

## Summaries of doctor's theses

### **POMIAR I OCENA MIĘDZYNARODOWEJ KONKURENCYJNOŚCI PRZEMYSŁU SPOŻYWCZEGO (MEASUREMENT AND ASSESSMENT OF THE INTERNATIONAL COMPETITIVENESS OF THE FOOD INDUSTRY)**

**Doctoral dissertation by mgr Katarzyna Łukiewska**

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### **Introduction**

Competition in economic terms is related to business activity and market-oriented management. It is understood nowadays as competition and rivalry between entities pursuing similar goals, and is treated as one of the basic economic mechanisms of market economy. Given ongoing globalization, integration and internationalization processes, and the opening of national economies as well as the free flow of inputs between countries, the following increase in the extent and intensity of competition, international competitiveness is an important and topical research area in the economics. Competitiveness is currently one of the commonly used and relatively often researched categories, dealt with by both economy theoreticians and business entities. However, the complexity and multidimensionality of competitiveness makes its definition and quantification extremely difficult. Despite the relatively high interest in this subject, competitiveness is still an ambiguously defined term. In the literature there are excessively many definitions of competitiveness, with none commonly accepted. Multidi-

mensionality and the associated ambiguity in defining and interpreting this concept make measurements in this area difficult. The multitude of approaches to competitiveness results in diverse indicators presented in the literature to assess its various aspects. So far, no standard, universal measures or coherent methods for assessing the competitiveness of entities at the meso-economic level have been developed. An overview of the methods of measuring the competitiveness of the industry shows the use of two groups of measures. The first one refers to the factor-based aspect of competitiveness, and includes productivity and prices of inputs as well as relations between them. The other group relates to the competitive position and includes indicators such as trade balance, shares in the global market and indices of the revealed comparative advantage. The analysis of previous research has identified certain gaps in the method of measuring and assessing the industry's competitiveness. There are no studies dealing with these issues holistically, which would assess competitiveness in a synthetic way, while pointing to competitive factors and results. Only such an approach to the problem enables comprehensive assessment of competitiveness, taking into account its sustainable growth. It should also be noted that most of the analyses and models presented so far do not account for innovation. In the literature, however, the growing importance of new determinants of competitiveness related specifically to progress and innovation is emphasized. The selection of appropriate tools and methods to measure and assess competitiveness at the level of the industry is, therefore, a major research problem.

The food industry analysed in the study is one of the most important, in economic and social terms, sectors of the EU economy. It includes nearly 265 thousand enterprises that generate an annualized value added of EUR 866 billion, i.e. 13.1% of the value added generated by the entire manufacturing sector. Food is also a strategic commodity that satisfies the basic needs of the society. Therefore, respective EU Member States strive to improve the competitiveness of food producers. The considerations presented in the paper attempt to supplement the indicated methodological and cognitive gaps.

### **Objective of the paper, research hypotheses and scope of research**

The main objective of the research conducted as part of the doctoral dissertation was to develop a measurement model and assess the international competitiveness of the food industry in the European Union countries. To pursue the thus formulated main objective, the following specific objectives were defined:

1. Development of a model for measuring the sector's competitiveness.
2. Assessment of the potential, position and competitiveness of the food industry in the European Union countries.
3. Determination of the interaction between competitive potential and the competitive position of the food industry in the European Union countries.

In the context of the adopted research objectives, the following research hypotheses were formulated:

1. Heterogeneity of the components of the food industry's competitiveness translates, at the level of a country, into its diversification.
2. There is a positive relationship between competitive potential and the competitive position of the food industry.

3. The components of competitive potential uniformly affect the competitive position of the food industry.

The research covered the food industry in respective EU Member States and was dedicated to the international competitiveness of the food industry, defined in this paper as: the ability to sustainably strengthen and retain a profitable share in domestic and export markets on which the industry operates. Consideration was given to supply competition regarding the competition within the industry between respective EU Member States struggling to win consumers. Having regard to the geographical criterion, the European Single Market was adopted as the competition area. The time frame of the analysis was 2007-2015.

### Research methods

The research was predetermined by the accomplishment of the main objective and the specific objectives. The research was carried out in three stages, each of which allowed for accomplishing one specific objective and verifying the hypotheses associated with it. In the first stage of the research, analysis and criticism of the literature were carried out. Based on literature research involving a number of domestic and foreign publications and on legal acts, theoretical concepts relating to defining and interpreting competition and competitiveness, delimitation of the industry, concepts and sources of international competitiveness of the industry as well as specific characteristics of the food industry's competitiveness were reviewed. Then, a comprehensive review of the existing methods of competitiveness measurement at the level of the industry was made, and the available statistical data were analysed. This allowed for systematizing relevant knowledge and developing an original model for measuring the competitiveness of the industry. The starting point in the model building process was the conceptualization of the concept of competitiveness with respect to the competitive capacity and competitive position. Then, having regard to substantive and statistical premises as well as the definition of the industry's competitiveness adopted in the paper, a set of indicators describing these categories was created. The competitive capacity is described by means of the following indicators:

1. The country's share in the total number of the EU food enterprises (PPR).

$$PPR_{it} = \frac{LP_{it}}{\sum_{i=1}^n LP_{it}}$$

where:

$PPR_{it}$  – the share of country  $i$  in the total number of the EU food enterprises in period  $t$ ;

$LP_{it}$  – the number of food enterprises in country  $i$  in period  $t$ ;

$n$  – the number of analysed countries.

## 2. Labour productivity (PP).

$$PP_{it} = \frac{V_{it}}{Z_{it}}$$

where:

- $PP_{it}$  – labour productivity in the food industry in country  $i$  in period  $t$ ;  
 $V_{it}$  – value of sold output of the food industry in country  $i$  in period  $t$ ;  
 $Z_{it}$  – average employment in the food industry in country  $i$  in period  $t$ .

## 3. Unit labour costs (JKP).

$$JKP_{it} = \frac{KP_{it}}{V_{it}}$$

where:

- $JKP_{it}$  – unit labour costs in the food industry in country  $i$  in period  $t$ ;  
 $KP_{it}$  – labour costs in the food industry in country  $i$  in period  $t$ .

## 4. The share of innovation-active enterprises in the total number of food enterprises (I).

$$I_{it} = \frac{P_{lit}}{P_{it}}$$

where:

- $I_{it}$  – the share of innovation-active enterprises in country  $i$  in the total number of food enterprises in period  $t$ ;  
 $P_{lit}$  – the number of food enterprises in country  $i$  surveyed as part of the CIS, that introduced in analysed period  $t$  innovation of any type;  
 $P_{it}$  – the number of all food enterprises in country  $i$  surveyed as part of the CIS in period  $t$ .

The competitive position of the industry was determined by means of the following indices:

## 1. Share in the intra-EU exports (U).

$$U_{it} = \frac{E_{it}}{\sum_{i=1}^n E_{it}}$$

where:

- $U_{it}$  – the share of the food industry in country  $i$  in the intra-EU exports in period  $t$ ;  
 $E_{it}$  – the value of exports within the food industry in country  $i$  to the EU market.

## 2. Trade coverage ratio (TC).

$$TC_{it} = \frac{E_{it}}{Im_{it}}$$

where:

- $TC_{it}$  – trade coverage ratio in the food industry in country  $i$  in period  $t$ ;  
 $Im_{it}$  – value of imports in the food industry in country  $i$  from the EU market in period  $t$ .

### 3. Profitability of the industry (R).

$$R_{it} = \frac{NOB_{it}}{O_{it}}$$

where:

$R_{it}$  – profitability of the food industry in country  $i$  in period  $t$ ;

$NOB_{it}$  – value of the gross operating surplus in the food industry in country  $i$  in period  $t$ ;

$O_{it}$  – value of turnover in the food industry in country  $i$  in period  $t$ .

In the second stage of the research, the competitive capacity, position and synthetic competitiveness of the food industry in the EU Member States were assessed with the use of the developed research model. The comparative method and descriptive statistics were used to evaluate the selected indicators describing the competitiveness of the food industry in the different EU Member States. Then, methods of multidimensional statistical analysis, including non-linear ordering and line ordering, were applied. In order to compare and aggregate the different sub-variables, these were standardized in a classical manner. The Ward's method was used to develop a typology of the EU Member States, based on the group of hierarchical agglomerative methods of cluster analysis. The resulting typological classes were described based on intra-class means and analysis of the level of selected features in the different Member States. The Hellwig's method of constructing a synthetic index was used to replace the analysed sub-indices describing a given country with one aggregate value to establish a hierarchy of countries in accordance with the competitiveness of the food industry. Then, the mean and standard deviation were used to identify four groups of countries with high, medium, low and very low levels of the synthetic index. Ward's method and the synthetic index were applied three times, to assess the competitive capacity, competitive position and competitiveness of the food industry.

The third stage featured determination of the interactions between the competitive capacity and the competitive position, as well as their components. The correlation diagrams were used to present the relationships between selected features describing the competitive capacity and competitive position in a graphic form and to determine the nature of these relationships. The Pearson product-moment correlation coefficients were used to assess the strength and nature of the dependencies concerned. The panel regression method was used to estimate the impact of features describing competitive capacity on the development of sub-indices and the synthetic competitive position index. Panel regression models, estimated using the classical least squares method (ones with fixed effects and ones with random effects), were developed. In the verification of the models, the coefficient of determination  $R^2$ , the Fischer–Snedecor  $F$  test of  $R^2$  significance, the student's  $t$ -test of the significance of the model parameters, standard errors and the Akaike information criterion were used and the coincidence property was tested.

## Research results and key conclusions

The results of statistical analyses and econometric modelling made it possible to verify the adopted research hypotheses. The first hypothesis assumed that the heterogeneity of the components of the food industry's competitiveness translates at the

country's level into its diversification. This hypothesis was confirmed. Based on coefficients of variation, it was found that all selected indicators describing both the competitive capacity and competitive position were characterized by significant diversification in the food industry in the EU countries. In the course of the conducted analyses, it was also found that it is not possible to identify one component of competitiveness that would be universal for all countries and would determine its diversification, while ensuring a high level of competitiveness. Using the Ward method, typological classes, characterized by a similar level of features describing the competitive capacity, position and competitiveness of the food industry, were created. Various competitive advantages were identified in different groups. In none of these groups was it found at a time that countries achieved high results with respect to all analysed components. For example, as for competitive capacity, countries in Class I (Belgium, Ireland and the Netherlands) were characterized by a high level of labour productivity, those in Class II (France and Italy) were characterized by a high level of production capacity, while those belonging to Class VIII (Bulgaria, Latvia, Hungary, Romania and Poland) – by low labour costs. As for the competitive position, Type II countries (Denmark, Hungary and Spain) were characterized by a high trade coverage ratio, Type III (Belgium, France and Germany) – by a high share in exports, and Type V ones (Greece and the United Kingdom) – by high profitability. Consequently, a similar situation occurred with respect to international competitiveness (accounting for the competitive capacity and competitive position at a time). Type III countries (Greece and the United Kingdom) were characterized by high profitability, Type IV (the Czech Republic, Lithuania, Slovakia, Estonia and Portugal) and Type V (Bulgaria, Hungary, Poland, Latvia and Romania) – by low (or very low) labour costs, and Type VI (Belgium, Denmark, Spain and the Netherlands) – by a high trade coverage ratio.

In the course of the research into the first hypothesis and its verification, it was also found that various components of competitiveness determined the high position of the EU Member States in ratings of the competitive capacity, position and competitiveness, developed based on synthetic indicators. Relatively high competitive capacity was recorded in France, Italy, Belgium, Germany and Ireland. France and Italy were distinguished mainly by the volume of production capacity, Belgium – by a high level of innovation, Germany – by the volume of production capacity and innovation in the industry, and Ireland – by labour productivity, labour costs and innovation. The highest competitive position of the food industry was recorded in Ireland, Spain, the Netherlands and Poland. The advantage of Ireland and Poland resulted mainly from the high profitability of the industry, while that of Spain and the Netherlands was due to a positive balance of trade. The high international competitiveness of the food industry (accounting for the competitive capacity and the competitive position at a time) in Ireland was mainly due to outperformance in labour productivity, relative labour costs, innovation and profitability. In Italy, it was production capacity, as well as innovation, labour productivity and relative labour costs, while in the Netherlands and Spain – the balance of trade. Belgium outperformed other countries in innovation, as well as relatively low labour costs, while Germany – in the volume of production capacity as well as innovation in the industry and the share in exports. France outperformed other countries in production capacity and the share in exports. The research results are consistent

with the theoretical considerations presented in the literature. Numerous concepts present various categories and indicators describing the competitiveness of entities at various levels of economic analysis. These include availability of factors of production, relative, absolute and alternative costs, labour productivity, technological advancement, similar demand preferences, product diversification, productivity of factors of production, the balance of trade, profitability and comparative advantages.

The second research hypothesis referred to the existence of a positive relationship between competitive capacity and the competitive position of the food industry. This hypothesis was verified positively. Based on Pearson product-moment correlation coefficients and correlation diagrams, a statistically significant linear relationship was found between the synthetic competitive capacity index and the synthetic competitive position index. Depending on the adopted time range, Pearson product-moment correlation coefficients were in the range of 0.44-0.52, and were statistically significant. In most of the analysed countries, there were also analogies between the assessment of these two categories (made based on the mean and the standard deviation). The above-average level of both the competitive capacity and the competitive position of the food industry was recorded in Spain, the Netherlands, Ireland, Greece, the United Kingdom, Denmark, Belgium, Germany, Italy and France. A low (or very low) level in these two categories was recorded in the food industry of Latvia, Romania, Luxembourg, Lithuania, the Czech Republic, Estonia, Slovakia, Croatia, Slovenia, Sweden and Cyprus. The relevant results are an empirical confirmation of the relationships between the various components of competitiveness, presented in the literature. In accordance with theoretical models, competitive capacity leads to accomplishment of specific competition results, and these results determine the volume and quality of the competitive capacity.

The third research hypothesis, which assumed that components of competitive capacity uniformly affect the competitive position of the food industry in the European Union countries, was rejected. This hypothesis was tested using panel regression models. The research shows that a given country's share in intra-EU food exports was significantly affected by labour productivity and the production capacity volume. The estimated directional coefficients of the model were positive. The joint development of these two categories explained in 66.78% differences in the share in food exports in the EU Member States in the analysed period. In the course of the research, cause and effect relationships between labour productivity and relative labour costs versus the TC index were identified. In countries with higher labour productivity, as well as lower relative labour costs, a higher relative intra-EU balance of trade in food was recorded. In total, these two components explained 42.0% of the TC index variance. The profitability ratio was described by three variables: labour productivity, relative labour costs and the production capacity rate. In this case, the determination coefficient was relatively low and amounted to 10.48% (the F test shows, however, that it was statistically significant). This proves high significance of the factors affecting the profitability of the food industry other than those included in the model. The results of the space-time modelling of panel data, taking into account permanent individual effects, confirmed the significant impact of labour productivity, relative labour costs and production capacity on the level of the synthetic competitive position index of the food industry in the EU Member States in the analysed period. The directional coefficients corresponding to the PP and

PPR variables were positive, while that corresponding to the JKP variable was negative. These three categories describing competitive capacity explained jointly 53.30% of the variance of the synthetic competitive position index. These conclusions are consistent with theoretical concepts regarding the impact of labour productivity (Melitz model), labour costs (the theory of comparative costs) and production capacity (the industry concentration concept) on trade performance of enterprises and industries in international trade, presented in the literature. The models developed in the empirical part of the study did not confirm a statistically significant causal-effect relationship between the selected measure of innovation versus sub-indices and the synthetic competitive position index. Thus, the assumptions of Posner's technological gap theory, in accordance with which innovative solutions help to increase sales and exports of products to foreign markets, were not confirmed. It would be reasonable to use other measures of innovation in the industry in further research. It is also worth noting that the lack of a general relationship between innovation and competitiveness of the food industry in the EU Member States does not mean that these two categories are by no means related. Innovation can be one of numerous determinants of the competitive position used only in some Member States.

The implementation of the research procedure and the accomplishment of the research objectives set in the thesis make it possible to formulate some methodological remarks and identify limitations in the assessment of the industry's international competitiveness, found at every stage of the conducted analyses. The lack of a clear definition of competitiveness was the first difficulty encountered in the course of the research. It should be emphasized that the way in which competitiveness is defined is of fundamental importance in researching and assessing this phenomenon, as it determines the selection of appropriate indicators and adequate methods of its measurement to solve a specific research problem. Significant limitations of research into competitiveness are related with insufficient availability of statistical data. For example, there is no information in available databases on the gross value of non-current assets and current assets in the food industry in the EU Member States. Therefore, it was not possible to use, e.g. the Cobb–Douglas production function and estimate total productivity. It is not possible to obtain complete data regarding innovation in the food industry (including the value of exports of new and modernized products) either. Moreover, data regarding innovation are published every two years and are aggregated for three-year periods. In the course of the research, some limitations to the use of statistical and econometric methods in analysis of the interaction between the competitive capacity and the competitive position of the industry were also observed. For example, short time series were a barrier to performing the Granger causality test, while a relatively small number of observations and the lack of normal distribution of the values of the adopted competitiveness indices prevented the use of the canonical correlation method.

The methodological remarks presented herein show that the discussion on the methodology of measurement and assessment of competitiveness at the level of the industry should continue. Further exploration of these issues may regard the selection of competitiveness indices and the search for other factors describing competitive capacity that could determine accomplishment of a competitive advantage, and the recognition of other measures describing the different components of competitiveness, including

industry innovation. It would be interesting to introduce a differentiation of the impact of the different sub-indices on the multidimensional assessment of competitiveness, by determining the weights of the adopted measures and more in-depth analysis of the relationships between competitive capacity and the competitive position.

### **Significance of the research**

The dissertation includes an original model for measuring the competitiveness of the industry, which fills the methodological research gap in the acquis in the area of economic sciences. The proposed original research model is universal and has a wide range of applications. It is a tool that can be used to monitor the competitiveness of various industries, sectors and branches in spatial terms. The results of such analyses can be used by various types of business entities. Enterprises can obtain information on the profitability and attractiveness of the industry and on elements determining the accomplishment of a sustainable high competitive position on international markets by entities representing any industry. Identification of industries with sustainable advantages on international markets may help state authorities to formulate guidelines for economic policy and build the competitiveness of the entire economy, which is based, to a large extent, on the competitiveness of the various industries.

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