

Quantitative measurement and modeling of globalization of companies and markets

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Abstract

Based on the improved methodology and evaluation techniques of assessing globalization levels as well as on the basis of analysis of interdependence of globalization processes and effectiveness of a company, this article makes a quantitative evaluation of globalization levels of companies and markets, along with the analysis of influencing factors that determine the extent of globalization that takes place in a company. The globalization level of the largest top-ten companies (according to the rating of Forbes Global 2000 Leading Companies) in 2015 was identified as well as that of corresponding industry markets: auto and truck manufacturers, major banks, software and programming, large department stores (retailers), telecommunication services, electronics producers, electronics, oil and gas operations.

Keywords: *company globalization index, index of market globalization, cluster analysis, factor analysis, correlation and regression models*

JEL Classification: C43, F16, F23, F60, L30, L60

1. Introduction

Formulation of the problem. In order to form a global strategy of competitive behavior of firms, improve their competitiveness and financial level it is major important to evaluate the extent of company's involvement in global relations and globalization levels of markets where a company operates. In this context, the issue of quantitative measurement and based on it positioning of companies in terms of globalization acquires particular relevance along with the analysis of factors that can cause or determine prevalence and depth of these processes.

Analysis of recent research and publications. The broadest characteristic of global markets and directions towards the increase of competitiveness of national economies under conditions of globalizing was suggested by Porter (1886, 1990, 1998). The essence of competitive strategies of global companies and their differences from multinational are described in the works of Porter (1990), Yipa et al. (1988), Azevedo and Bertrenda (2004), Inkpena and Ramasvami (2005), Qian and Li (2002), Rugman et al. (2012) and Schuler (2011). However, the literature neither present approaches to make quantitative assessment of

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companies' and markets' globalization levels no their positioning based on the assessment. Developed by M. Porter, hierarchical system of market globalization indicators, requires adaptation on the basis of industry characteristics, confidentiality level, availability and possibility to obtain a normalized index. In this context, it is important to study the factors affecting globalization level of companies, as well as the impact of globalization on main indicators of a company, such as companies' market value, their efficiency and others.

The purpose of the article – to make a quantitative evaluation of companies' and markets' globalization level and analysis of the factors that determine the extent of globalization that take place in a company based on improved methodology and techniques of globalization evaluation based on the analysis of globalization interdependence and efficiency of a company.

Methodology. This article is a logical continuation of the series of works of authors dedicated to problems of quantitative evaluation of globalization in the modern world and includes: determination of essence of global markets and global industry companies as well as methods of evaluation of companies' and markets' globalization (see e.g. Bazylevych et al., 2014; Kovtun and Ignatyuk, 2014). The method of evaluation, based on the selection of indicators was suggested to be further applied practically; hierarchical system of indicators of companies' and markets' globalization, decomposed system of global market and companies indices that characterize the level of globalization and the processes of its spread and deepening in the world were presented. The index of globalization for individual companies was calculated based on the unweighted arithmetic average and showed that the system of statistical indicators increasingly makes it possible to take into account manifestations of global processes. As a result, the obtained rating conflicts the ratings that are based on individual performance. Thus, a single index includes various aspects of companies' activities that can claim their positioning as global ones. The indicators that have been included in the index of globalization are presented in the previous papers (see e.g. Bazylevych et al., 2014; Kovtun and Ignatyuk, 2014).

2. Results

2.1. Measurement of globalization of companies and markets

At the first stage of the study that assesses the extent of globalization of markets and industries they represent, 16 leading companies were selected. All of them are the leaders in the global ranking – Forbes Global 2000 Leading Companies in 2014 on tobacco, cars and banking services markets. Following the results of sectoral globalization evaluation it was concluded that the most

global markets are those that developed historically and faced less competition. That is why the market of banking services is much less global comparing to tobacco market and far less developed in terms of globalization level than car market, which, itself is quite modern.

In the course of research, additional results have been received, allowing to make adjustments to the grading scale which, as defined, ranges from 0 to 1. Thus, according to the prior proposal, the width of the interval variation scale to identify the extent of globalization constituted 0.(3) units but as the results of more in-depth analysis shows, the group of companies, which is characterized by an average level of globalization is heterogeneous in terms of the depth extent of this process. It is therefore proposed to adjust the scale.

During the second phase of the study, representative samples for 7 markets were formed. They include 10 top companies – leaders in the global ranking of Forbes Global 2000 Leading Companies in 2015, namely: automobile market, banking, telecommunications, software and programming, consumer electronics, retail, oil and gas processing. Based on partial integral assessments of companies, pivot integrated assessment was identified. The assessment was determined for individual groups of companies using the formula of arithmetic mean in terms of market capitalization or the company's role on a market, based on the company's share on the world market in the group of respective companies. The results of globalization index calculation presented in the Table 1, with the fact that new scale of globalization characterizes global processes on the markets of surveyed industries. This gives basis to make more fundamental conclusion.

Market	Market globalization index	Rating	Level of globalization
Software and Programming	0.663	1	above average
Consumer Electronics / Electronics	0.629	2	above average
Oil and gas operations	0.626	3	above average
Major banks	0.536	4	above average
Large department stores (retailers)	0.464	5	average
Auto and truck manufacturers	0.433	6	average
Telecommunications services	0.182	7	low

Table 1. Market rating based on globalization indices.

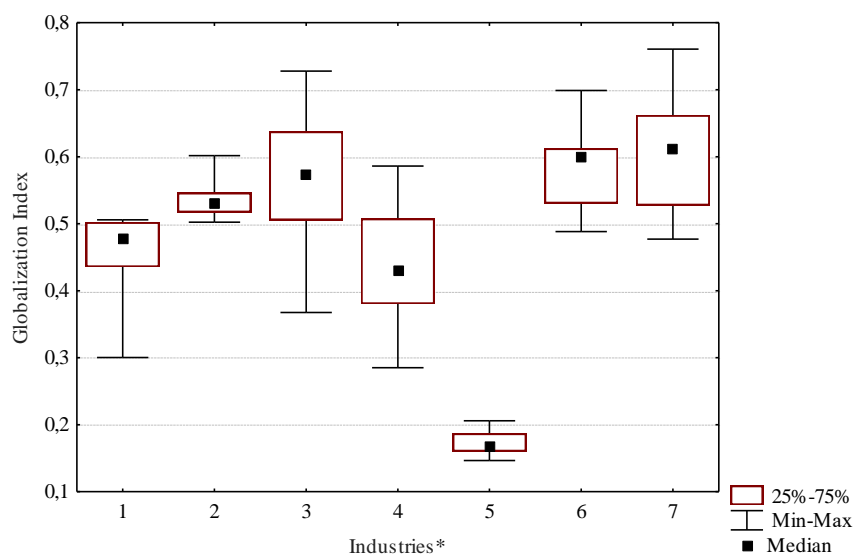
Source: hereinafter – own calculations based on The World's Biggest Public Companies, 2015.

The most global among the considered markets of 10 top companies of Forbes Global 2000 ranking were markets of software and programming and consumer electronics/electronics, which casts doubts on the preliminary conclusion that the most global are those markets that historically have been more developed and are characterized by less competition.

2.2. Analysis of the variation of companies and markets' globalization index

Let us perform analysis of companies' rating patterns and try to identify the factors that lead to a more global level. Fig. 1 shows the categorized diagram of globalization index variation of companies by spheres of economics, which gives grounds to assume that globalization processes are different and have their own specificity, which are defined as peculiar features of the sector as well of patterns of its development.

As it is seen, the most globalized market is a market of software and programming (No. 3 in Fig. 1), yet it is different by its large scale of variation. This only proves that the use of unweighted estimates, excluding the factor of market weight of a company, may give the wrong idea about the real position of industry in terms of market globalization.



*) 1 – Auto & Truck Manufacturers; 2 – Major Banks; 3 – Software & Programming; 4 – Department Stores; 5 – Telecommunications services; 6 – Consumer Electronics / Electronics; 7 – Oil & Gas Operations.

Fig. 1. Categorized diagram of companies' globalization index diffusion by industries.

Despite such variation, the companies of this industry can be considered homogeneous in terms of globality: the coefficient of variation accounts for 18.1%, and the average value of globalization index is typical for this group of companies. However, within this market, as well as on the market of oil and gas operations, there are companies that can be considered to be very global. It should be noted that the difference in the estimation of an average level of companies' globalization index and the market globalization index, which is also an average, can be explained by the fact that in a course of calculation weighted assessment of market globalization index was used, whereas analysis of indices variation supposes unweighted evaluation.

Companies that represent a market of telecommunications services (No. 5 in Fig. 1) – 0.182 (Table 1) show the lowest level of globalization, that corresponds to the lower level rather than to the level that is below average.

The most homogeneous in terms of market globalization appears the market of banking services provided by major banks: the lowest coefficient of variation and oscillation, and the value-weighted and unweighted estimates in terms of globalization (0.536) coincide, indicating a balance of these banks on market. A similar conclusion about a balance can be extended to the market represented by companies' manufacturers of auto and trucks (No. 1, Fig. 1, Table 1). Thus, the results indicate that the level of sector globalization affects the level of homogeneity of product for the intended purpose and degree of standardization of a product. In this case, the term "homogeneity" has a slightly different meaning than it is in a classic economic-theoretical sense. It implies existence of identical product standards, the possibility of unlimited use of products produced in other countries. It is known that the presence of the same product standards characterizes network markets, which, in turn, are more global. The more homogeneous products are presented on a market for their specified purpose, the more global the market is, in particular, a market of software and programming, consumer electronics and oil and gas operations. At the same time, availability of relevant national standards to be met by the product presented on a market, comes into a conflict with the condition of its global turnover and ultimately leads to lower levels of globalization of both the companies and the markets they represent.

For example, the market of software and programming, as well as consumer electronics, has a higher level of globality, compliant to global product standard, compared to the banking market, where the existence of national standards is not only necessary, but also is a prerequisite for the provision of such services.

Among the countries represented by research companies, the USA, Japan and Germany (the top three countries) play the greatest role in globalization of world markets. Interestingly,

that these three countries are members of three continents: America, Europe and Asia. It is significant that almost one-third of the share (29.8%) to the total index of globalization falls on the United States.

Japan is represented by twice as fewer companies – 11 and twice as less contribution (15.1%) in the overall index of globalization. If to unify Germany, UK, Spain, France and Italy, as representatives of the European Union, then 19 of represented companies account for 26% of contribution to the total globalization index, which is still less than that of the United States. Unification of 22 companies in Asia, including Russia, gives a 30.7% of contribution to the total globalization index that is almost comparable to the contribution of the United States. Thus, the USA can be considered the most globalized country in the world, among presented on the target markets.

Continuing investigation on discrepancies that occur in the level of industrial markets globalization, the analysis showed that the examined markets not accidentally differ in depth of globalization processes. Current effect $F(6, 63) = 41.966, p = 0.0000$.

Thus, according to the results of decomposition hypothesis on the average globalization index and t-test for independent samples, there are three clusters of markets where globalization processes are developed and shaped differently.

The market of telecommunication services according to its globalization level has no similarity with any of the examined markets. Compared globalization processes take place on the markets of major enterprises that are engaged in retailing and manufacturing of cars and trucks. The most similar in terms of importance are the markets of consumer electronics, electronics and oil and gas operations. This gives grounds to make an assumption on similarity of forming patterns of globalization development on these markets. Thus, the index of globalization of companies, the calculation of which is based on the method of multidimensional medium, provided an opportunity to consider indicators that characterize different manifestations of globalization processes, and not just figures that reflect the scale of activities, namely, the amount of assets, sales, profits and market value, which more typically characterize leadership, power, attractiveness and financial stability of companies. The obtained result proves that the rating built on index globalization calculation doesn't coincide with the Forbes Global 2000 Leading Companies in 2015 rating, or, in any case, does not follow the consistency pattern of mismatch or partial consistency of ratings. Spearman correlation coefficient equals to the rank of 0.15 and has insufficient level for drawing conclusion about consistency ratings and matching or mismatching of positions are random.

Therefore, in a point of fact, Forbes Global 2000 ranking, is not a rating of global companies but, in essence, is a rating of world leaders, which, naturally, includes global companies as well. Accordingly, the scope of the company's activity and its size is an important sign of globality, but these can not be considered as its only criteria, nevertheless, necessary condition of globalization, but still not sufficient.

2.3. Modelling of globalization of companies and markets

Let us investigate what factors contribute to the growth of companies and markets globality, as well as how a globalization level influences the efficiency of companies' performance. For this, a system of absolute and relative indicators characterizing a company's size, scale and efficiency of its operations was used.

The obtained results give grounds to make interesting conclusions:

1. Strengthening of globalization processes of cars and trucks manufacturers is accompanied by a deterioration of qualitative characteristics of companies' performance that is reflected in negative correlation.
2. The globalization of major banks is not grounded: it occurs by itself and is connected primarily with a high degree of fictitious growth of their assets and their activities. In fact, it indicates absence of connection between their activities and their real assets, and characterizes a significant share of the fictitious part in a composition of their activities.
3. Globalization processes in companies of software and programming are closely related to the realization of the scale effect, inherent to them. They are characterized by the fact that the increase in the absolute size of a company is accompanied by accumulation of potential, increase of resources, scale and results of their performance.
4. Major retailers are not characterized by the scale effect: due to a scale effect, productivity reduces (materiality of this connection has not been proved because of a small sample size). In these companies, the globalization processes have not proven the improvement of quality characteristics of their activities.
5. Low levels of globalization in a sphere of telecommunication services companies, is mainly related to the existence of internal standards for data transmission and can be attributed to the lack of technical support from the side of global telecommunications.
6. Companies manufacturers of consumer electronics and electronics are characterized by positive effects of globalization, accompanied by the increased sales volumes and increased productivity.

7. Globalization of oil and gas companies is also based on a scale effect: the more company is globalised, the greater volume of its sales and assets. However, while the materiality of this connection has not been proven due to a small sample size, the growth of globalization leads to a reduced productivity and is accompanied by a deterioration of profitability indices.

Based on the study results and conclusions, even regression models of influence factors on globalization level, in the context of specific markets, have been developed (Table 2).

Market	Equality	Beta-coefficient	Determination coefficient for the level of probability $p = 0.000$
Auto and truck manufacturers	$0.603 - 0.35 \cdot \frac{MA}{A}$	-0.867	0.751
Software and programming	$0.518 + 0.0013 \cdot A$	0.705	0.497
Manufacturers of consumer electronics and electronics	$0.505 + 0.001 \cdot S$	0.757	0.574
Gas and oil operations	$0.452 + 0.001 \cdot S$	0.754	0.569

Table 2. Results of correlation-regressive analysis of influence factors on the globalization level broken down by industry markets.

According to the modeling results some general and partial conclusions can be drawn:

- the level of globalization on the market of auto and trucks at 75.1% is linearly explained by a reduction of market capitalization level per unit of assets that is globalization is accompanied by a decrease in the market value of company's assets per unit: if globalization index increases by 0.1 points, the market value per unit of assets decreases to 0.2168 dollars per dollar assets in 75% of cases;
- the globalization level on the market of companies developing software and programming at 49.7% is linearly explained by the asset growth, i.e. globalization is accompanied by an increase in value of company assets if globalization index increases at 0.1 points, the market value of assets increases at 38.357 billion dollars in 50% of cases;

- the globalization level of companies-manufactures of consumer electronics and electronics, as well as oil and gas operations at 75% linearly explained by the growth in sales, i.e. globalization is accompanied by a strengthening of the market position of companies: if globalization index increases by 0.1 points, the sales volume increases at 59, 93 billion dollars for companies-manufacturers of consumer electronics and electronics and 93.959 billion dollars for oil and gas companies in almost 57% of cases.

Conclusions

The analysis results allowed to obtain a significant amount of visual and analytical material that gives grounds to draw the following conclusions:

1. The sectoral globalization level is affected by a level of homogeneity of a product according to its intended purpose and a degree of the product standardization. By “homogeneity” we mean the existence of identical product standards, the possibility of unlimited use of products produced in other countries. The more homogeneous the products are in the market at their purpose, the more global it is, in particular, it is a market of software and programming, consumer electronics, and oil and gas operations. At the same time, the availability of relevant national standards to be met by a product on a market, comes into conflict with the terms of its global turnover and ultimately leads to lower globalization levels of both companies and the markets they represent.
2. Among the countries that represent the examined companies, the greatest role in the globalization of world markets (the top three countries) is played by the USA, Japan and Germany. Almost one-third of contribution (29.8%) to the total index of globalization falls on the United States. Japan is represented by twice as fewer companies – 11, and a half of contribution (15.1%) in the overall index of globalization.
3. The increase of globalization is accompanied by: on the market of car manufacturers – a reduction in the market value of company assets per unit; on the market of software and programming companies- the rising of company assets cost; on the market of companies-manufacturers of consumer electronics and electronics, as well as oil and gas operations – strengthening of market position of the companies.
4. It was established that the globalization of major banks cannot be attributed to anything: it occurs by itself and is connected primarily with a high degree of fictitious growth in their assets and their activities. In fact, it indicates the absence of a link with their real assets, and characterizes the significant share of transactions with fictitious assets in the structure of their activities.

5. Major retailers are not characterized by a scale effect: due to a scale effect, productivity reduces (materiality of this connection has not been proved likely due to a small sample size). It also has not been proven that these companies experience the improvement of quality characteristics of their activities along with the globalization processes they undergo.

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