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THE APPLICATION OF THE ALTMAN Z-SCORE IN THE ASSESSMENT OF THE BUSINESS MODEL OF THE COMPANY

ZASTOSOWANIE FUNKCJI Z-SCORE ALTMANA W OCENIE MODELU BIZNESU PRZEDSIĘBIORSTWA

DOI: 10.15611/pn.2017.474.08

JEL Classification: L10, L69, M29, M49

Summary: In the paper, there has been discussed the problem of adaptability of the instruments of management accounting to the assessment of the business model of the company, while indicating their impact on the management process in the area of efficiency of the selected company of the cement sector. The aim of the paper is to learn the possibilities and validity of the application of discriminant analysis in the form of Altman model and interdependence analysis expressed with Pearson's correlation coefficient to assess the business model implemented in the surveyed company. The research methods applied to achieve the objective are: critical analysis of literature, descriptive analysis, trend analysis, Altman model and Pearson's correlation coefficient as well as case study. The research period is the years 2005–2015. The problem of adaptability of the instruments of management accounting for the assessment of the business model of the company is important and up-to-date due to its impact on decision-making processes in the area of efficiency of enterprises.

Keywords: business model, management accounting, Altman model.

Streszczenie: W opracowaniu podjęto problem adaptacyjności instrumentów rachunkowości zarządczej do oceny modelu biznesu przedsiębiorstwa, wskazując ich wpływ na proces zarządzania w obszarze efektywności wybranego przedsiębiorstwa sektora cementowego. Celem opracowania jest poznanie możliwości i zasadności zastosowania analizy dyskryminacyjnej w postaci modelu Altmana oraz analizy współzależności zjawisk wyrażonej za pomocą współczynnika korelacji liniowej Pearsona do oceny modelu biznesu zaimplementowanego w badanym przedsiębiorstwie. Metodami badawczymi zastosowanymi do realizacji celu są: analiza krytyczna literatury, analiza opisowa, analiza trendu, model Altmana oraz współczynnik korelacji liniowej Pearsona i studium przypadku. Okresem badawczym są lata 2005–2015. Problematyka adaptacyjności instrumentarium rachunkowości zarządczej do oceny modelu biznesu przedsiębiorstwa jest ważna i aktualna ze względu na jej wpływ na procesy podejmowania decyzji w obszarze efektywności przedsiębiorstw.

Słowa kluczowe: model biznesu, rachunkowość zarządcza, model Altmana.

1. Introduction

A business model is the concept of conducting a business activity due to which the company generates value [Osterwalder 2012, p. 19–21], taking into account the mechanisms of the separation of the internal areas of the company activity and the mechanisms for the integration of the components of the organization [Cyfert, Krzakiewicz 2012, p. 17]. Therefore, International Integrated Reporting Council [IIRC, 2013, p. 15–19] directs the reporting of the organization to generating information on creating and retaining value in the company using a business model [Bek-Gaik, Rymkiewicz 2016, p. 32, 33]. Thus, an important instrument of business management is management accounting which provides information on the efficiency of the course of economic processes [Nowak 2003, p. 9].

A wide range of instruments of management accounting satisfies the need for information of different groups of stakeholders. An attractive source of information on the efficiency of the implemented business model may be discriminant analysis [Nowak 2005, p. 249]. Multidimensional operation of discriminant models not only provides information on the threats to the continuation of an activity but also allows for assignment and classification of multidimensional objects of the distinguished diagnostic features. The supplement of discriminant analysis in the assessment of the business model may be interdependence analysis which allows for learning the mechanisms creating the examined relationships and assessing the strength and direction of these relationships [Nowak 2001, p. 44]. Therefore, it is reasonable to formulate the question: does the information generated by discriminant analysis and interdependence analysis allow to assess the business model of the company? The need to search for the answer to this question indicates the objective of the paper. It is to learn the possibilities and validity of the application of discriminant analysis in the form of Altman model and interdependence analysis expressed with Pearson's correlation coefficient to assess the business model implemented in the company. The methods applied to accomplish the objective are: critical analysis of literature, descriptive analysis, trend analysis, Altman model and Pearson's correlation coefficient as well as case study.

2. The essence of a business model in the company

In strategic terms, a business model is a conceptual instrument of business management. In the subject literature, a business model is defined as the system of actions connected and interdependent which affects the way the business is conducted as well as relationships with customers and partners [Amit, Zott 2012]. Business models constitute the tool presenting the logic of the operation of enterprises in a specific field, including a set of elements and relationships occurring between these elements [De Wit, Meyer 2007, p. 147]. This means that the business model ought to

take into account the variability of business environment which makes the model “travel” [Romanowska 2010, p. 7] transforming the business model into a strategic management tool difficult to copy.

The subject matter of business models has been often discussed in the subject literature in recent years. B. Nogalski presents four fundamental business models reflecting the way of responding to changing conditions in the external environment by the managerial staff: the model of a passive, reactive, proactive and active company [Nogalski 2009, p. 5, 6]. In the first three business models, the differentiating and integrating factor is response time to changes in the external environment of the company. If the changes in the environment are characterized by a high rate of variability and the company concentrates its activities on reduction in disturbances or adaptation, such a reaction of the company causes the widening of an organizational gap [Romanowska 2010, p. 7]. The last of the presented business models characterizes market leaders that base the strategy of competitive advantage on innovativeness in the field of products, services, operations and resources in order to generate value adapted to individual needs of customers [De Wit, Meyer 2007, p. 147]. Therefore, creating market strategies should take into account the customer’s involvement in the process of creating products and services [Gospodarek 2013, p. 25]. Active companies respond with innovative activities which results in narrowing the gap between the organization and the changes in the environment [Romanowska 2010, p. 8]. The occurrence of innovation makes competitors take immediate decisions allowing for maintaining or achieving advantage in the conditions of hypercompetition [Kotler, Caslione 2009, p. 44, 45].

An interesting approach to business models is presented by M. Reeves, C. Love and P. Tillmanns. They used the matrix of Boston Consulting Group (BCG) and identified two criteria classifying business models: adaptability to changes in the environment and predictability of the environment. On the basis of the above they characterized four business models: shaping, visionary, adaptive and classical [Reeves et al. 2012]. The authors underline that the adaptation of the company strategy allows to achieve competitive advantage on the market. Managers must select a business model individually taking into account current changes in the environment and adaptability of the company. Therefore, the process of the model implementation must take into account such factors as the market sector in which the company operates or the instruments of the strategy implementation.

Summing up, it should be underlined that building a business model allows to achieve and maintain an increase in value for the customer, which is associated with risk, though. The risk of a business model may be neutralized by the application of the rule of “a correct order of strategic elements” in accordance with “blue ocean strategy” [Chan Kim, Mauborgne, 2007, p. 42, 43].

3. Methodology of the research – Altman model and Pearson's correlation coefficient

In the paper, the attention has been drawn to the instrument enabling the assessment of the business model of the company, namely Altman model, which belongs to the group of multifactorial discriminant methods indicating the symptoms of bankruptcy of enterprises. The structure of Altman model allows for examination, with specific indicators, the information included in financial statements of enterprises. Altman proposed a few versions of so called Z-score function [Altman 1984]. The model applied in the present paper was produced in 1983 and it takes the form of [Altman 1984]:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5,$$

where: X_1 – working capital / total assets,
 X_2 – retained earnings / total assets,
 X_3 – earnings before interest and taxes / total assets,
 X_4 – book value of equity / book value of foreign capital,
 X_5 – net sales / total assets.

Altman model provides information [Nowak 2005, p. 249–255; Ciecierski 2004, p. 375; Suszyński 2007, p. 183] on the threat of bankruptcy and insolvency of the company [Zarzecki 2003]. The result of the research conducted on the basis of Altman model refers to the accepted limits of classification of enterprises as well as individual groups of classification. The presented model is called the *Zeta* function or the Z-Score model and is based on the parameters of the primary concept of Altman except for the X_4 variable, in which instead of market value there was applied book value [Altman 1984; Altman, Hotchkiss 2007, p. 229–239]. Redefining the *Zeta* function caused that a larger number of companies may use the Altman concept. The primary version of the concept of Altman required the knowledge of the market value of equity of the analyzed company [Gnysińska 2013, p. 66, 67]. The Z-Score model, being based on the balanced (book) value of equity, was addressed to enterprises that were not able to specify the market value of equity.

The Altman models, apart from advantages, also have some drawbacks, from among which the most important one is a high degree of generalization and synthesis, which is not always enough to diagnose the financial situation, which is a multidimensional category [Kościelniak 1998; Kitowski 2015]. In order to detail the assessment of business models of the analyzed company there was carried out the examination of the strength and direction of the linear relationship between decision-making factors based on the value of Pearson's correlation coefficient [Nowak 2001, p. 44–52, 2003, p. 42–48, 2012, 2015d].

In order to detail the assessment of the business model one may examine the strength and direction of the linear relationship between decision-making factors

based on the value of Pearson's correlation coefficient. The values of Pearson's correlation coefficient are in the range of $\langle -1, 1 \rangle$. Strong correlation occurs when the value of the coefficient is around 1 or -1 , weak correlation occurs when the value of the coefficient is close to 0. The sign of the coefficient determines the direction of the relationships between the analyzed variables. In studies, it is assumed that the value of the correlation within the following ranges amounts to: from 0 to 0.3 – weak relationship, from 0.3 to 0.6 – moderately strong relationship, from 0.6 to 1 – strong or very strong relationship.

4. The application of Altman model and the correlation function for the assessment of the business model of the company – the results of the empirical studies

In the paper, the research process was conducted on the basis of the case study, which allows for the presentation of an accurate and in-depth image of the analyzed phenomena and relationships [Czakoń (ed.) 2015, p. 189–209]. A case study is, however, a method with a limited (probabilistic) possibility of scientific cognition. It should be remembered that the constraints of a case study are: low representativeness of the results, intuitiveness and subjectivity of beliefs, high consumption and high costs of the conducted research. To assess the business model there was applied the Altman *Zeta* function treated as a decision-making instrument. The empirical research was carried out in a company of the cement industry (conventionally called the X company). The empirical research was conducted on the basis of the purposive sampling based on the financial information shared by the examined company. The research period is the years 2005–2015.

The aim of the paper is to learn the possibilities and validity of the application of discriminant analysis in the form of Altman model and interdependence analysis expressed with Pearson's correlation coefficient to assess the business model implemented in the company. The first stage of the research includes the verification of the ability to continue the activity and solvency in the analyzed company.

When examining the ability to continue the activity and solvency in the X company (Fig. 1) it should be stated that the analysis of Altman model indicates that there is a downward trend in the X company. The level of Altman model in years 2010–2015 is in the sphere of ambiguous classification. Admittedly, the X company does not belong to the “non-bankrupt” group, although the level of financial liquidity (X_1) and profitability (X_3) had declined by 2010. However, in subsequent years, both profitability (X_3) and assets turnover (X_5) improved, therefore, it can be concluded that the surveyed company is not exposed to the risk of bankruptcy.

In the subsequent stage of the research, in order to detail the assessment of Altman model in the X company, there was conducted the study of the strength and direction of the linear relationship between the decision-making factors based on the value of Pearson's correlation coefficient. Summing up, the examination of the

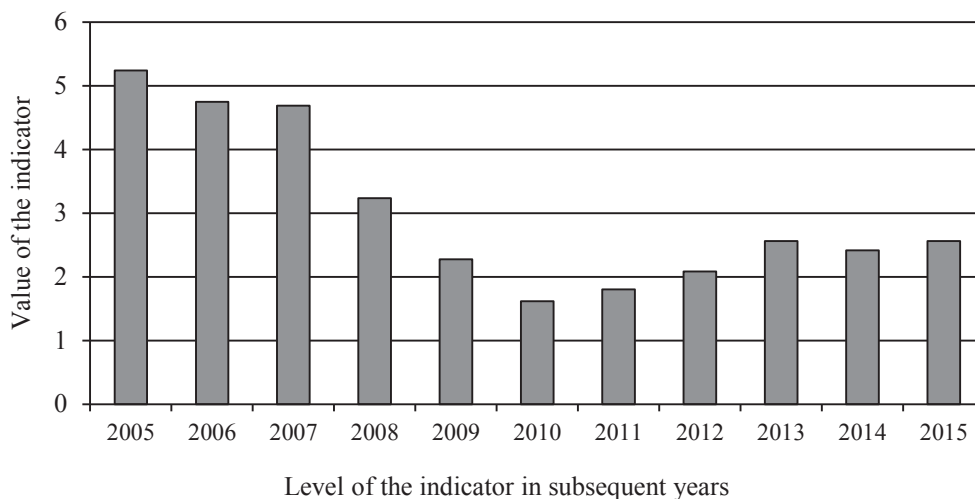


Fig. 1. The Altman Z-score in the surveyed company

Source: own study.

correlation between the Altman Z-score and its components in the X company indicates the occurrence of very strong positive relationships between Z' indicator and financial liquidity and market efficiency of equity (Table 1). At the same time, an increase in solvency is accompanied by an increase in financial liquidity as well as an increase in the share of market value of equity in the structure of liabilities in total in the surveyed company. There can be noticed a strong relationship between Z' indicator and cumulated return on assets, which proves the monitoring of efficiency by the analyzed company with a simultaneous increase in retained earnings in relation to total assets. The correlation occurring between Z' indicator and cumulated return on assets indicates a moderate positive relationship. The examined relationships are statistically significant (statistical significance $\alpha = 0.05$).

Table 1. Pearson's correlation coefficient between individual ratios of Altman model for the company

Pearson's correlation coefficient between:	Z' = Altman indicator in the X company
X_1 = financial liquidity	0.91
X_2 = cumulated return on assets	0.71
X_3 = return on assets	0.23
X_4 = market efficiency of equity	0.98
X_5 = assets turnover	0.10

Source: own calculations – statistically significant correlation at significance level of 0.05 (at significance level of 0.01 – Student's *t*-distribution).

Summing up the results of the empirical research, it should be concluded that an important decision-making area in the assessed business model of the examined company is an increase in solvency achieved with an increase in financial liquidity. The conducted research indicates that the X company conducts the quality policy based on high prices. This is reflected both in the level of profitability and inventory turnover. Creating the competitive position on the cement market by the X company is based on building value for the customer, which is achieved by the quality of the provided products. The company aims at stimulating efficiency of use of resources in order to generate higher profit. The analysis in the area of solvency of the analyzed company of the cement industry provides multidimensional information on the sources of their financing as well as the course of organizational processes. While verifying the correctness of the proposed solutions in the field of the conducted research based on Altman model, it can be concluded that they allowed to examine the detailed reasons for the existing phenomena. The business model of the X company is characterized by the mutually adjusted and complementary processes aimed at achieving competitive advantage in the cement market segment.

5. Conclusions

Management accounting generates information which supports the processes of planning, implementation and monitoring of the company strategy. Moreover, management accounting has a set of instruments which may efficiently support the achievement of long-term objectives and bring about an improvement in efficiency of the decisions taken in the company [Nowak 2015a]. The instruments of management accounting allow for defining strategic directions of the operation of the company using measures enabling the assessment of the achievements of the company.

In recent years the instruments of management accounting have been subjected to development and improvement both theoretically, methodologically and in terms of application [Nowak 2015a]. This means that management accounting takes into account the changes taking place in the conditions for the operation of enterprises [Nowak 2011, p. 330]. The study supports the view that management accounting is evolutionary in nature [Nowak 2011, p. 329–344], manifesting itself, on the one hand, in adaptability of the existing solutions and, on the other, in using the methods not applied so far [Nowak 2015b].

The aim of the paper has been to learn the possibilities and validity of the application of discriminant analysis in the form of Altman model and interdependence analysis expressed with Pearson's correlation coefficient to assess the business model implemented in the company. It should be clarified that the assessment of the business model amounts to the way of classifying, as a result of the conducted analysis, to the instruments of modern management in the company. It is important since the application of the Altman Z-score as the business model evaluation criterion

allows to examine the condition of the company using the information included in the financial statement.

Summing up the literature studies and the results of the empirical research, it should be concluded that the adaptation of discriminant methods, which belong to the statistical methods of image recognition, based on multidimensional comparative analysis [Nowak 1998, p. 168], allows for assessing new areas of management accounting, including business models. In the discriminant proceedings, an important issue is the verification of its form known as a degree of accuracy of discriminant function [Siemińska 2002, p. 159]. The verifier of the correctness of estimation of discriminant function in the assessment of the business model is the correctness of the obtained results. This means that discriminant methods not only allow for assessing the financial situation of the company but also for enabling the reduction in a potential set of information, its ordering and making comparisons when assessing the business model. However, one should be aware of the limited scientific cognition using discriminant methods, among which there should be listed not mentioning qualitative factors, affecting the financial situation of business units and a high degree of generalization and synthesis, which is not always sufficient for the diagnosis of the financial situation, which is a multidimensional category.

The assessment of the business model should take into account the formation of many different phenomena taking place independently but interdependently. Therefore, it requires the application of the research into quantitative interdependence using correlation and regression methods [Nowak 2001, p. 44]. The properly assessed business model allows for taking effective decisions in the field of the directions of future development and simultaneously the extent of the strategy implementation as well as it allows for the settlement of the board and measurement of achievements. Therefore, the analysis of the decision-making dependencies applied for the assessment of the business model may be conducted with regression and correlation functions.

The information on the business model may be the subject of the analysis and decision-making when applying quantitative methods, at the same time, the assessment of the business model may be supported with quantitative methods at different stages of verification of the information on the examined model. The basic advantage of the application of quantitative methods for the assessment of the business model is basing the conclusions on precise rules for the formulation, solution and optimization of the decision-making problems [Nowak 2015c] occurring at the stage of control of the implementation of the business model.

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