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THE IMPACT OF CRISES ON THE INTELLECTUAL CAPITAL OF COMPANIES IN THE FOOD SECTOR

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Abstract

Both the financial crisis of the first decade of the 21st century, as well as the deterioration of trade relations between the European Union and the Russian Federation were events that significantly affected the functioning of the largest listed companies on the food market: on the one hand, aggravating the conditions of economic functioning, on the other hand creating a stimulus to seek new innovative solutions to help companies survive on the market. The aim of the work was to present the impact of crises on the intellectual capital of WIG-Food index companies, which is an indirect measure of innovation. The MV/BV and q-Tobin index were used for the study, as well as selected quantitative methods: multiple regression, Ward's method and seasonal additive decomposition. The results of the work indicate that the companies are divided into two groups, within which similar trends in shaping intellectual capital are observed. In addition, one of the groups clearly noticed the impact of the financial crisis and the introduction of an embargo on the shaping of intellectual capital.

JEL classification: O34, G01, L66
Keywords: intellectual capital, agriculture, crisis, embargo, food industry

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Introduction

The financial crisis, which took place at the beginning of the first decade of the 21st century and contributed to the reorientation of economic policy across Europe (Mierzejewski, 2015), significantly affected the macroeconomic stability of Poland, causing an economic slowdown in the region. The return to the lost economic condition occurred in Poland only in 2017 (Mierzejewski, 2018, pp. 143-158). The second, also significant event for the Polish economy was the deterioration of the trade relations between the European Union and the Russian Federation, which took place after the crisis in Ukraine in 2014. As a result of the deterioration of the relation, there was a limitation of exports of agri-food products from Poland, which contributed to the restructuring of this area of the economy in terms of trade (Firlej, et al. 2016). Currently, the scientific literature emphasizes the growing importance of intellectual capital in the development of enterprises and entire economies. Knowledge is defined as a basic economic resource and as a source of competitive advantage (Dobija, 2003). Considering how important the role of knowledge in business development is, it is important to examine how crises affect its development.

Purpose and methods of work

The purpose of the work was to conduct an attempt to assess the impact of the financial crisis and trade embargo between the European Union and the Russian Federation on the formation of intellectual capital of companies included in the WIG-Food trade index. The quarterly and annual data for the years 2004-2018 relating to selected financial results were used for the study: company share price, number of shares, amount of assets and liabilities, long-term and short-term liabilities and the size of inventories held by the company. Moreover, in the research, in the construction of selected models describing the time series of intellectual capital formation, selected macroeconomic variables were used, ie: the Euro - US dollar exchange rate, the price of crude oil and the price of Polish 10-year bonds. Data in this respect were downloaded from the Investing portal (investing.com. Retrieved from: 27/05/2019).

The selection of the above macroeconomic variables used to build the model took place after a detailed review of the scientific literature. At work 'Influence of changes in exchange rates on the international agricultural trade in the terms of global recession' author showed a correlation between changes in foreign exchange rates and trade in food products, and also mentioned that during the recession, the population replaces expensive food with cheaper equivalent (Staszczak, 2010). The main factors behind the rise in world food prices include a significant increase in the production of biofuels (Mitchel, 2008), as well as changes in prices on commodity markets, especially crude oil (Gwiazda, 2011). Government bonds, on the other hand, determine the level of imports and exports, and also affect the level of investment in the country (Kujawski, et al. 2015), so they were also useful in creating the model. The construction of the model was also influenced by the embargo and the crisis in 2008, in the time series the value of 0 meant that these phenomena did not occur, while 1 meant that these phenomena occurred in a given period of time.

The study used a descriptive method as well as a comparative and selected quantitative methods, ie: multiple regression, Ward's method and seasonal additive decomposition. The selected research methods explain precisely the cyclical changes in the relationship between the above mentioned macroeconomic variables and the shaping of intellectual capital in food industry companies. Two methods were used to calculate the value of intellectual capital: the MV/BV method and the q-Tobin method. These methods will be presented in more detail later in this work.

Economic situation, financial crisis and deterioration of trade on the agricultural market

The financial crisis that took place in 2008-2009 began in the United States, and its main reason is seen as disregard for the dynamic development of the securities market, which were related to risky mortgage loans (Adamczyk, 2012). Today, through the processes of globalization of the economy of individual countries are characterized by a large openness, and are closely related to each other. This phenomenon caused a rapid extension of the crisis from the United States to almost the whole world (Radomska, 2013). Deterioration of the economic situation of countries, in particular highly developed ones, was caused by a drop in demand due to the collapse of global exports and shocks in financial markets, which caused sudden changes in exchange rates

and the withdrawal of capital by international institutions (Ibidem). The Polish economy, compared to other highly developed countries, was less affected by the crisis. In the case of the food industry discussed in this article in Poland, however, a decrease in the growth tendencies and a reduction in investments was noted (Żelazowska-Przewłoka, 2012). During the crisis, Polish consumers decided to purchase the cheapest food products, which affected the reduction of jobs and wage reductions in food industry enterprises (Firlej, 2009).

The Russian Federation on 7 August 2014 decided to impose an embargo on imports of selected groups of agri-food commodities, among others from Poland. It was a response to economic sanctions imposed previously by the European Union on Russia caused by the unlawful annexation of Crimea by that state (Nacewska-Twardowska, 2015, pp. 220-230). The effect of these decisions was to limit the export of some export goods, such as meat and milk, as well as its processed products and fruit and vegetables (Firlej, et al., 2016). However, despite the deterioration of trade with the Russian Federation, no noticeable deterioration in the export and import of Polish goods, including food products was noticed (Ibidem).

The role of intellectual capital and selected methods of its measurement

Intellectual capital called „wealth of organization" (Stewart, 1997, pp. 56-59, Sveiby, 1997), or „the treasure of organization" (Dzinkowski, 1999) is the key to success in building organizations of the 21st century. It is defined in many ways, one of them is the statement that intellectual capital is intellectual property and a complex combination of processes and cultures related to interpersonal relationships and human capital (Fitz-Enz, 2001). Today, especially in the European Union, there is a strong emphasis on supporting the innovation of economies. Projects such as regional innovation strategies (RIS) aim to increase competitiveness and coordinate scientific and research activities so that technical achievements can be implemented in the economy (Bal-Woźniak, 2005). In the scientific literature intellectual capital is more and more often identified as the most valuable of any enterprise. It is noted that the position of leaders in the industries belongs to those enterprises that in a short time can transform the knowledge and skills of employees into profitable products and services offered to clients (Ujwary-Gil, 2018).

The methods of measuring intellectual capital are classified according to four areas (Sveiby):

1. MCM - Market Capitalization Methods – methods based on market capitalization, for example Market-To-Book Value, Tobin's q index,
2. Return on Assets Methods - methods based on return on assets, for example Economic Value Added (EVA™), czy Calculated Intangible Value.
3. DIC - Direct Intellectual Capital Methods - methods of direct measurement of intellectual capital, for example Human Resource Costing and Accounting (HRCA), czy Dynamic Monetary Model.
4. SC - Scorecards Methods – point card methods, for example methods of Skandia Navigator, IC Rating™, Intellectual Capital Statements.

Two methods belonging to the Market Capitalization Methods group (the MV/BV method and the q-Tobin method) were used in the study of the intellectual capital value of WIG-food companies.

The MV/BV method was proposed by Stewart in 1997 (Stewart, 1997), and uses the differences between the market and book value of a given company to calculate the value of intellectual capital. The obtained results do not indicate the direct value of intellectual capital in the company, but on the fact whether it exists at all. The method takes the form of the following formula (Palimąka & Mierzejewski, 2016, pp. 62-63):

$$\frac{MV_t}{BV_t} = \frac{(p_t \times q_t)}{(A_t - FA_t)} \quad (1)$$

where p_t = share price at time t,

q_t = number of shares at time t,

A_t = total assets at time t,

FA_t = foreign capital at time t.

The MV/BV method makes it possible to compare the results of intellectual capital between companies, as well as to observe changes in the value of intellectual capital over time, thus providing information on the development of a given company.

The q-Tobin method was proposed by the Nobel Prize winner Tobin in 1969 (Sopińska, 2014, p. 130) and is based on the determination of the ratio of market value to the cost of replacement of tangible assets. In the intellectual capital study of companies belonging to the WIG-Food

index, a model of Cung and Pruitt was used, which determines the market value as the sum of the company's components reduced by the book value of current assets and enables the calculation of the q-Tobin ratio. According to this approach, this indicator takes the form (Firlej, et al., 2016, pp. 162-163):

$$q - Tobin\ rate = \frac{MVCS + BVPS + BVLTD + BVINV + BVCL - BVCA}{BVTA} \quad (2)$$

where *MVCS* = market value of ordinary shares,
BVPS = book value of preference shares,
BVLTD = book value of long-term liabilities,
BVINV = book value of stocks,
BVCL = book value of short-term liabilities,
BVCA = book value of current assets,
BVTA = book value of all assets.

Similarly to the MV/BV method, the q-Tobin method is used to analyze the evolution of intellectual capital over time and to compare the results between companies operating in the same economic area.

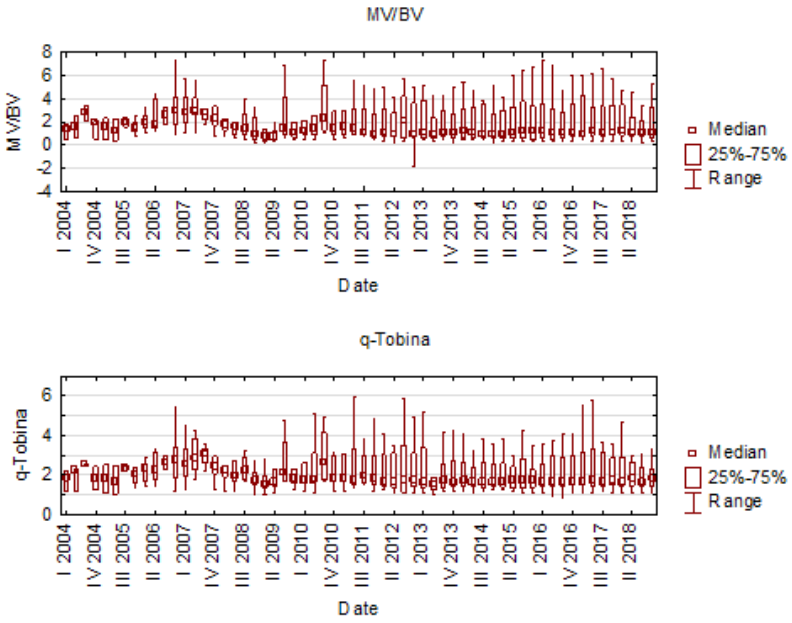
Formation of the intellectual capital of companies WIG-Food

In conditions of strong competition, enterprises increasingly recognize the value and role of intellectual capital, that is knowledge, skills of employees, product innovation in building a competitive advantage over other companies operating in the same industry (Rzempała, 2007). (Ciekanowski, 2014) wrote about the importance of human capital, pointing out that human resources are responsible for a significant part of the profit of most companies, and without appropriate employees, enterprises are deprived of development opportunities (Ibidem). The role of knowledge as a strategic resource of the company has been described in detail by (Materska, 2005). The author points out that properly used information and knowledge that are connected with specific company goals can provide the company with lasting uniqueness and competitive advantage (Ibidem). It is positively appreciated that the importance of intellectual capital is increasingly noticed not only in the scientific literature, but also by entrepreneurs (Beyer, 2012).

Chart 1 Shows the shaping of intellectual capital, measured by the methods of MV/BV and q-Tobin in WIG-Food companies. The high intellectual capital result in 2007 and the significant fall in response to the financial crisis in 2009 is particularly noticeable. On the other hand, the influence of the introduction of the embargo on the intellectual capital of WIG-Food companies was felt to a much lesser extent and only by the MV/BV method.

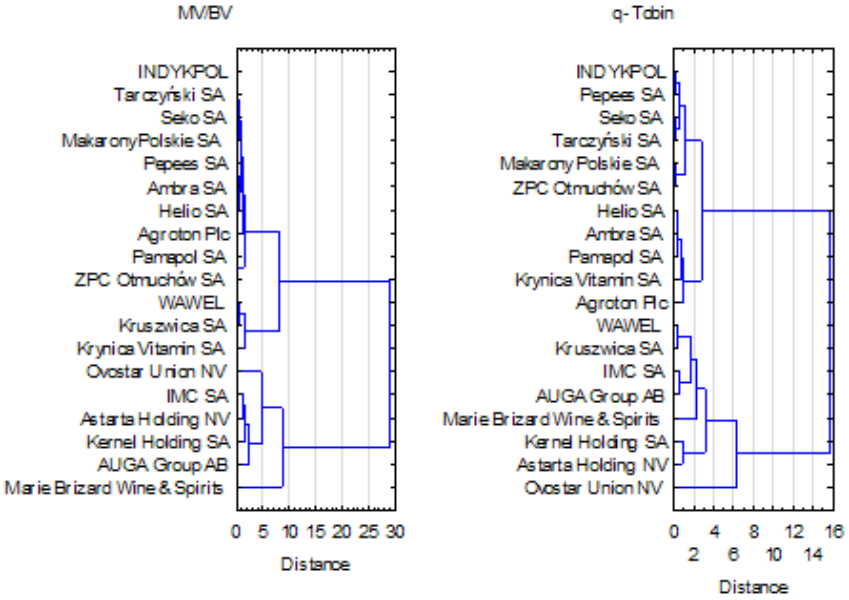
It was noted, however, that two groups can be distinguished from the intellectual capital of individual companies, in which companies show similar trends. The

Chart 1: The evolution of intellectual capital indicators of the WIG-Food stock exchange indexes



Source: Own study based on data from the Investing.com financial portal and the Notoria.pl website, download date: 25/05/2019

Chart 2: Dendrogram of groups of companies differentiated by the size of the measurement of intellectual capital by selected methods



Source: Own study based on data from the Investing.com financial portal and the Notoria.pl website, download date: 25/05/2019

next part of the work presents the division of companies into these groups and explains what trends in the intellectual capital of companies within groups are based on, as well as what the companies in each group have in common.

Cluster analysis is a tool whose aim is to arrange objects into groups in such a way that the degree of linking objects with objects belonging to the same group is as large as possible, and with objects from other groups as small as possible. On the basis of the Ward cluster analysis (chart 2.) two groups of companies were distinguished:

- Group I: INDYKPOL, Seko SA, Pepees SA, Helio SA, Ambra SA, Makarony Polskie SA, Pamapol SA, ZPC Otmuchów SA, Tarczyński SA, Krynica Vitamin SA, Agroton Plc;

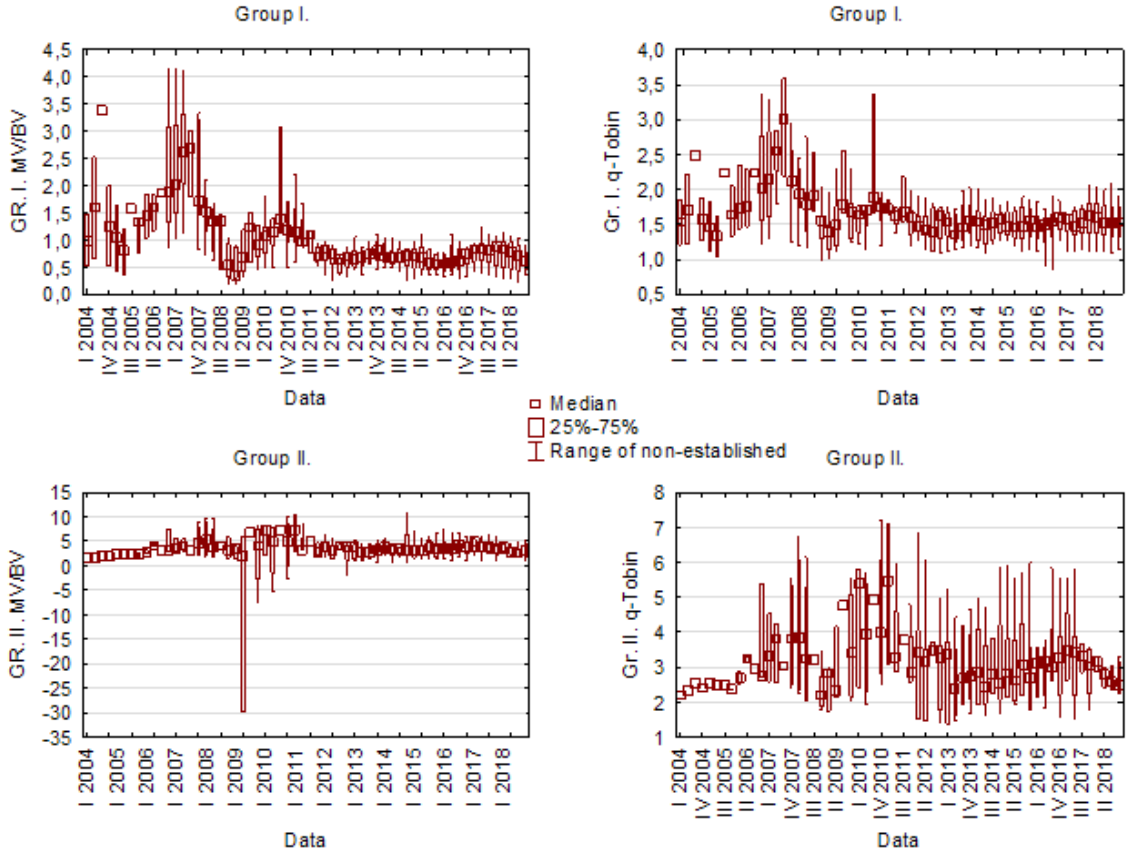
- Group II: WAWEL, Kruszwica SA, IMC SA, AUGA Group AB, Marie Brizard Wine & Spirits, Kernel Holding SA, Astarta Holding NV, Ovostar Union NV.

These groups are characterized by different results of measuring intellectual capital. As a result, in the further part of the work, the average values for each group were used to conduct an assessment of the impact of the financial crisis and trade embargo between the European Union and the Russian Federation.

The results of both groups are presented in Chart 3, where the differences in the size of intellectual capital in the years 2004-2018 are clearly shown. In the case of the MV/BV method, the average value of the indicator in group I. was 0.97, while in the case of group II. as much as 3.49. In addition, there was a clear difference between the results of variance and the standard deviation for the MV/BV index - for group II. were respectively: 11.91 and 3.45, and for group I. successively: 0.38 and 0.62. These differences indicate a markedly higher variability of observed values of variance and the standard deviation in group II. Similar statistics were done for the q-Tobin method. The results for individual groups also showed that Group I is characterized by a lower average value in the analysed period (1.65 compared to 2.73 for Group II), as well as by significantly lower results of variance and standard deviation, amounting to: 0.19 (in group II, 5.11) and 0.44 (for group II, 2.26). In both groups, using the MV/BV method, a significant impact of the financial crisis of the first decade on the decline in intellectual capital in the surveyed companies was noted. However, no significant impact of the Russian embargo on intellectual capital formation in the surveyed companies was noticed, only in the case of the MV/BV method in the group of II companies there was a slight decrease in intellectual capital, which after a short period returned to its previous level.

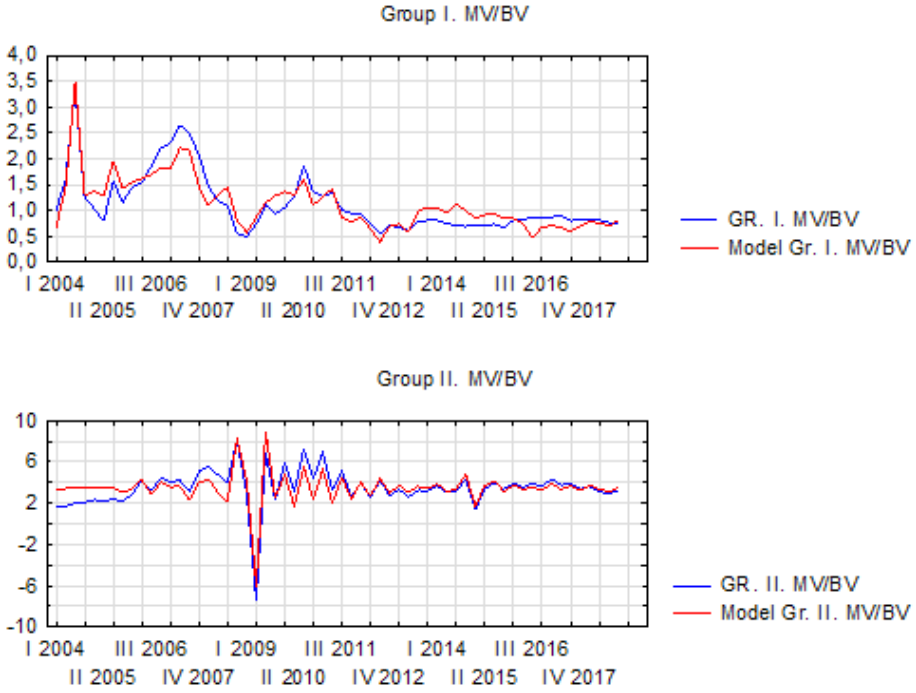
The main difference between groups is observed between their countries of origin and shareholding. Group I, except for the Ukrainian Agroton Plc, are Polish

Chart 3: The intellectual capital formation in 2004-2018 divided into two groups of companies



Source: Own study based on data from the Investing.com financial portal and the Notoria.pl website, download date: 25/05/2019

Chart 4: Model of intellectual capital formation measured by the MV/BV method in groups



Source: Own study based on data from the Investing.com financial portal and the Notoria.pl website, download date: 25/05/2019

companies. Foreign shareholders with more than 50% of shares in the company control only two companies: ZPC Otmuchów SA and Ambra SA. On the other hand, group II consists almost exclusively of foreign companies, including mainly Ukrainian ones (Astarta Holding NV, Ovostar Union NV, Kernel Holding SA, IMC SA), as well as a French company (Marie Brizard Wine & Spirits) and Lithuanian (AUGA Group AB). In other companies, the main shareholders are foreign entities, in Kruszwica SA over 64% of shares belonged to Koninklijke Bunge B.V. Rotterdam and over 25% to Windstorm Trading & Investments Limited, while over 52% of WAWEL's shares belonged to Hosta International AG (Biznesradar.pl, 2019).

Chart 4 presents the results of observations and the regression model of the multiple shaping of the measurement of intellectual capital in two groups of enterprises. For Group I adopted a model equation value:

$$y_t = -0{,}071 + 0{,}388x_{1t} + 1{,}168x_{2t} - 0{,}432x_{3t} + 0{,}923x_{4t} + 0{,}266x_{5t} \quad (3)$$

where y_t = intellectual capital,

x_{1t} = government bonds,

x_{2t} = random ingredient Gr. I. MV/BV,

x_{3t} = financial crisis,

x_{4t} = isolated seasonal component Gr.I. MV/BV,

x_{5t} = introduction of an embargo.

The coefficients of the model's determination indicated a high level of model fit taking the values: R = 0.90, R^2 = 0.82 and improvement. R^2 = 0.80.

For group II. the model's form has adopted parameters referring to previously distinguished seasonal changes, i.e. the value of the random and seasonal component, thus not indicating the relation of the series in relation to the economic events studied. The coefficients of determination of this model were successively: R = 0.88, R^2 = 0.77 and corrected. R^2 = 0.77.

The models made indicate that in the case of using the MV/BV method only in Group I, the financial crisis and the introduction of the embargo influenced the shaping of the intellectual capital of the companies.

Similar calculations were made for the average value of intellectual capital in two groups of companies measured by the q-Tobin method (Chart 5). The values of model parameters for group I. assumed the form:

$$y_t = 1{,}297 + 0{,}14x_{1t} + x_{2t} + 1{,}26x_{3t} \quad (4)$$

where x_{1t} = government bonds,

x_{2t} = isolated seasonal factor,

x_{3t} = isolated random factor.

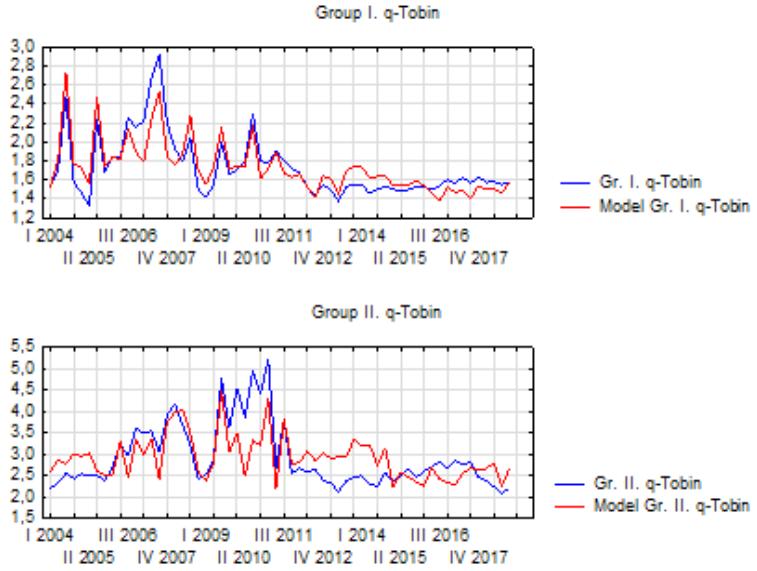
In the case of results relating to the model for group II. the parameter values were as follows:

$$y_t = -0{,}76 + 2{,}88x_{1t} + 1{,}34x_{2t} \quad (5)$$

where x_{1t} = crude oil price,

x_{2t} = isolated random component.

Chart 5: Model of intellectual capital formation measured by the MV/BV method in groups



Source: Own study based on data from the Investing.com financial portal and the Notoria.pl website, download date: 25/05/2019

In addition, both models were characterized by lower statistics of determination coefficients - for the group I model: R = 0.86, R^2 = 0.74 and correct. R^2 = 0.73, while for the group II model: R = 0.68, R^2 = 0.47 and correct. R^2 = 0.45.

The models produced show that the financial crisis and the Russian embargo did not directly contribute to the shaping of the intellectual capital of companies. On the other hand, it is not possible to rule out the indirect impact of crises on the shaping of intellectual capital through their impact on macroeconomic factors included in the model (such as oil prices and government bonds).

Conclusions

The aim of the work was to research the impact of crises on the formation of intellectual capital in companies in the food sector. The work uses the methods of MV/BV and q-Tobin to measure intellectual capital in companies, models describing the formation of the capital were created and the following results were obtained:

1) Only the financial crisis has clearly influenced the intellectual capital of WIG-Food companies.

2) The work noted that companies can be divided into two groups within which companies exhibit similar tendencies in shaping intellectual capital. It was noted that the differences between the groups concerned the countries of origin of the companies. In one of the two groups, six companies come from abroad, while in the other two companies the main shareholders are foreign entities.

3) Models of shaping intellectual capital in particular groups of companies indicated that the crises affected only the intellectual capital calculated by the MV/BV method of the group I company. The capital calculated using the q-Tobin method and the second group were influenced by seasonal factors and macroeconomic factors , such as oil prices or government bond prices. It can therefore be assumed that the financial crisis and the embargo indirectly influenced the intellectual capital of companies by influencing the development of these macroeconomic factors.

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