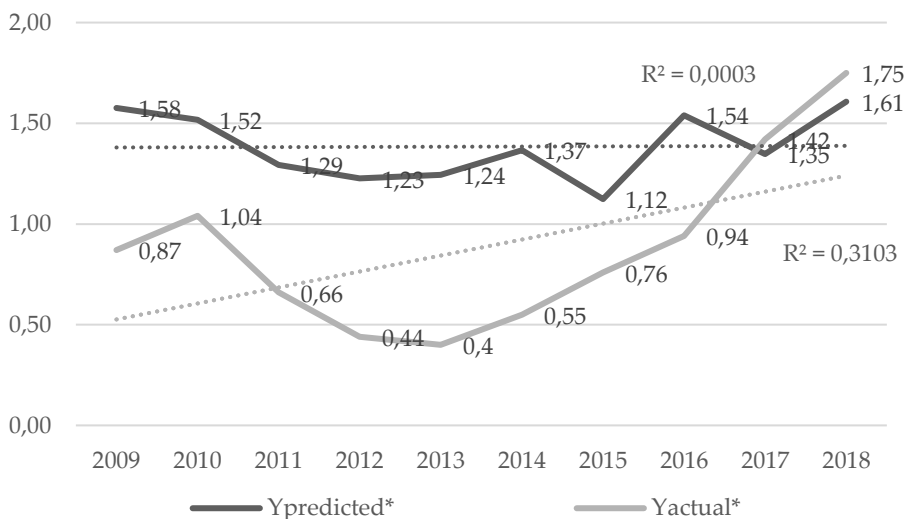


Fig. 3. Comparison of the actual and predicted values of the indicators characterizing the correlation between the components of the capital structure, 2009-2018 [32].

According to Figure 3, the curve with the predicted values of indicators characterizing the correlation between the components of capital structure has recorded an improvement trend for the period between 2009-2017. According to the mathematical trend assessments, the settlement of the situation has required implementation of individual solutions and measures for each year.

Figure 4 presents the comparison of the actual and predicted values of indicators characterizing the level of security of liabilities with the assets of the organization.

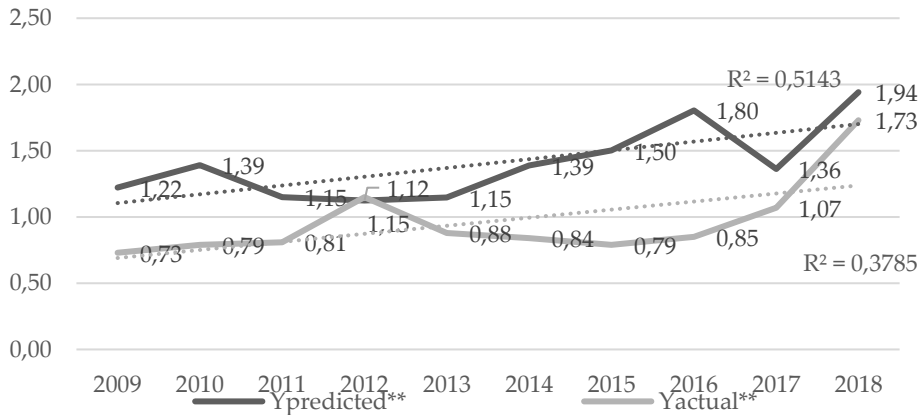


Fig. 4. Comparison of actual and predicted values of indicators characterizing the level of security of liabilities with the assets of the organization, 2009-2018 [35].

Figure 4 shows that the curve with the predicted values of indicators characterizing the level of security of liabilities in the assets of the organization has also recorded an improvement trend for the period between 2009-2018.

However, in this case, the mathematical trend assessments show that the settlement of the situation has allowed to increase the similar decisions from 37.8% to 51.4%. Thus, the selection of the most targeted from the managerial decisions gets sufficient justification, which plays an essential role in solving new strategic and tactical problems of financial policy in the future. At the same time the actual and predicted values of indicators characterizing the correlation between the components of the capital structure and indicators characterizing the level of security of liabilities with the assets of the organization can be used to determine the overall rating of financial stability.

4 Conclusions and recommendations

In recent years, the financial and economic crises in the world economy have hit the financial situation of commercial organizations quite hard, significantly reducing the level of solvency and creditworthiness. The commercial organizations of the Republic of Armenia were not left out of such manifestations.

New solutions to the theoretical methodological issues of financial policy, the search for effective ways to improvement are of paramount importance to theorists and practitioners engaged in financial management.

In the conditions of low efficiency of the capital market activity and existing financing mechanisms, the commercial organizations of the Republic of Armenia face certain difficulties in the process of attracting financial resources, which influences the formation of an unfavorable capital structure. As a result, the high financial stress also poses some problems in terms of creditworthiness of organizations.

It should be noted that the three groups assessing the debt burden of commercial organizations, namely the correlation between the components of the capital structure, the level of security of liabilities in the assets of the organization and the set of indicators characterizing the debt burden are essential in building approaches for assessment of financial stability, solvency and liquidity. Therefore, we consider that for the indicators included in the basis of managerial decisions, the determination of marginal values and differentiation of common areas of control over the components of the financial situation, with specific

justification, are one of the important ways to improve the financial management of commercial organizations.

The key features of the proposed approach are as follows:

- It is possible to find individual solutions in the context of the relationship between the marginal values of indicators assessing the debt burden for a particular organization and the preferred structure of its liabilities.
- One of the distinguishing features of the proposed approach is that it takes into account the results of the training model of prediction, which is very important for assessing the quality of management of the debt burden of an organization from the position of the preferred structure of liabilities.
- In case of a long time lag for a particular organization, it becomes possible to identify errors in the decisions made during the debt burden management regarding the choice of funding sources, formed structure and pricing policy for attracting financial resources.
- If organizations of the same sector are observed during the research, this approach will enable firstly to substantiate the cross-sectoral marginal values for the debt burden assessment indicators for a specific period, and secondly to determine the complex of measures for regulation of marginal areas to be formed in the process of financial policy development in accordance with the characteristics specific to the given sector, aiming to improve the quality of the debt burden management in a specific organization of the branch.
- One of the most significant advantages of the proposed approach, in our view, is the determination of marginal ranges in line with the predicted preferred variants of liabilities for the sets of indicators assessing the debt burden, which, has been carried out for “Proshyan Brandy Factory” LLC. In our opinion, establishment of marginal ranges for the sets of indicators assessing the debt burden of a particular organization is one of the most effective ways to improve the internal control.
- In the context of the dynamic connection between the debt burden assessment indicators and the preferred structure of liabilities, the approach we have taken for determination of marginal values and control areas, is one of the new solutions aimed at improving financial policy of commercial organizations.

Appendix A

Table 8.1. Predicted values of indicators characterizing the correlation between the components of capital structure for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities/Assets	Long-term liabilities/ Assets	Long-term liabilities/ (Equity + Long-term liabilities)
	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2009	3.40	0.60	0.17	0.43
2010	3.14	0.52	0.24	0.50
2011	2.36	0.46	0.24	0.45
2012	2.13	0.43	0.25	0.44
2013	2.17	0.43	0.26	0.45
2014	2.50	0.40	0.31	0.52
2015	1.72	0.33	0.30	0.45

Continuation of Table 8.1

Year	(Long-term liabilities + Short-term liabilities) / Equity	Short-term liabilities/Assets	Long-term liabilities/ Assets	Long-term liabilities/ (Equity + Long-term liabilities)
	K 1.1	K 1.2	K 1.3	K 1.4
2016	2.50	0.19	0.53	0.65
2017	2.50	0.44	0.27	0.49
2018	2.50	0.13	0.59	0.67
Maximum	3.40	0.60	0.59	0.67

Table 8.2. Predicted values of indicators characterizing the level of security of liabilities with the assets of the organization for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	(Debt - Short-term liabilities) / Long-term liabilities	Current Assets / Current liabilities	(Debt - Short-term financial investments)/Assets	Long-term liabilities/ (Equity + Long-term liabilities)
	K 2.1	K 2.2	K 2.3	K 2.4
2009	0.15	1.50	0.77	0.43
2010	0.44	1.69	0.76	0.50
2011	-0.03	1.60	0.70	0.45
2012	-0.08	1.75	0.68	0.44
2013	0.08	1.86	0.68	0.45
2014	0.44	2.31	0.71	0.52
2015	0.73	2.64	0.63	0.45
2016	0.74	4.80	0.71	0.65
2017	0.45	2.07	0.71	0.49
2018	0.70	6.98	0.71	0.67
Maximum	0.74	6.98	0.77	0.67

Table 8.3. Standardized values of the predicted indicators characterizing the correlation between the components of capital structure for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	K 1.1	K 1.2	K 1.3	K 1.4
2009	1	1	0.286457	0.632523
2010	0.921367	0.852127	0.413933	0.745246
2011	0.693379	0.764778	0.408834	0.663682
2012	0.624644	0.711311	0.42601	0.6523
2013	0.638163	0.705972	0.439428	0.669053
2014	0.733974	0.665566	0.531211	0.775702
2015	0.504252	0.549329	0.510815	0.667361

Continuation of Table 8.3

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}
2016	0.733974	0.30964	0.898342	0.964247
2017	0.733974	0.727084	0.467756	0.728422
2018	0.733974	0.211085	1	1

Table 8.4. Values of squares of indicators characterizing the correlation between the components of capital structure for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	K _{1.1}	K _{1.2}	K _{1.3}	K _{1.4}	Y* actual
2009	1	1	0.082058	0.400085	1.575482
2010	0.848917	0.726121	0.171341	0.555392	1.517159
2011	0.480774	0.584885	0.167145	0.440473	1.293552
2012	0.390181	0.505964	0.181484	0.425495	1.226019
2013	0.407252	0.498396	0.193097	0.447632	1.243534
2014	0.538718	0.442978	0.282185	0.601713	1.365868
2015	0.25427	0.301762	0.260932	0.445371	1.123537
2016	0.538718	0.095877	0.807019	0.929773	1.539931
2017	0.538718	0.528651	0.218796	0.530599	1.347874
2018	0.538718	0.044557	1	1	1.607257

Table 8.5. Standardized values of indicators characterizing the level of security of liabilities with the assets of the organization for "Proshyan Brandy Factory" LLC, 2009-2018.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}
2009	0.209954	0.215417	1	0.632523
2010	0.597916	0.24221	0.980991	0.745246
2011	-0.03634	0.229175	0.908758	0.663682
2012	-0.10937	0.250107	0.879945	0.6523
2013	0.107989	0.266206	0.885948	0.669053
2014	0.6025	0.331024	0.923965	0.775702
2015	0.999029	0.379027	0.817517	0.667361
2016	1	0.688329	0.923965	0.964247
2017	0.617045	0.296478	0.923965	0.728422
2018	0.957273	1	0.923965	1

Table 1.6. Table of squares of indicators characterizing the level of security of liabilities with the assets of the organization for “Proshyan Brandy Factory” LLC, 2009-2018.

Year	K _{2.1}	K _{2.2}	K _{2.3}	K _{2.4}	Y ^{**} actual
2009	0.044081	0.046404	1	0.400085	1.22
2010	0.357504	0.058666	0.962344	0.555392	1.39
2011	0.001	0.052521	0.825842	0.440473	1.15
2012	0.001	0.062553	0.774304	0.425495	1.12
2013	0.011662	0.070866	0.784904	0.447632	1.15
2014	0.363006	0.109577	0.853712	0.601713	1.39
2015	0.998058	0.143661	0.668334	0.445371	1.50
2016	1	0.473797	0.853712	0.929773	1.80
2017	0.380745	0.087899	0.853712	0.530599	1.36
2018	0.916372	1	0.853712	1	1.94

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