DISCRIMINATIVE MODEL TO ASSESS THE EFFICIENCY OF CASH FLOW MANAGEMENT

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Introduction. The discriminatory analysis has become widely used to determine and forecast the financial state of enterprises. Over the recent 45 years, hundreds of studies forming models for forecasting business failures have been published. Most of these studies have focused on one specific area. In addition to the discriminatory analysis, other methods were used, including the logit-analysis, the probit analysis, the regression analysis, and the neural network. The Altman model (1868) is the oldest and most common model that uses multivariate discriminatory analysis to forecast the corporate bankruptcy.

The aims at developing the discriminant functions to reliably identify the quality and efficiency of cash flow management at an enterprise.

Materials and methods. The study uses scientific publications of leading scientists, financial statements of 15 confectionery companies in Ukraine for 2012-2018 (94 observations), and the author's observations. In order to solve the set tasks, the methods of researching economic processes were used: economic-statistical, grouping, induction and deduction, and abstract-logical. The discriminative model was made in the *SPSS Statistics* program.

Results and discussion. The discriminatory analysis solves several types of problems. Problems of the first type assume the availability of information about a number of objects whose characteristics make it possible to assign them to one of two or more groups. Based on this information, there is a function that makes it possible to match new objects and the groups that characterize them. The second type of problems is referred to the situation where the features of the object's belonging to a

particular group are lost, and they need to be restored. Problems of the third type are related to forecasting future events by using the available data. Such problems are possible when forecasting, for example, the financial state of enterprises in future periods. This study solves the first type of problems.

In order to assess the efficiency of the cash flow management at enterprises, a system of indicators for assessing cash flows and the overall financial state of the confectionery enterprises was previously studied, and 6 coefficients were selected: K1 – the cash flow liquidity coefficient, K2 – the cash flow efficiency coefficient, K3 – the coefficient of net replenishment of funds, K4 – the financial autonomy coefficient, K5 – the coverage coefficient, and K6 – the cash filling of the operating margin. The analysis of the pairwise K1 – K6 correlations shows the absence of marked correlations, i.e. the above indicators are independent and can be further used when forming a discriminative model.

The efficiency of cash flow management – ECFM – was chosen as a result indicator. The current situation at the enterprises was determined by assigning the calculated ECFM to one of 4 groups of classifications (Table 1): 1) sustainable efficiency, 2) partial efficiency, 3) unstable (pre-crisis cash flow management) efficiency, and 4) absolute inefficiency.

The analysis of the observation processing summary shows the validity of all 94 observations. According to the method of discriminatory analysis, the number of functions is equal to the number of classification groups minus 1 (in our case, 3). Successful enterprises classification is measured with the correlation coefficient between the calculated value of the discriminant function and the indicator of belonging to the classification group. The canonical correlation coefficient for the first discriminant function is 0.993. This allows choosing it as a classification function to determine the efficiency of cash flow management at enterprises. It means that out of 3 discriminant functions the first function is chosen as qualitative. Besides, a high own value shows that the discriminant function has been chosen successfully.

Table 1

Criteria for Classifying Enterprises by Groups Based on the Efficiency of Cash Flow Management

State of cash flow management	Group No.	Conditions to refer the enterprise to the relevant group
Sustainable efficiency (SE)	1	The values of five or six indicators (including obligatorily K1 and at least one of K2, K3, K4) must comply with the normative or recommended values (≥1)
Partial efficiency (PE)	2	The values of four indicators (including one of the K1, K2, K3 indicators) must meet the normative or recommended values. The value of K1 should be ≥ 1, K2 ≥ 0.5
Unstable (pre-crisis) efficiency (UE)	3	The values of three indicators (including one of the K1, K2, K3 indicators) must meet the normative or recommended values.
Absolute inefficiency (AE)	4	The values of two or less indicators meet the normative or recommended values, or are included in the indicators that meet the normative or recommended values, there are no K1, K2, K3 indicators

Source: compiled by the author

The coefficients of the first discriminant function allow expressing the function to be defined (2):

$$ECFM = -0.805 - 0.007 \cdot \text{K1} - 0.223 \cdot \text{K2} + 0.785 \cdot \text{K3} + 0.483 \cdot \text{K4} + \\ +0.0001 \cdot \text{K5} - 0.001 \cdot \text{K6} \qquad (2)$$

where ECFM is the numerical value to group enterprises depending on the values of their financial indicators K1-K6 in accordance with the centrides (mean values) of groups.

Table 2 shows the coordinates of the centroids for the four groups. They make it possible to interpret the canonical function in relation to the role in the classification.

Table 2

Functions in Groups Centroids

State of cash flows management	Function		
	1	2	3
Sustainable efficiency (SE)	80.519	-0.079	-0.141
Partial efficiency (PE)	-0.564	0.608	0.349
Unstable (pre-crisis) efficiency (UE)	-1.192	-0.116	-0.468
Absolute inefficiency (AE)	-0.730	-1.998	0.550

Source: calculated in the SPSS software

According to the analysis of a priori probabilities of the classification, the largest share of enterprises will enter the second (PE – 43.6%) and third (UE - 44.7%) groups.

In order to classify new enterprises, the values of the classification functions are calculated as follows:

1) Sustainable efficiency (3):

$$ECFM1 = -3{,}884.304 + 1{,}152.643 \cdot \mathrm{K1} - 27.193 \cdot \mathrm{K2} + 63.850 \cdot \mathrm{K3} + \\ +22.027 \cdot \mathrm{K4} + 0.073 \cdot \mathrm{K5} - 0.082 \cdot \mathrm{K6} \quad 3)$$

2) Partial efficiency (4):

$$ECFM2 = -570.679 + 1{,}149.217 \cdot \mathrm{K1} - 8.549 \cdot \mathrm{K2} + 0.149 \cdot \mathrm{K3} - \\ -16.664 \cdot \mathrm{K4} + 0.063 \cdot \mathrm{K5} - 0.020 \cdot \mathrm{K6} \quad 4)$$

3) Unstable (pre-crisis) efficiency (5):

$$ECFM3 = -570.960 + 1{,}149.813 \cdot \mathrm{K1} - 9.142 \cdot \mathrm{K2} - 0.320 \cdot \mathrm{K3} - \\ -16.664 \cdot \mathrm{K4} + 0.058 \cdot \mathrm{K5} - 0.019 \cdot \mathrm{K6} \quad 5)$$

4) Absolute inefficiency (6):

$$ECFM4 = -608.709 + 1{,}188.825 \cdot \mathrm{K1} - 10.037 \cdot \mathrm{K2} + 0.072 \cdot \mathrm{K3} - \\ -24.300 \cdot \mathrm{K4} + 0.064 \cdot \mathrm{K5} - 0.031 \cdot \mathrm{K6} \qquad 6)$$

The achieved forecasting accuracy is 79.8%, which is a good result.

Conclusions. In order to form the adequate author's discriminative model to assess the efficiency of cash flow management by using the available indicators, the author selected those (6) that will make it possible to draw the most significant conclusions about the quality of cash flow management at enterprises. According to the analysis, the efficiency of cash flow management of the Ukrainian confectionery enterprises is determined by various financial parameters (liquidity, efficiency, financial sustainability, and profitability). The inclusion of the offered coefficients in the model allows more accurately identifying the situation on the quality of cash flow management at enterprises.