

COMPLEX EVALUATION OF THE ECONOMIC CRISIS IMPACT ON LITHUANIAN INDUSTRIES

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Received 13 July 2013; accepted 05 November 2013

Abstract. The paper analyses the impact of the economic crisis of 2008 on Lithuanian industries. The research involves 68 industries identified according to the 2nd-digit level classification of economic activities by Statistics Lithuania. Considering industry to be a complex phenomenon, the crisis effect is evaluated complexly on the basis of the system of 10 financial state and performance indicators belonging to four main groups of enterprise financial ratios: profitability, liquidity, solvency and asset turnover. SAW, TOPSIS and VIKOR multi-criteria decision making methods, widely applied in construction, economics and management, are selected as mathematical tools for quantitative assessment of the economic crisis effect on Lithuanian industries. By applying multi-criteria decision making methods relative positions (ranks) of industries are determined for every year of the period of 2006–2011. The ranks and their changes are further analysed distinguishing pre-crisis, crisis, and post-crisis periods, determining the industries most and least affected by the economic crisis; also, the industries characterised by the fastest and the slowest after-crisis recovery.

Keywords: industry research, economic crisis, financial ratios, financial indicators, multi-criteria decision making, SAW, TOPSIS, VIKOR.

Reference to this paper should be made as follows: Krivka, A. 2014. Complex evaluation of the economic crisis impact on Lithuanian industries, *Journal of Business Economics and management* 15(2): 299–315.

JEL Classification: C44, G01, G11, G32, L25.

Introduction

Nowadays economic reality, characterised by growing countries' and regions' economic integration, globalization of business relations, free movement of capital and labour force, offers wide possibilities for the social and economic development of market economy countries and for increasing the welfare of their citizens. Expansion of financial markets together with growing banking sector assure the sources of financing business setting up and further development; diminishing barriers of international trade provide access to new markets for companies and satisfaction of growing needs for customers with a wide variety of goods and services.

Although there is a little doubt about the advantages of international economic integration, a few recent years have shown in practice the other side of the coin. In 2007 the crisis, which initially affected the financial system of the United States, shortly spread all over the world and stimulated the economic recession, with both business and ordinary citizens suffering from its consequences (Thao *et al.* 2013; Kowalski 2012). In many countries the financial crisis caused a rapid decrease in tax revenues, while austerity measures in fiscal policy (raising taxes and cutting public spending) applied by governments even deepened the economic problems (Adam, Iacob 2012).

The Republic of Lithuania was amongst the countries to experience the deepest economic downturn: according to GDP data, the economic crisis, which started in the end of 2008, caused the fall of the annual GDP by 14.8 % in 2009 (Statistics Lithuania 2013). It has to be admitted that deep recession was stimulated not only by the global economic crisis, but also by the internal specifics of the national economy evolution, and particularly because of the economy overheating and real estate price bubble caused by irresponsible lending and speculation. Though the first signs of economic recovery appeared in the 2nd quarter of 2010, the country's economic growth remained very slow during the last 3 years, while the GDP of 2012 is still under the pre-crisis level of 2007.

It has to be mentioned though, that GDP dynamics and other macroeconomic indicators provide general information only about the impact of the economic crisis, whereas even with a naked eye one may indicate the dissimilar effect of the crisis on various industries, also unequal rates of after-crisis recovery. Possibly uneven development of Lithuanian industries during the economic crisis of 2008 and afterwards, in the author's opinion, requires calculation-based evaluation with its results providing more detailed and scientifically grounded information about the impact of the recent crisis on business enterprises.

The *problem* of this paper is the complex quantitative evaluation of the economic crisis impact on industries. The *aim* of the research is to complexly evaluate the impact of the economic crisis of 2008 on Lithuanian industries on the basis of the system of quantitative indicators characterising enterprise's financial state and performance. Relying on scientific literature the system of industry research criteria is developed, while relative weights of the criteria are estimated by involving competent experts. By applying multi-criteria decision making methods (MCDM) relative positions (ranks) of Lithuanian industries are determined for every year of the period of 2006–2011. The ranks and their changes are further analysed distinguishing pre-crisis, crisis, and post-crisis periods, determining the industries most and least affected by the economic crisis; also, the industries characterised by the fastest and the slowest after-crisis recovery.

1. Literature review

Modern quantitative methods of enterprise performance analysis are based on the company's financial reports: horizontal analysis of enterprise financial statements studying accounts' dynamics during several periods; vertical analysis – a study of the structure of enterprise assets, equity and liabilities, and their changes; analysis of financial ratios –

the indicators, characterising enterprise's financial state and performance, are calculated, compared through different accounting periods, between various companies, also with their recommended values (Hofmann, Lampe 2012; Erdogan 2013; Kotane, Kuzmina-Merlino 2012; Hegazy, M., Hegazy, S. 2012; Zelgalve, Zaharcenko 2012).

With an enterprise being a complex phenomenon for research, individual financial ratios are combined into complex (integrated) indicators in the research on bankrupt probability (Altman 1968; Bhunia, Sarkar 2011; Yap *et al.* 2010), complex evaluation of enterprise financial state and performance by applying multi-criteria evaluation methods (Ginevičius, Podvieszko 2013; Hsu 2013; Hosseini *et al.* 2013). In strategic management models enterprise's financial indicators are complemented with qualitative criteria in order to complexly evaluate enterprise's strategic potential, calculate the results of strategy application (Ginevičius *et al.* 2012; Ginevičius, Krivka 2010; Punniyamoorthy, Murali 2008; Hegazy, M., Hegazy, S. 2012).

Analysis of enterprise financial indicators is also applicable for studying economic sectors or industries. The research of that kind deals with generalised (average) values of financial indicators of a group of enterprises or the whole industry assessing efficiency of companies' performance (Li *et al.* 2011), studying the relation between enterprise performance and the value of its shares (Balatbat *et al.* 2010; Hosseini *et al.* 2013), performing comparative analysis of inter-industry performance or inter-state industries' evolution (Kotane, Kuzmina-Merlino 2012; Claudiu-Marian 2011; Hon, Chu 2011), implementing the research on the relations between enterprise size, organization structure, market share or market concentration, and performance (Hays *et al.* 2009; Uslayet *al.* 2010) and other research of the similar nature.

Industry performance analysis in the context of an economic crisis also deserves economists' attention during the recent few years; however, most of the researchers are concentrated on the particular sector of economy, industry or market, e.g. furniture industry (Li *et al.* 2011), textile (Abbas *et al.* 2012), banking sector (Romanova 2012; Lakštutienė *et al.* 2011), agriculture (Li *et al.* 2011), TFT-LCD panel industry (Hon, Chu 2011), automobile industry (Du 2009; Bok 2009), tourism (Baleanu *et al.* 2009), construction (Al-Malkawi 2013). Other scientists perform research on the economic crisis effect on small and medium enterprises (Yiannaki 2012; Soininen *et al.* 2012) or large publicly listed companies (Dzikowska, Jankowska 2012; Norvaišienė 2012; Hsu 2013).

Summarizing the literature analysis performed, absence of the detailed, complex research on the economic crisis effect on industries is discovered. With regards to the accomplished literature study, the author indicates a niche for the research on the economic crisis of 2008 impact on Lithuanian economy presented in this paper, which has to involve all the main industries, be based on quantitative criteria – the system of financial state and performance indicators – and integrated approach to industry, as a complex phenomenon, analysis, with support of widely recognized mathematical instruments applicable for complex quantitative evaluation.

2. Research scope and methodology

The industries analysed in the paper are identified according to the 2nd-digit level classification of economic activities (based on NACE2) published by Statistics Lithuania (official national authority in the sphere of statistics). With regards to experience of other authors (Erdogan 2013; Kotane, Kuzmina-Merlino 2012; Balatbat *et al.* 2010; Hsu 2013; Hosseini *et al.* 2013; Abbas *et al.* 2012; Al-Malkawi 2013), the system of financial state and performance indicators is composed of four main groups of enterprise financial ratios: profitability, liquidity, solvency and asset turnover. The indicators selected for the research and their formulas are presented in Table 1.

Table 1. Financial state and performance indicators selected for the research and their formulas

No	Indicators	Formulas
Group A. Profitability indicators		
1	Gross margin ratio	Gross profit / Sales revenues
2	Return on sales (ROS)	Net profit / Sales revenues
3	Return on assets (ROA)	Net profit / Total assets
4	Return on equity (ROE)	Net profit / Equity
Group B. Liquidity indicators		
5	Current ratio	Current assets / Current liabilities
6	Quick ratio	(Current assets – Inventory) / Current liabilities
Group C. Solvency indicators		
7	Equity-to-debt ratio	Equity / Total liabilities
8	Debt ratio	Total liabilities / Total assets
Group D. Asset turnover indicators		
9	Total asset turnover	Sales revenues / Average total assets
10	Accounts receivable turnover	Sales revenues / Average accounts receivable

The period of the research are the calendar years 2006–2011 including both pre-crisis, crisis and post-crisis years (at the moment of the research the data of 2012 had not been published yet). The research involves all the industries (2nd-digit level economic activities), which data is published by Statistics Lithuania (the list of the industries under research is provided further with the results of the research in Table 5), combining for 97.6 % of Lithuanian enterprises (according to their value-added).

The complex quantitative evaluation of the economic crisis impact on Lithuanian industries is considered to be a mathematical problem of assessing the industries selected for the research with regards to the system of enterprise financial indicators as the evaluation criteria. To solve a problem of that kind, multi-criteria evaluation methods, developed throughout the recent years and widely applied in construction (e.g. Zavadskas *et al.* 2008; Ginevičius *et al.* 2008; Šaparauskas *et al.* 2011), economics and manage-

ment (e.g. Ginevičius *et al.* 2012, 2013; Ginevičius, Podvezko 2008, 2009; Ginevičius, Podvezko 2011, 2013; Hsu 2013), seem to be an appropriate tool.

The alternatives under evaluation are 68 industries – each of them is assessed with regards to 10 financial state and performance indicators (the scheme of evaluation is presented in Table 2); the evaluation is performed for every year of the research period of 2006–2011. The value r_{ij} of the particular evaluation criterion (financial indicator) i ($i = 1, \dots, m$) for the assessed alternative (industry) j ($j = 1, \dots, n$) is taken from the officially published data by Statistics Lithuania (2013). To estimate weights ω_i of the financial indicators, the method of expert evaluation is applied, with respect to the condition $\sum_{i=1}^m \omega_i = 1$. The experts (financial directors or CEOs) were asked to provide a single set of criteria weights (showing the relative importance of the particular financial indicator) for the whole period of the research.

Table 2. The scheme of multi-criteria assessment of Lithuanian industries with regards to financial state and performance indicators

Criteria		Criteria values						
No	Description	Max (+) / Min (-)	Weight	Industry 1	...	Industry j	...	Industry 68
1	Gross margin ratio	+	ω_1	$r_{1,1}$	...	$r_{1,j}$	...	$r_{1,68}$
2	Return on sales (ROS)	+	...	...	...	...	...	...
3	Return on assets (ROA)	+	...	...	...	...	...	...
4	Return on equity (ROE)	+	...	...	...	...	...	...
5	Current ratio	+	...	...	...	...	...	...
6	Quick ratio	+	ω_i	$r_{i,1}$	...	$r_{i,j}$	...	$r_{i,68}$
7	Equity-to-debt ratio	+	...	...	...	...	...	...
8	Debt ratio	-	...	...	...	...	...	...
9	Total asset turnover	+	...	...	...	...	...	...
10	Accounts receivable turnover	+	ω_{10}	$r_{10,1}$	...	$r_{10,j}$	...	$r_{10,68}$

The result of multi-criteria evaluation is the ranking of industries for every year of the period of 2006–2011. The further analysis is implemented studying the changes of the ranking to compare pre-crisis year of 2006, the crisis years of 2008–2009, and after-crisis year of 2011 – the dynamics of the ranks reflect the impact of the crisis on the particular industry, including after-crisis recovery.

The experience of the recent research (e.g. Ginevičius, Podvezko 2009; Ginevičius *et al.* 2008, 2012; Ginevičius, Krivka 2010; Ginevičius, Podvezko 2011, 2013) suggests that

the phenomenon under analysis has to be assessed by applying several multi-criteria methods seeking for higher reliability of results; moreover, in order to minimize the subjectivity of the specific method, average ranks are accepted to be the ultimate result. To efficiently combine several multi-criteria evaluation methods, it is important to form a “bunch” of correlating methods (Ginevičius, Podvezko 2008). SAW, TOPSIS and VIKOR methods are selected for multi-criteria assessment of Lithuanian industries. SAW method calculates the sum of normalized weighted values S_j of all criteria for each j -th alternative (Ginevičius *et al.* 2008, 2012, 2013; Podvezko 2011):

$$S_j = \sum_{i=1}^m \omega_i \tilde{r}_{ij}, \quad (1)$$

while initial values are normalized using the formula (Ginevičius *et al.* 2008, 2012; Podvezko 2011):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{j=1}^n r_{ij}}. \quad (2)$$

TOPSIS indicates the best (V^*) and the worst (V^-) solutions with regards to each criterion (Opricovic, Tzeng 2004; Ginevičius *et al.* 2008):

$$V^* = \{V_1^*, V_2^*, \dots, V_m^*\} = \left\{ \left(\max_j \omega_i \tilde{r}_{ij} / i \in I_1 \right), \left(\min_j \omega_i \tilde{r}_{ij} / i \in I_2 \right) \right\}, \quad (3)$$

$$V^- = \{V_1^-, V_2^-, \dots, V_m^-\} = \left\{ \left(\min_j \omega_i \tilde{r}_{ij} / i \in I_1 \right), \left(\max_j \omega_i \tilde{r}_{ij} / i \in I_2 \right) \right\}, \quad (4)$$

where: I_1 is a set of maximizing criteria, I_2 is a set of minimizing criteria. The distance of each alternative to the best and the worst solutions is calculated:

$$D_j^* = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^*)^2}, \quad (5)$$

$$D_j^- = \sqrt{\sum_{i=1}^m (\omega_i \tilde{r}_{ij} - V_i^-)^2}, \quad (6)$$

followed by the TOPSIS criterion, which maximum value (i.e. the value which is closest to 1) corresponds to the best alternative:

$$C_j^* = \frac{D_j^-}{D_j^* + D_j^-}. \quad (7)$$

The initial values r_{ij} are normalized by applying the vector normalization formula (Ginevičius *et al.* 2008, 2012):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^n r_{ij}^2}}. \quad (8)$$

VIKOR is based on the three evaluation criteria S_j , R_j and Q_j , calculated by the following formulas (Opricovic, Tzeng 2004; Ginevičius *et al.* 2008):

$$S_j = \sum_{i=1}^m \omega_i \tilde{r}_{ij}, \tag{9}$$

$$R_j = \max_i (\omega_i \tilde{r}_{ij}), \tag{10}$$

$$Q_j = v \frac{S_j - S^*}{S^- - S^*} + (1 - v) \frac{R_j - R^*}{R^- - R^*}, \tag{11}$$

where: $S^* = \min_j S_j$, $S^- = \max_j S_j$, $R^* = \min_j R_j$, $R^- = \max_j R_j$, v is the majority criterion, equalled to 0.5 in empiric research (e.g. Ginevičius, Krivka 2010). The lowest values of Q_j indicate the best alternatives.

Normalization of maximizing criteria values is performed by applying the formula:

$$\tilde{r}_{ij} = \frac{\max_j r_{ij} - r_{ij}}{\max_j r_{ij} - \min_j r_{ij}}. \tag{12}$$

Where negative values are involved in multi-criteria assessment, they are transformed into positive by adding the shifting constant b_i to each value r_{ij} of the i -th criterion having at least one negative value (Podvezko 2011):

$$\bar{r}_{ij} = r_{ij} + b_i. \tag{13}$$

For the shifting procedure to have the least possible effect on evaluation results, minimum values of the shifting constant are considered, calculated as follows:

$$b_i = \left| \min_j r_{ij} \right| + 0.01. \tag{14}$$

3. Research procedure and results

The questionnaires for estimating weights of the selected financial state and performance indicators (evaluation criteria) were submitted to 80 enterprises. The experts (financial directors or CEOs) were asked to evaluate weights of the financial indicators in two steps: first the weights of the indicators inside every particular group (see Table 1) were estimated; then the weights of the groups (profitability, liquidity, solvency and asset turnover) in the integrated criterion were determined. The ultimate weight ω_i of the i -th indicator was calculated by multiplying its weight ω_i^g inside the group by the weight ω_g of the group in the integrated criterion:

$$\omega_i = \omega_i^g \cdot \omega_g, \tag{15}$$

with respect to the conditions: $\sum \omega_i^g = 1$ (for every group of indicators) and $\sum \omega_g = 1$ (for the integrated criterion).

Such practice was addressed in order to simplify evaluation procedure and to avoid unintentional overweighting of profitability indicators, which could occur in case of direct evaluation just because of the number of indicators in profitability group (4 indicators) compared to other groups consisting of 2 indicators.

Table 3. Evaluation criteria weights based on expert estimates

Evaluation criteria		Experts and criteria weights									
No	Description	1	2	3	4	5	6	7	8	9	Average
1	Gross margin ratio	0.053	0.060	0.080	0.063	0.060	0.160	0.098	0.075	0.140	0.081
2	Return on sales (ROS)	0.140	0.090	0.160	0.088	0.150	0.040	0.338	0.105	0.420	0.139
3	Return on assets (ROA)	0.018	0.075	0.040	0.038	0.030	0.100	0.005	0.045	0.035	0.044
4	Return on equity (ROE)	0.140	0.075	0.120	0.063	0.060	0.100	0.049	0.075	0.105	0.085
5	Current ratio	0.060	0.120	0.060	0.100	0.080	0.060	0.004	0.140	0.128	0.078
6	Quick ratio	0.090	0.180	0.090	0.150	0.120	0.090	0.006	0.210	0.023	0.117
7	Equity-to-debt ratio	0.090	0.100	0.150	0.210	0.110	0.090	0.050	0.098	0.050	0.112
8	Debt ratio	0.210	0.100	0.150	0.140	0.090	0.060	0.050	0.053	0.050	0.107
9	Total asset turnover	0.140	0.080	0.105	0.090	0.240	0.180	0.320	0.140	0.035	0.162
10	Accounts receivable turnover	0.060	0.120	0.045	0.060	0.060	0.120	0.080	0.060	0.015	0.076
Totals		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Nine answers with fully and accurately filled questionnaires were received to provide data for calculating the ultimate criteria weights (Table 3).

The concordance coefficient, calculated as the ratio of actual (S) and ideal (S_{max}) dispersions, is applied to check the degree of agreement of expert estimates (Kendall 1970; Ginevičius *et al.* 2008):

$$W = \frac{S}{S_{max}} = \frac{12S}{r^2m(m^2 - 1)}, \tag{16}$$

while the actual dispersion is calculated by the formula:

$$S = \sum_{i=1}^m (c_i - \bar{c})^2, \tag{17}$$

where: c_i is the sum of ranks of all r experts' criterion i estimates, \bar{c} is the mean value of sums of all criteria ($i = 1, \dots, m$) ranks. The consistency of estimates is tested by χ^2 distribution with $\nu = m - 1$ degrees of freedom:

$$\chi^2 = Wr(m - 1) = \frac{12S}{rm(m + 1)}. \tag{18}$$

Whereas the calculated value of $\chi^2 = 21.01$ is larger than the critical value of $\chi_{cr}^2 = 16.92$ (with the significance level of $\alpha = 0.05$ and 9 degrees of freedom), the expert estimates are considered to be in agreement, while the average weights are employed for multi-criteria assessment of Lithuanian industries.

For every year of the research (2006–2011) the ranks of the industries are calculated by applying the three chosen MCDM methods: SAW, TOPSIS and VIKOR. The test for correlation of the results obtained (Table 4) discloses diverging results of VIKOR, with the correlation coefficient (modulus value) with SAW being less than 0.8. Thus, only SAW and TOPSIS methods are considered for ultimate ranking of the industries.

Table 4. Correlation of the results of multi-criteria evaluation

	TOPSIS	VIKOR
SAW	0.923	-0.618

The ultimate ranks of Lithuanian industries, presented in Table 5, are the average results obtained by SAW and TOPSIS. Absolute changes of the rank compared to pre-crisis year of 2006 are further calculated: a positive change discloses the improvement of the relative position of the industry, while a negative change corresponds to the fall of the rank.

Table 5. The ultimate ranks of the industries and their changes compared to 2006

Industries	Ranking										
	Ultimate ranks						Rank absolute changes compared to 2006				
	2006	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
1	2	3	4	5	6	7	8	9	10	11	12
A02 Forestry and logging	6	4	10	5	4	5	2	-4	1	2	1
A03 Fishing and aquaculture	41	60	20	35	61	62	-19	21	6	-20	-21
B06 Extraction of crude petroleum and natural gas	2	5	2	2	2	4	-3	0	0	0	-2
B08 Other mining and quarrying	15	14	15	45	48	32	1	0	-30	-33	-17
C10 Manufacture of food products	62	44	52	28	34	50	18	10	34	28	12
C11 Manufacture of beverages	25	26	24	24	47	44	-1	1	1	-22	-19
C13 Manufacture of textiles	65	65	65	54	53	32	0	0	11	12	33
C14 Manufacture of wearing apparel	48	50	48	38	36	21	-2	0	10	12	27
C15 Manufacture of leather and related products	43	67	53	58	58	65	-24	-10	-15	-15	-22
C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	63	53	68	62	55	59	10	-5	1	8	4

Continue of Table 5

1	2	3	4	5	6	7	8	9	10	11	12
C17 Manufacture of paper and paper products	55	58	62	55	42	55	-3	-7	0	13	0
C18 Printing and reproduction of recorded media	39	59	52	43	44	30	-20	-13	-4	-5	9
C20 Manufacture of chemicals and chemical products	51	38	28	20	12	9	13	23	31	39	42
C21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	35	16	36	24	11	25	19	-1	11	24	10
C22 Manufacture of rubber and plastic products	52	52	59	54	51	54	0	-7	-2	1	-2
C23 Manufacture of other non-metallic mineral products	28	28	36	49	56	61	0	-8	-21	-28	-33
C24 Manufacture of basic metals	39	59	33	52	63	44	-20	6	-13	-24	-5
C25 Manufacture of fabricated metal products, except machinery and equipment	50	46	51	45	51	46	4	-1	5	-1	4
C26 Manufacture of computer, electronic and optical products	68	66	28	38	28	37	2	40	30	40	31
C27 Manufacture of electrical equipment	63	60	58	62	46	39	3	5	1	17	24
C28 Manufacture of machinery and equipment n.e.c.	36	46	32	27	26	34	-10	4	9	10	2
C29 Manufacture of motor vehicles, trailers and semi-trailers	8	35	15	8	8	10	-27	-7	0	0	-2
C30 Manufacture of other transport equipment	32	27	25	18	6	26	5	7	14	26	6
C31 Manufacture of furniture	63	35	46	33	36	35	28	17	30	27	28
C32 Other manufacturing	30	49	36	35	30	51	-19	-6	-5	0	-21
C33 Repair and installation of machinery and equipment	22	40	36	33	39	58	-18	-14	-11	-17	-36
D35 Electricity, gas, steam and air conditioning supply	20	18	20	16	23	43	2	0	4	-3	-23
E36 Water collection, treatment and supply	7	8	9	5	5	11	-1	-2	2	2	-4

Continue of Table 5

1	2	3	4	5	6	7	8	9	10	11	12
E38 Waste collection, treatment and disposal activities; materials recovery	53	62	52	42	24	31	-9	1	11	29	22
F41 Construction of buildings	49	57	65	68	67	68	-8	-16	-19	-18	-19
F42 Civil engineering	40	47	43	49	42	66	-7	-3	-9	-2	-26
F43 Specialised construction activities	37	36	50	61	60	58	1	-13	-24	-23	-21
G45 Wholesale and retail trade and repair of motor vehicles and motorcycles	24	15	50	52	44	29	9	-26	-28	-20	-5
G46 Wholesale trade, except of motor vehicles and motorcycles	47	37	45	44	41	48	10	2	3	6	-1
G47 Retail trade, except of motor vehicles and motorcycles	17	18	17	6	10	11	-1	0	11	7	6
H49 Land transport and transport via pipelines	30	37	52	50	42	40	-7	-22	-20	-12	-10
H50 Water transport	6	10	8	13	25	66	-4	-2	-7	-19	-60
H51 Air transport	61	28	5	28	64	50	33	56	33	-3	11
H52 Warehousing and support activities for transportation	37	40	31	28	25	24	-3	6	9	12	13
H53 Postal and courier activities	22	36	41	49	54	37	-14	-19	-27	-32	-15
I55 Accommodation	48	32	68	38	65	45	16	-20	10	-17	3
I56 Food and beverage service activities	39	34	63	36	42	17	5	-24	3	-3	22
J58 Publishing activities	48	46	48	36	46	54	2	0	12	2	-6
J59 Motion picture, video and television programme production, sound recording and music publishing activities	60	57	56	65	39	55	3	4	-5	21	5
J60 Programming and broadcasting activities	13	15	6	24	23	43	-2	7	-11	-10	-30
J61 Telecommunications	4	21	20	17	18	18	-17	-16	-13	-14	-14
J62 Computer programming, consultancy and related activities	29	25	23	46	26	22	4	6	-17	3	7
J63 Information service activities	11	10	11	17	17	16	1	0	-6	-6	-5

End of Table 5

1	2	3	4	5	6	7	8	9	10	11	12
L68 Real estate activities	6	28	66	66	64	50	-22	-60	-60	-58	-44
M69 Legal and accounting activities	20	32	40	31	33	17	-12	-20	-11	-13	3
M70 Activities of head offices; management consultancy activities	8	1	5	4	4	2	7	3	4	4	6
M71 Architectural and engineering activities; technical testing and analysis	33	36	30	29	27	29	-3	3	4	6	4
M72 Scientific research and development	20	14	10	11	17	36	6	10	9	3	-16
M73 Advertising and market research	42	27	41	50	52	42	15	1	-8	-10	0
M74 Other professional, scientific and technical activities	62	54	49	48	57	36	8	13	14	5	26
M75 Veterinary activities	11	13	13	12	9	6	-2	-2	-1	2	5
N77 Rental and leasing activities	54	47	49	68	67	39	7	5	-14	-13	15
N78 Employment activities	25	11	15	10	10	12	14	10	15	15	13
N79 Travel agency, tour operator reservation service and related activities	14	10	21	9	16	11	4	-7	5	-2	3
N80 Security and investigation activities	16	23	17	13	19	36	-7	-1	3	-3	-20
N81 Services to buildings and landscape activities	2	2	3	1	1	1	0	-1	1	1	1
N82 Office administrative, office support and other business support activities	25	32	37	47	26	24	-7	-12	-22	-1	1
P85 Education	17	18	20	13	13	15	-1	-3	4	4	2
Q86 Human health activities	35	17	21	21	14	16	18	14	14	21	19
R90 Creative, arts and entertainment activities	59	32	60	55	38	46	27	-1	4	21	13
R93 Sports activities and amusement and recreation activities	67	68	2	57	59	4	-1	65	10	8	63
S95 Repair of computers and personal and household goods	49	45	38	29	28	36	4	11	20	21	13
S96 Other personal service activities	57	62	52	53	63	66	-5	5	4	-6	-9

The changes of the ranks in the years 2008–2009 compared to pre-crisis year of 2006 are supposed to indicate the industries most and least affected by the economic crisis. The further dynamics of the ranks, particularly in 2011, allow determining the industries characterised by the fastest and the slowest after-crisis recovery, also indicate the changes of the ranking during the whole period of the research (2006–2011).

The most affected by the economic crisis industries are considered to be L68 Real estate activities (significant fall of the rank from the 6th in 2006 to the 66th in 2008–2009); G45 Wholesale and retail trade and repair of motor vehicles and motorcycles, H53 Postal and courier activities, H49 Land transport and transport via pipelines – three industries falling by 20 or more positions in the ranking during the crisis; F43 Specialised construction activities, F41 Construction of buildings, N82 Office administrative, office support and other business support activities, M69 Legal and accounting activities, B08 Other mining and quarrying, C23 Manufacture of other non-metallic mineral products, J61 Telecommunications – all falling by 15–19 positions in the industries' ranking in 2008–2009 compared to 2006.

The least affected by the crisis industries are H51 Air transport, R93 Sports activities and amusement and recreation activities, C26 Manufacture of computer, electronic and optical products, C20 Manufacture of chemicals and chemical products, C31 Manufacture of furniture, C10 Manufacture of food products – all experiencing the rise of the rank by at least 20 positions during the crisis compared to 2006; also, Q86 Human health activities, M74 Other professional, scientific and technical activities, A03 Fishing and aquaculture, N78 Employment activities, C30 Manufacture of other transport equipment, M72 Scientific research and development – rising by 10 or more positions in the ranking.

By comparing the ranks of 2011 (post-crisis period) to 2008–2009 (the years of the deepest crisis) industries' after-crisis recovery is analysed. The fastest recovery, considering the industries significantly affected by the crisis, appeared in I56 Food and beverage service activities, G45 Wholesale and retail trade and repair of motor vehicles and motorcycles, M69 Legal and accounting activities, N82 Office administrative, office support and other business support activities, L68 Real estate activities and H49 Land transport and transport via pipelines. On the other hand the list of crisis-affected industries, which even worsened their relative position comparing 2011 to 2008–2009, includes C33 Repair and installation of machinery and equipment, C23 Manufacture of other non-metallic mineral products, C15 Manufacture of leather and related products and F41 Construction of buildings.

Considering the whole period of the research (2006–2011), which includes pre-crisis, crisis and post-crisis years, the main changes in the ranking of Lithuanian industries due to the recent economic cycles are further indicated. The most appreciable improvement of the rank is noticed to be in R93 Sports activities and amusement and recreation activities (+63 positions), C20 Manufacture of chemicals and chemical products (+42), C13 Manufacture of textiles (+33), C26 Manufacture of computer, electronic and optical products (+31), C31 Manufacture of furniture (+28), C14 Manufacture of wearing

apparel (+27) and M74 Other professional, scientific and technical activities (+26); while a significant fall of the rank is determined in H50 Water transport (−60), L68 Real estate activities (−44), C33 Repair and installation of machinery and equipment (−36), C23 Manufacture of other non-metallic mineral products (−33), J60 Programming and broadcasting activities (−30) and F42 Civil engineering (−26).

Finally, the average ranks of the industries in the period of 2006–2011 are compared, identifying the best and worst performing industries during the recent economic cycles. The top industries according to their average ranks are N81 Services to buildings and-landscape activities, B06 Extraction of crude petroleum and natural gas, M70 Activities of head offices; management consultancy activities, A02 Forestry and logging, E36 Water collection, treatment and supply, M75 Veterinary activities, G47 Retail trade, except of motor vehicles and motorcycles and N79 Travel agency, tour operator reservation service and related activities, J63 Information service activities and N78 Employment activities; while the worst performing industries are supposed to be F41 Construction of buildings, C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials, S96 Other personal service activities, C15 Manufacture of leather and related products, C13 Manufacture of textiles, J59 Motion picture, video and television programme production, sound recording and music publishing activities, C27 Manufacture of electrical equipment, C17 Manufacture of paper and paper products, N77 Rental and leasing activities and C22 Manufacture of rubber and plastic products.

Conclusions

The paper presents the empiric research on the impact of the economic crisis of 2008 on Lithuanian industries. The research has involved 68 industries, while the crisis effect has been evaluated on the basis of the system of 10 financial state and performance indicators belonging to four main groups of enterprise financial ratios: profitability, liquidity, solvency and asset turnover.

According to the research methodology, considering the integrated approach to industry as a complex phenomenon, the problem of complex evaluation of the economic crisis impact has been formalised as the comparative quantitative assessment of the industries (alternatives for evaluation) with regards to the chosen financial state and performance indicators (evaluation criteria). Multi-criteria decision making methods SAW, TOPSIS and VIKOR, widely applied in the recent research for evaluating complex economic phenomena, have been chosen as the tool for evaluation. Considering low correlation of the results between SAW and VIKOR, the latter MCDM method has been rejected, with ultimate ranks being the average of SAW and TOPSIS.

By analysing the changes of the ranks in 2008–2009 compared to pre-crisis year of 2006, the industries most and least affected by the economic crisis have been indicated. Furthermore, the ranks of post-crisis year of 2011 have been compared to 2008–2009, and the industries characterised by the fastest and the slowest after-crisis recovery have been identified.

Considering the whole period of the research (2006–2011), which includes pre-crisis, crisis and post-crisis years, the most improved industries, as well as the ones with the deepest fall of the rank, have been determined. Finally, the average ranks of the industries during the period of 2006–2011 have been compared identifying the industries being on the top and in the bottom of the list according to their performance indicators.

The results of the research from the practical point of view might be useful for potential investors while choosing the particular industries or enterprises for long-term investment, also for government authorities involved in forming and implementing economic policy. For other researchers the approach and methodology of the research might seem interesting, as well as the results obtained.

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