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THE ASSESSMENT OF BANKRUPTCY RISK OF AN ENTERPRISE WITH THE USE OF MEASURES BASED ON THE CONCEPT OF ECONOMIC PROFIT (BASED ON CONSTRUCTION COMPANIES FROM THE POLISH STOCK MARKET)

The value-based management concept has been created, implemented and improved over the last 30 years in Anglo-Saxon countries and highly developed countries of continental Europe, and since early-2000s also in Poland and other countries of Central and Eastern Europe. Important for the efficient and effective use of this concept is the measurement and assessment of value creation efficiency with the use of value measures based on the economic profit concept. In the existing theoretical, methodological and empirical studies devoted to the conditionings of the use of value measures researchers hardly ever decided to verify their usefulness as estimators of enterprise bankruptcy risk. Bankruptcy prediction models created and used so far are based merely on the use of book and financial measures in their structure. It proves the purposefulness of conducting an analysis of the efficiency of value creation of an enterprise in relation to the assessment of its bankruptcy risk, basing on the use of value measures. In this context, the authors notice a significant research gap which has become a premise for the formulation of a hypothesis that measures based on the economic profit concept can be useful in explaining the level of bankruptcy risk of construction companies listed on the Warsaw Stock Exchange during the years 2010-2015. The verification of the formulated hypothesis is planned though conducting a discriminant analysis and thus attempting to build a discriminant function basing on relative values of economic profit.

Keywords: value-based management, economic profit, efficiency of enterprise value creation, bankruptcy risk assessment

Які Анджей, Чевік Войцех. Оцінка ризику банкрутства підприємтсва з використанням вартісних показників на основі концепції економічного прибутку (на прикладі будівельних компаній, що котируються на Польскій фондовій біржі).

Концепція вартісно-орієнтованого управління була створена, впроваджена та вдосконалена протягом останніх 30 років в англосаксонських країнах та високорозвинених країнах континентальної Європи, а з початку 2000-х років також у Польщі та інших країнах Центральної та Східної Європи. Важливим для ефективного використання цієї концепції є вимірювання та оцінка ефективності створення вартості із застосуванням вартісних показників на концепції економічного прибутку. У існуючих теоретичних, методологічних та емпіричних дослідженнях, присвячених умовам використання вартісних показників, дослідники майже не намагалися перевірити їх корисність для оцінювання ризику банкрутства підприємства. Створені та використовувані досі моделі прогнозування банкрутства базуються лише на використанні в їх структурі книжкових та фінансових показників. Вищезазначене доводить доцільність проведення аналізу ефективності створення вартості підприємства для оцінки ризику його банкрутства, спираючись на використання вартісних показників. У цьому контексті автори помітили значний пробіл у дослідженнях, який став передумовою для формулювання гіпотези про те, що вартісні показники можуть бути корисними для пояснення рівня ризику банкрутства будівельних компаній, які котирувалися на Варшавській фондовій біржі протягом 2010-2015 років. Перевіримо сформульовану гіпотезу шляхом проведення дискримінантного аналізу та спробуємо побудувати дискримінантну функцію на основі відносних значень економічного прибутку.

Ключові слова: вартісно-орієнтоване управління, економічний прибуток, ефективність створення вартості підприємства, оцінка ризику банкрутства

1. Introduction

The value-based management concept (VBM) has been created, implemented and improved over the last 30 years in Anglo-Saxon countries and highly developed countries of continental Europe, and since early-2000s also in Poland and other countries of Central and Eastern Europe. Considering key objectives of the VBM concept, related to the maximisation of the market value of an enterprise, what is important for the efficient and effective use of this concept is the measurement and assessment of value creation efficiency with the use of value measures based on the economic profit (EP) concept. The measures enable to monitor the enterprise value creation process, also enabling the identification of the areas of its activity in which value is created, and the areas in which destruction of the enterprise value takes place.

They are also a useful source of information for the participants of the capital market about the effectiveness of managing capital resources entrusted by investors. Thus, value measures can also be treated as an element of the comprehensive system of the performance measurement of an enterprise (Mancini & Piscitelli, 2018; Škare & Hasić, 2016).

In the existing theoretical, methodological and empirical studies devoted to the conditionings of the use of value measures researchers hardly ever decided to verify their usefulness as estimators of enterprise bankruptcy risk. Bankruptcy prediction models created and used so far are based merely on the use of book and financial measures in their structure (Gavurova et al., 2017; Prusak, 2018; Wieczorek-Kosmala et al., 2018). It proves the purposefulness of conducting an analysis of the efficiency of value creation of an enterprise in relation to the assessment of its bankruptcy risk, basing on the use of value measures. In this context, the authors notice a significant research gap which has become a premise for the formulation of a hypothesis that measures based on the economic profit concept can be useful in explaining the level of bankruptcy risk of construction companies listed on the Warsaw Stock Exchange in the years 2010–2015. The choice of the time horizon and the objects of analysis is not accidental. It is a period of the accumulation of building investments concerning the construction and extension of sports, road and tourist and recreational infrastructure which took place in Poland in the years 2010-2012 in connection with the organisation of the UEFA European Championship, Euro 2012 by Poland and Ukraine, and which also contributed to a rapid increase in the number of bankruptcies of construction companies on the Polish market in the following years (2013-2015). The verification of the formulated hypothesis is planned though conducting a discriminant analysis and thus attempting to build a discriminant function basing on relative values of economic profit.

2. Economic profit as a measure of enterprise efficiency – theoretical background

The term of economic profit goes back to the end of the 19th century, as it comes from residual income which was used by Marshall (1890) in his work, meaning income calculated upon the inclusion of operating costs, debt and equity costs, as well as income tax. As opposed to profit as a traditional book measure of efficiency, economic profit, in addition to costs of foreign capital, includes also cost of equity, which is not considered by the book measurement of enterprise efficiency. Therefore, it is a measure which in addition to accounting information to a great extent considers also market information in the form of such parameters of equity cost account as: risk-free rate, market returns and investment risk level measured by βcoefficient (Altaf, 2016). The conceptualisation and development of different types and applications of economic profit is related to the value-based management concept. The concept

brought, among others, a need for the measurement and assessment of partial effects of enterprise value creation through the use of appropriate accounting tools for this.

Undoubtedly, as the most recognizable measure based on the economic profit concept is regarded to be economic value added (EVA). The measure was developed by the end of 1980s by a New York-based Stern Steward & Company, and then popularised by a pioneer work by Steward (1991) and continuators of his thought, first of all Ehrbar (1998), Martin & Petty (2000), McTaggart, Kontes & Mankis (1994), and Young & O'Byrne (2001). EVA has also gained a lot of recognition in the global business environment owing to its implementation by numerous global corporations, such as Coca-Cola, Siemens, Whirpool, or Marriot Corp., which use it as a business performance measure, a tool of value-based management system and the base for pro-value motivation (Salaga et al., 2015). Economic value added is at the same time a measure which already in its basic form (basic EVA) constitutes the integration of accounting and financial measures being the parameters of EVA account in an enterprise. In various formulas for the calculation of EVA we can find such accounting measures as: NOPAT (net operating profit after tax), NP (net profit), ROI (return on invested capital), ROE (return on equity) and financial measures, such as: WACC (weighed average cost of capital) and cost of equity (Berzakova et al., 2015). It also confirms the evolutionary character of the process of development of enterprise efficiency measures. Experiences arising from the development of the applications of EVA and other measures based on the economic profit concept brought about, on the one hand, the emergence of different types of those measures and, on the other hand, the extension of the scope of their use in enterprise management. It refers, first of all, to:

● the creation of various forms of EVA arising from the scope of corrections applied in the account and focused on the objectivization of the efficiency measurement of enterprise value creation (Young & O'Byrne, 2001; Ehrbar, 1998),

● exposing the shareholder approach in EVA account through the use of the measure of economic profit for shareholders, used in the EBO model [the acronym coming from the first letters of this model creators' names: Edwards, Bell & Ohlson] (Bittelmeyer, 2007), also called estimated value created (EVC) (Galon & Nantell, 1994). The shareholders' perspective is also exposed by Rappaport (1986) in the shareholder value added measure (SVA),

● the creation of relative value measures based on the economic profit concept (Stronka, 2004),

● the use of measures based on economic profit for the purpose of business valuation within value controlling and within value-focused restructuring (Fernandes, 2019; Jaki, 2012).

An overview of selected measures based on the economic profit concept is presented in Table 1.

Table 1

Efficiency measures based on the economic profit concept

No.	Symbol of measure	Calculation formula	Designations	Comment
		Absolute and value measures		
1	EVA	$S_t \cdot M_t \cdot (1 - T_t) - WACC_t \cdot IC_{t-1}$	EVA – economic value added	Direct approach in the measure calculation
		$\begin{aligned} EBIT_t \cdot (1 - T_t) - WACC_t \cdot IC_{t-1} \\ = NOPAT_t - WACC_t \cdot IC_{t-1} \end{aligned}$	S_t – Net sales value achieved by the enterprise at the end of period t	Operating approach in the measure calculation
		$NP_t + INT_t \cdot (1 - T_t) - WACC_t \cdot IC_{t-1}$	M_t – profit margin $EBIT_t$ – operating profit before the payment of interest and tax at the end of period t (earnings before interests and taxes)	Financial approach in the measure calculation
		$(ROI_t - WACC_t) \cdot IC_{t-1}$	INT_t – interests at the end of period t T_t – income tax rate at the end of period t $WACC_t$ – weighted average cost of capital at the end of period t IC_{t-1} – value of invested capital in total at the beginning of period t $NP_{\cdot t}$ – net profit at the end of period t ROI_t – return on invested capital at the end of period t	Indicator-based approach in the measure calculation
2	EVC	$NP_t - E_{t-1} \cdot k_{E,t}$	EVC – estimated value created ROE_t – return on equity at the end of period t E_{t-1} – equity at the beginning of period t $k_{E,t}$ – cost of equity at the beginning of period t other designations – as previously	Shareholder approach to economic profit
		$(ROE_t - k_{E,t}) \cdot E_{t-1}$		

No.	Symbol of measure	Calculation formula	Designations	Comment
3	REVA	$$NOPAT_t - WACC_t \cdot \underline{IC_{MV,t}}$$	REVA – refined economic value added $NOPAT_t$ – net operating profit after tax at the end of period t $\underline{IC_{MV,t}}$ – market value of invested capital in total at the end of period t $P_{S,t-1}$ – market price of one share of the company at the beginning of period t N_{t-1} –the number of shares issued by the company at the beginning of period t other designations – as previously	Classical approach to economic profit
		$$NP_t - \left(\left(P_{S,t} \cdot N_t \right) \cdot k_{E,t} \right)$$		Shareholder approach to economic profit
4	SVA	$$\frac{\Delta NOPAT_t}{WACC \cdot (1+WACC)^{t-1}} - \frac{Inv_{A,T} - DEP_{ACC,t-1} + \Delta WC_t}{(1+WACC)^t}$$	SVA – shareholder value added $\Delta NOPAT_t$ – change in net operating profit after tax annually $Inv_{A,T}$ – value of investment expenditure on fixed assets planned to be incurred in the current period $DEP_{ACC,\,t-1}$ – accumulated value of depreciations at the end of the previous period ΔWC_t – change in the value of net working capital in the current period TSR_t – total shareholder return at the end of period t other designations – as previously	Measure based on Rappaport's concept
		$$\left(TSR_t - k_{E,t} \right) \cdot E_{t-1}$$		Alternative estimation formula
Relative and percentage measures				
5	CEE	$$\frac{EVC}{E \cdot k_E} \cdot 100\%$$ $$VCI - 1$$	CEE – cost efficiency of equity VCI – value creation index other designations – as previously	-

No.	Symbol of measure	Calculation formula	Designations	Comment
6	CEC	$$\frac{EVA}{WACC \cdot IC} \cdot 100\%$$	CEC – cost efficiency of invested capital in total other designations – as previously	-
7	SEVC	$$\frac{EVC}{E} \cdot 100\%$$ $$ROE - k_E$$	SEVC – standardized estimated value created other designations – as previously	-
8	SEVA	$$\frac{EVA}{IC} \cdot 100\%$$ $$ROI - WACC$$	SEVA – standardized economic value added other designations – as previously	-
9	VCI	$$\frac{ROE}{k_E} \cdot 100\%$$	VCI – value creation index other designations – as previously	-
10	XEP	$$EP_t - \underline{EP_B}$$	XEP – indexed economic profit EP_t – economic profit established for period t $\underline{EP_B}$ – average economic profit established for similar companies (most important competitors, sector or the whole market)	In XEP formula economic profit values are corrected by the value of invested capital

Source: own study.

3. Methods and scope of research

The verification of the hypothesis posed in the article is planned through conducting a discriminant analysis, and thus the estimation of discriminatory force of diagnostic variables which are value measures based on the economic profit concept. The analysis began from defining the time span of the analysis and the subjective scope of the studied population of enterprises, as well as determining the criterion of discrimination of enterprises to the group of «bankrupts» or «non-bankrupts». The time span of the analysis will include the years 2010–2015. It is the period of preparing and implementing by Poland (together with Ukraine) the UEFA European Championship, Euro 2012. In the years 2010–2012 there was an accumulation of various construction investments, which during the years 2013–2015 contributed to the

rapid growth of bankruptcies of construction companies on the Polish market[2]. Therefore, the study included companies listed on the Warsaw Stock Exchange, belonging to the construction sector. The classification was made based on the International Industrial Standard Classification (ISIC) – Section F (Constructing). To the group of «bankrupts» only those companies were assigned which in the analysed period filed bankruptcy petitions (both liquidation and arrangement bankruptcy). On the other hand, to the group of «non-bankrupts» those entities were classified which in the analysed period were distinguished by a good economic and financial standing and continued their activities. 44 construction companies were analysed. The structure of the studied population was as follows: 33 bankrupts (75%) and 11 non-bankrupts (25%). The source of necessary financial data was the base EMIS Intelligence – Polska. For the needs of calculations Statistica package (version 13) was used. The final shape of the database required to conduct such procedures as: verification and supplementation of missing values of variables with the use of the median, verification of variables from the point of view of outliers[3], estimation of discriminatory force of variables with the use of classical coefficient of variation, examination of the normality of empirical distributions of value measures[4].

For the measurement and assessment of the efficiency of value creation, the following measures based on the economic profit concept were used, whose characteristics and accounting formulas are presented in Table # 1:

- EVC – estimated value created,
- EVA – economic value added,
- SEVC – standardized estimated value created,
- SEVA – standardized economic value added,
- CEE – cost efficiency of equity,
- CEC – cost efficiency of capital,
- REVA – refined economic value added,
- XEP – indexed economic profit.

For the needs of the analysis the equity cost rate of the studied population of enterprises was estimated, using Damodaran's model (Damodaran, 2014). In order to determine the benchmark for the indexed measure, the subjective comparative base was defined, which included the group of «non-bankrupts», and then on the basis of their partial effects of value creation (determined by SEVC measure) their averaged value was estimated by means of the median. One of the requirements of discriminant analysis during the selection of diagnostic variables is their information capacity, which is estimated through the level of correlation of one variable with another one.

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[2] The conditionings of the functioning of the Polish construction sector in the indicated period were described more broadly, among others, in the work (Jaki, 2018).

[3] For this purpose, two-way Tukey's criterion was used ($\alpha = 5$).

[4] For this purpose, the following tests were used: Kolmogorov-Smirnov, Lilliefors and Shapiro-Wilk, with the assumption of α on the level of 5.

To do this, on the basis of Pearson's linear correlation level, the set of four variables was selected, constituting the values of measures which, according to the authors of this paper, are most intensively used within the VBM concept. These are: FCFEPS – free cash flow for equity per share, SEVC – standardized estimated value created, TSR – total shareholders return and price-earnings ratio (P/E)[5]. The selected statistics (minimum/maximum value – MIN/MAX and the median – ME) of value measures constituting the output set of diagnostic variables to the research process are presented in Table 2.

Table 2

Selected statistics of diagnostic variables for the analysed companies

Measure	«Bankrupts»			«Non-bankrupts»			All companies		
	MIN	MAX	ME	MIN	MAX	ME	MIN	MAX	ME
FCFEPS	-41.06	51.37	0.29	-8.2	8.88	0.17	-41.06	51.37	0.17
SEVC	-0.40	0.03	-0.15	-0.6	0.45	-0.08	-0.61	0.45	-0.08
SEVA	-0.32	-0.02	-0.07	-0.6	0.10	-0.09	-0.61	0.10	-0.09
CEE	-3.69	0.21	-0.83	-4.0	2.99	-0.58	-4.04	2.99	-0.60
CEC	-3.67	-0.25	-0.85	-6.0	1.10	-0.88	-6.01	1.10	-0.88
REVA	-0.54	0.30	-0.14	-0.6	0.05	-0.08	-0.57	0.30	-0.08
XEP	-0.28	0.04	-0.02	-0.6	0.15	-0.00	-0.56	0.15	-0.00
TSR	-0.74	0.91	-0.28	-0.8	2.13	0.02	-0.83	2.13	0.01
P/E	-8.29	508.62	23.25	-51.4	74.72	10.52	-51.38	508.62	10.52

Source: Own calculations.

4. Economic profit in the assessment of bankruptcy risk – results of the research and discussion

The research employed a progressive stepwise method boiling down to the introduction of subsequent diagnostic variables with the highest discriminatory force to the model (Shiker, 2012). In the first place, the usefulness of four value measures in the prediction of bankruptcy risk of construction companies listed on the Polish capital market was verified, namely FCFEPS, SEVC, TSR and P/E. The results of the analysis showed that the selected set of variables is statistically significant (Wilks' lambda = 0.74345; F = 11.905; p < 0.0000). The greatest contribution to the discrimination of enterprises to the groups of «bankrupts» and «non-bankrupts» was revealed by P/E measure (partial Wilks' lambda = 0.783556), and the smallest one – by TSR measure (partial Wilks' lambda = 0.990162). Then it was verified whether various types of measures based on the economic profit concept influence the discriminatory force of the model. At the same time, it will allow to assess the level of usefulness in explaining the level of bankruptcy risk of the analysed companies. For this purpose,

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[5] Measures: FCFEPS, TSR and P/E are widely described in the literature devoted to the issues of business valuation, value-based management and value controlling. See: (Cornell, 1993), (Damodaran, 2012).

SEVC measure in the output set of variables was replaced, consecutively, by the following measures: SEVA, CEE, CEC, REVA and XEP. The results of the conducted analysis are presented in Table # 3.

Table 3

Parameters describing discriminatory force of measures based on the economic profit concept

Measure	Summary of discriminant analysis	Discriminatory force of variables	Comment
SEVA	Wilks' lambda = 0.76554; F = 14.190; p < 0.0000	partial Wilks' lambda: P/E – 0.801849; FCFEPS – 0,971173; TSR – 0.972289	SEVA measure outside the model
CEE	Wilks' lambda = 0.73087; F = 12.704; p < 0.0000	partial Wilks' lambda: P/E – 0.777353; FCFEPS – 0.954718; G1 – 0.956946; R1 – 0.989588	-
CEC	informative force the same as in the case of SEVA	-	CEC measure outside the model
REVA	informative force the same as in the case of SEVA	-	REVA measure outside the model
XEP	informative force the same as in the case of SEVA	-	XEP measure outside the model

Source: Own calculations.

The conducted analysis of the usefulness of the selected value measures in the assessment of bankruptcy risk of construction companies listed on the Warsaw Stock Exchange proved that out of six used types of economic profit the most useful one turned out to be cost efficiency of equity (CEE), which is indicated by the highest value of partial Wilks' lambda. The measure provides information about the intensity in value creation with regard to the values of the cost of capital invested by the shareholders. The second, in terms of the contribution of individual measures in the discrimination of companies, was standardized estimated value created (SEVC). The remaining value measures based on the economic profit concept (SEVA, CEC, REVA and XEP) were outside the model, which means that they are not useful in predicting bankruptcy risk. However, the most useful measure in the assessment of bankruptcy risk of construction companies turned out to be price-earnings ratio (P/E), a popular measure in the investors' environment. In consequence, we may be inclined to state that the earning potential of the analysed construction companies in the studied period, speculated by the capital market participants, could be information about the threat of bankruptcy. Also the fact that only measures using economic profit in the shareholder formula (based on net profit and equity) are useful in the assessment of bankruptcy risk is interesting.

5. Conclusions

The conducted study has proved that the selected value measures based on the economic profit concept may be a useful tool used for the needs of risk management of an enterprise, in the area of the assessment of its bankruptcy risk. In this way the formulated research hypothesis was verified positively. However, the method of estimating one of the leading parameters of economic profit, namely equity cost, is still a disputable issue. In the economic literature the fact that it is a parameter of intangible, non-cash, abstract and non-recordable character is stressed a lot of times, which additionally intensifies difficulties in its objective estimation. It is the reason for which numerous methods of the estimation of equity cost are used, and each method finally provides different results, which, with regard to the research problem presented in the article, implies a different discriminatory force of economic profit. Therefore, the conducted analysis should be treated as a base for further, multi-directional economic research, focused on building a linear discriminant function, with the application of a more varied sphere of VBM instruments, including measures based on cash measurement of the efficiency of value-based management of an enterprise, as well as different methods of the estimation of equity cost with regard to measures based on the economic profit concept.

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