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Integral Assessment of the Enterprise Investment Attractiveness: Testing the Hypothesis of Non-Conformity to Investor's Interests

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Abstract: The study attempts to improve the construction of a dynamic model for assessing the investment attractiveness of the enterprise. The researchers use the calculation of the Kendall correlation coefficient for two rank series by comparing the actual order of the growth rates of investment appeal indices with the standard ones based on internal environment indicators of a leading chemical enterprise. The researchers calculate the dynamic assessment of investment attractiveness. The study emphasizes that the maximum value of the dynamic assessment of investment attractiveness is equal to one in the case when all observed characteristics conform to the interests of potential investors. To test the null hypothesis about the statistical insignificance of the Kendall correlation coefficient the "tau" statistics and the calculation of the critical values of the Kendall rank correlation coefficient were used. The researchers employed an applied statistical analysis of the company's internal environment indicators for the dynamic assessment of investment attractiveness. In future, this technique will help researchers formulate unified approaches to assessing investment attractiveness by systemizing both internal and external factors based on the structure of the relationships between them.

Key words: Investment attractiveness, statistical analysis, ordinal measurement, Kendall rank correlation coefficient, internal and external, Russia

INTRODUCTION

We have to agree that due to insufficient research of the category "investment appeal of an enterprise" at the moment, there is no single methodology to generalize economic indicators that characterize the internal environment of the enterprise. Obviously, to make adequate investment decisions it is necessary to visualize economic information in the form of an integral indicator that can provide an analytical interpretation of various data. In Foreign countries, Altman's z-score is used extensively for predicting bankruptcy it was developed by the well-known Western economist E. Altman to assess the financial state and investment rating of the enterprise using a multiple discriminant analysis of 22 financial coefficients which he studied and selected 5 of them for inclusion in the final regression equation with the given linear constraints on the parameters (Altman, 1968). The DuPont model also deserves attention as it breaks ROE into its constituent components to determine which of these components is most responsible for changes in ROE. An interesting approach is of Dierkes, Maik; Erner, Carsten; Zeisberger, Stefan (Maik *et al*., 2010) which analyze a variety of investment parameters based on a statistics distribution of probability distributions by multiple generation of samples by the Monte Carlo method which allows for the diversity in potential investor's preferences. The main internal factors of the enterprise investment appeal represented in its financial state were investigated by Cokins (2009), Khavin (2004). Russian researchers also proposed several approaches to assessing the investment attractiveness of enterprises: based on financial and economic performance and the competitiveness of the enterprise by assessing the potential and risk of investment projects based on the valuation of the enterprise (Khasanova *et al*., 2015; Mikhail *et al*., 2016; Berestetsky and Sapotnitsky, 2004). Assessment of investment appeal should reflect a comprehensive description of the company's performance in the dynamics if necessary, these data can be obtained using public financial information. A company with growing capitalization, stable financial position and dynamically increasing profits and increasing sales, high rate of net profit on capital and low financial risk ratio is considered to be reliable and investment appealing. At the same time, to correct the investment strategy in assessing investment attractiveness, there should be feasible targets-standards of the optimal state of the company's

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financial and economic activities. Therefore, the purpose of this study is to improve the dynamic model for assessing the investment attractiveness of an enterprise that contains standard criteria for high investment potential and low risk level according to investor's requirements. Standard criteria are proposed to compare with those achieved in the enterprise by applying statistical analysis and checking the statistical hypothesis that the observed characteristics of investment attractiveness do not conform to the interests of investors.

MATERIALS AND METHODS

The study compared the actual order of investment appeal indicators with the investment appeal of the enterprise established in the standard dynamic assessment model by calculating the Kendall correlation coefficient for two rank series (Valz and Mcleod, 1990; Bottcher and Posthoff, 1975; Gijbels *et al*., 2016). Kendall rank correlation coefficient is chosen in the study because in the rank correlation group it can be used to ordinarily measure the relationship between dynamically ordered indicators. Ordinal measurement is the ordering of investment appeal indicators in accordance with the preference correlations revealed. As a sign of ordering, it is proposed to use measures of their dynamics, i.e., growth rates. The construction of the standard order of investment attractiveness indicators is an "ideal model" for assessing the investment attractiveness of the enterprise and it provides an objective reference point for assessing the actual order of indicators based on the Kendall rank correlation coefficient. The study used quarterly indicators from 2009-2015 of the leading chemical enterprise obtained from "Spark", the Internet system for analyzing markets and companies: Share Price (SP), net Profit (P), Short-term Liabilities (SL), Own Circulating Assets (OCA), Invested Capital (IC); Sales Revenues (SR), Cost of sales (C), Own Capital (OC), Current Assets (CA), Total Assets (TA), Long-term Liabilities (LL) and Accounts Payable (AP).

RESULTS AND DISCUSSION

The standard dynamic model for assessing investment attractiveness is the order of the chain growth rates of indicators whose observance for a long time in the real activity of the enterprise ensures the growth of its value (Khasanova *et al*., 2015; Czekala and Bukietynska, 2017): SP>P>SR>C>OCA>CA>OC>IC>TA>LL>AP>SL. Ordering comparison of the actual chain growth rates of investment attractiveness with the standard is performed through a dynamic assessment of the company's investment attractiveness which varies from 0-1 and is calculated based on the value of the Kendall rank correlation coefficient:

Table 1: Ranking of enterprise performance indicators

The indicators of the standard model	Standard rank	The rank of the actual chain growth rate					
		2010	2011	2012	2013	2014	2015
SP	1	3	1	7	3	5	2
P	2	11	12	1	12	1	1
SR	3	4	3	5	8	10	7
C	4	5	2	6	6	11	10
OCA	5	6	7	2	5	6	4
CA	6	8	4	8	9	3	6
OC	7	7	6	3	1	7	3
IC	8	2	5	11	2	8	5
TA	9	9	9	10	10	9	8
LL	10	1	8	12	11	12	12
AP	11	10	10	9	7	4	9
SL	12	12	11	4	4	2	11

$$\tau = \frac{S}{n\frac{(n-1)}{2}} = \frac{2S}{n(n-1)}$$

Where:

n = The number of indicators in the dynamic assessment model of investment attractiveness

S = The sum of the differences between the number of sequences and the number of inversions in the actual order of the indicators

$$S = P-Q$$

Where:

P = The total number of observations in the actual ordering that follow the current observations with a large rank value

Q = The total number of observations in the actual ordering that follow the current observations with a lower rank value

Ideally, the ordering of the actual chain growth rates of indicators should coincide with the standard dynamic model in which case the value of $\tau = 1$ and the observed characteristics fully conform to the interests of potential investors. The order of the actual chain growth rates of indicators that is completely opposite of the standard gives a value of $\tau = 0$. Therefore, the value of τ, characterizing the degree of approximation to the standard is a generalizing measure of the investment attractiveness of the enterprise.

Table 1 presents the standard and actual ranks of the chain growth rates of the analyzed enterprise for 2010-2015. Based on the data for 2010, Table 2 gives an example of calculating the indices necessary to determine the value of the Kendall rank correlation coefficient (τ). Thus, the Kendall rank correlation coefficient (τ) made:

Table 2: Calculation of the value of the Kendall rank correlation coefficient in 2010

Conventional sign of the indicators	Standard rank	The rank of the actual chain growth rate in 2010	P	Q
SP	1	3	9	2
P	2	11	1	9
SR	3	4	7	2
C	4	5	6	2
OCA	5	6	5	2
CÀ	6	8	3	3
OC	7	7	3	2
IC	8	2	3	1
TA	9	9	2	1
LL	10	1	2	0
AP	11	10	1	0
SL	12	12	0	0
Total	X	X	42	24

Table 3: Characteristics of dynamic models for assessing the investment attractiveness of the enterprise

Years	Dynamic Model of Investment Attractiveness Assessment (DMIAA)	$\|\tau\|$	Critical values ($\tau_{\alpha;(n)}$)	Compliance with the standard
Standard	SP>P>SR>Ñ>OCA>CA>OC>IC>TA>LL>AP>SL	X	X	X
2010	LL>IC>SP>SR>Ñ>OCA>OC>CA>TA>AP>P>SL	0.273	$\tau_{0,1;12} = 0.3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0.5234$	No compliance
2011	SP>C>SR>CA>IC>OC>OCA>LL>TA>AP>SL>P	0.515	$\tau_{0,1;12} = 0.3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0,5234$	Moderate (γ = 95%)
2012	P>OCA>OC>SL>SR>Ñ>SP>CA>AP>TA>IC>LL	0.318	$\tau_{0,1;12} = 0,3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0.5234$	No compliance
2013	OC>IC>SP>SL>OCA>Ñ>AP>SR>CA>TA>LL>P	0.000	$\tau_{0,1;12} = 0.3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0.5234$	No compliance
2014	P>SL>CA>AP>SP>OCA>OC>IP>TA>SR>C>LL	0.061	$\tau_{0,1;12} = 0.3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0.5234$	No compliance
2015	P>SP>OC>OCA>IC>CA>SR>TA>AP>Ñ>SL>LL	0.515	$\tau_{0,1;12} = 0.3343$ $\tau_{0,05;12} = 0.3983$ $\tau_{0,01;12} = 0.5234$	Moderate (γ = 95%)

$$\tau = \frac{2S}{n(n-1)} = \frac{2\times(42-24)}{12\times(12-1)} = 0.273$$

Indicators of the standard model are ranked in descending order of their chain growth rates in order to meet the conditions for the growth in the enterprise value and sufficiently low risks of investing in this enterprise.

In order to identify the compliance of the standard dynamic model for assessing investment attractiveness, we will check the statistical significance of the value of the Kendall rank correlation coefficient under the null hypothesis of the actual order of indicators which is completely opposite to the standard value (zero value of τ) by comparing the observed value $|\tau|$ with the critical values:

$$\tau_{\alpha}(n) = z_{1-\alpha/2}\sqrt{\frac{2(2n+5)}{9n(n+1)}}$$

Where:

n = The sample size

$z_{1-\alpha/2}$ = The inverse normalized distribution

($z_{1-\alpha/2} = 1.645$ for $\alpha = 0.1$; $z_{1-\alpha/2} = 1.960$ for $\alpha = 0.05$; $z_{1-\alpha/2} = 2.576$ for $\alpha = 0.01$)

Critical values of the Kendall rank correlation coefficient:

$$\tau_{0.1;\,12} = 0.3343;\ \tau_{0.05;\,12} = 0.3983;$$
$$\tau_{0.01;\,12} = 0.5234$$

In our case, 0.273<0.3333<0.3983<0.5234 means that with 90% probability (γ = 90%) the null hypothesis about the actual order of indicators that is completely opposite to the standard is not rejected the actual dynamic assessment of investment attractiveness in 2010 does not correspond to the standard (Table 3).

According to Table 3 for 2011 with 90% probability, it can be argued that the actual chain growth rates of the investment attractiveness of the standard dynamic model for assessing the investment attractiveness are significant $0.515>\tau_{0.05;12} = 0.3983$. In 2015, there was a moderate compliance: $0.515>\tau_{0.05;12} = 0.3983$. In 2012-2014, there was an actual order of indicators that was opposite to the standard.

Table 3 shows that, in general, the dynamic assessment of the company's investment attractiveness is fairly volatile against the background of low ranks in the growth rates of revenue and net profit. Growth in the invested capital and own capital in 2013 did not make it possible to comply with standard indicators of investment attractiveness. Nevertheless, the growth of the share

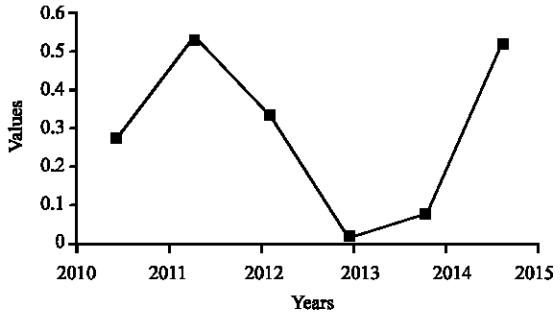

Fig. 1: Change in the general dynamic assessment of the investment attractiveness of the enterprise

price, sales revenues, own capital and net profit in 2015 are indicators for potential growth of investment attractiveness in 2016. Graphically, the dynamics of the assessment of investment attractiveness is presented in Fig. 1.

Data of Table 3 and Fig. 1 shows that from period to period the general dynamic assessment of the investment attractiveness of the analyzed enterprise has a cyclical nature. It is possible to forecast sufficiently high risks of investing in this enterprise.

CONCLUSION

The values of the Kendall rank correlation coefficient which are remote from the standard (equal to 1) indicate the need to develop a set of measures to achieve a stable growth in investment attractiveness. In particular, the low net profit growth rates that took place in 2010, 2011, 2013 determine the feasibility of proposals to improve the efficiency of the invested capital in terms of its profitability which can be developed on the basis of econometric modeling of return on assets. The above analysis of the company's investment attractiveness based on the Kendall rank correlation coefficient systematized a large variety of indicators and gave a visual representation of economic information. It seems possible to highlight the following advantages of the general dynamic assessment of the company's investment attractiveness based on applied statistical analysis of indicators which characterize the internal environment of the enterprise:

To systematize heterogeneous quantitative indicators of investment attractiveness based on the analysis and selection of its essential factors using open and accessible information to potential investors. To ensure the possibility to reflect the priorities and ideas of the investor-analyst during the process of measuring and assessing investment attractiveness to use generally accepted judgments about the need to increase investment attractiveness and its defining indicators in the long term; to ensure the ordinal measurement of the relationship between dynamically ordered indicators of investment attractiveness in the process of its measurement and assessment to ensure consistency, comparability and methodological unity of approaches to measuring and assessing the investment attractiveness of the enterprise.

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