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The competitiveness of the EU sugar industry[*1]

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Abstract

This research investigates competitiveness of sugar manufacturing companies of the European Union (EU). Sugar industry represents a vital part of the EU food and beverages industry. The aim of the research is to show how EU sugar producers can be more competitive on internal and global sugar market. The methodology includes dynamic panel data models using sample covering up to 189 sugar manufacturing companies from 25 EU Member States in the period 2008-2016. The key results demonstrate different impact of technology (Research and development activity), investments, sugar beet production, costs of employees, gas and sugar beet prices on average revenue of the EU sugar industry. The results confirm the importance of inputs such as natural gas, revenues from the previous period and investments as key factors of EU sugar industry competitiveness. The proposals and recommendations are presented after research results.

Key words: *competitiveness, sugar industry, the EU, GMM estimator*

JEL classification: *D24, O32, L66*

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1. Introduction

From the perspective of the global sugar market, there are some key factors which have shaped its development. According to Baron, (2008) and Nicoleta Pop et. al. (2013) these factors include the emergence of Brazil as one of the main players on the sugar and ethanol market, the major reform of the EU sugar policy, the expanding attention to environmental problems. It is worth noting that other relevant factors should be taken into consideration such ase the economic expansion of the emerging Asian economies, the necessity of developing alternative energy sources, the emergence of sugar crops as an energy supplier within increased oil prices and geopolitical tensions as well asd the extension of the refining industry and increased cross-border investments.

The European Union (EU) currently represents the world's leading beet sugar producer with share of approximately 50% of the whole beet sugar production process. Moreover, The EU almost reaches level of self-sufficiency within sugar production (Herceg, 2014). The Major part of the EU's sugar beet is grown in the northern part of Europe, where the climate is better for producing beet. The major competitors are in Germany, northern part of France, the United Kingdom and Poland (Europa, 2018).

The sugar industry represents an essential element of the rural economy (Banerjee, 2008). Approximately 2 million hectares are given over to sugar beet growing on generally medium-sized farms (CEFS, 2002). France and Germany represent for about 50% of the total production of EU sugar. Within the EU, literally all sugar – 98% of whole production – is derived from sugar beet (Vidal, 2000). Sugar cane has a share of about 78% of the world sugar production and other is produced from sugar beet (Herceg, 2014). Moreover, sugar cane includes lower level of sugar (standard average content of sugar is 12%), while sugar beet is more abundant in sugar (an average content is about 16%) (Dahlia, Anggakusuma, Kurniawan, Roshetko, 2010). The EU includes refining industry that processes imported raw cane sugar. EU sugar industry includes approximately 145000 sugar beet growers, which are in 20 EU countries. The EU sugar beet processing sector employs about 28000 workers.

On the other side, sugar beet production accounts for 20% of the global sugar production. The EU export activity accounts for 8% of its sugar production. That means that the EU tends to import more than export while supporting producers in many of the least-developed countries through duty- and quota-free imports. Moreover, the EU signed agreements with certain countries granting them tariff import quotas with reduced duties for sugar (Europa, 2018).

To support EU farmers and processors, the sugar industry was originally under specific measures such as production quotas and a minimum price. EU sugar industry was introduced by the rules of the sugar common market organization (CMO) in

1968, together with a higher support price for sugar producers than global market price (Europa, 2018). Meanwhile, the protective Common Agricultural Policy (CAP) had as one of its key scopes the self-sufficiency for food production by stimulating agriculture with remunerative and stable prices. CAP provided high incomes for European farmes Quotas. Along with a support price, CAP welcomed initiative to realize these aims in the sugar industry. However, EU agriculture sector became more market-orientated (the quota system was completed on September 30th, 2017. Rabobank International (2002) noted that EU sugar policy was established on 3 main requirements:

- production quotas and guaranteed price to adjust sugar market;
- process of intervention by buying and export restitutions to keep a high internal price;
- import tariffs and tariff-rate quotas to restrict imports in terms of country of origin and volume.

These reforms in 2003 (Nicoleta Pop et. al., 2013) have improved yield for sugar beets and growing efficiency in refining activity.

One of key motives for conducting this research is the fact that there are only few studies that are strictly oriented towards measuring the competitiveness of the EU sugar industry. This study is based on the hypothesis that sugar production inputs and market prices have significant impact on EU sugar industry firm's operating revenue in EU average operating revenue. It can be assumed that inputs such as sugar, gas price and sugar beet crop production have significant impact on competitiveness of the EU sugar industry. The main scope of this paper is to test the impact of internal (production input) and external (market prices, crop production) on competitiveness of 189 EU sugar-manufacturing companies and propose measures to improve the level of competitiveness.

Literature review section follows the introduction of the paper. The methodological approach is presented within the third section. The fourth section show econometric aspects and model testing. The fifth part of the paper indicates empirical results. Final section sets out proposals and conclusion.

2. Literature review

Although there are many research papers which examine competitiveness on national, sector and firm level, few studies are explicitly focused on the competitiveness of sugar industry of certain countries/group of countries.

The theoretical background of competitiveness has been discussed while implementing 3 key perspectives (Thorne 2004): traditional trade, industrial organization and strategic management theories. According to Kennedy et al. (1997), competitiveness can be observed from several different standpoints. Some authors distinct competitiveness as the ability to sustain a satisfying growth rate and real standard of living (Landau, 1992).

Generally speaking, the competitiveness represents the ability of a company or a group of companies (as part of an inter-connected system) to get market share, within domestic or international market. By creating cost efficiencies throughout the network of companies causing increasing returns to labor and capital (Banerjee, 2004).

Agriculture companies achieve higher level of competitiveness because of cost efficiency, leadership and/or differentiation of product (Porter, 1980). Moreover, technology attributes of production economies, product differentiation, purchased inputs, and external factorst represent key foundations of competitiveness (Harrison, 1997). Each characteristic affects a company's level of costs and the degree of product differentiation. These factors influence profits and market share (Kennedy, 1998).

Black and Boal (1994) noted inputs like human, physical and organizational capital resources. Abundance of these inputs boosted competitive performance of Australian sugar processing companies that achieved higher level of technical efficiency with low costs of productions and the highest recovery rate in the world.

In having been insulated from the dynamic global sugar market, companies started generating specific competencies and skills that are necessary for business success. According to Vasconcellos and Hambrick (1989), these characteristics of company's accomplishment are under the influence of task environment and arising essential market factors (production, product, product cost, product delivery, communication and information). In addition, Taggart and Taggart (1999) note that "non-price competitive activity, identified as an important element of competitiveness in imperfect markets, relies on investment in R&D".

According to Zimmermann and Zeddies (2001), sugar production competitiveness is influenced by many location factors like natural features (topography, temperature, and rainfall), economic location factors (opportunity costs of land, capital, labor and productivity), political location factors (factor and product prices), taxes and legislative. The competitiveness of sugar production industry is impacted by current and liberalized market conditions which can only be drawn from an analysis of the existing natural, economic and political production conditions and the expected development of the different location factors.

Authors have examined Brazil, Australia, Thailand and partly South Africa as one of the major sugar producers from 1997 to 1999. They have stressed out Australia and Brazil that profit from favorable natural, economic and political location factors. On the other hand, Germany faces high opportunity costs as well as high environmental and social standards predominate the advantages of high efficiency in the sugar sector. According to Zimmermann and Zeddies (2001), Thailand and South Africa proved to be countries with low productivity, low wages and low environmental and social standards.

Kennedy and Harrison (1999) examined the factors that influence competitiveness of the sugar beet industry. The group of observed countries included EU Member States (France, Germany, Italy, and the United Kingdom) and the USA. Authors estimated average annual changes in production and processing costs within year 1979/80 and 1994/95. They have concluded that relative competitiveness of the U.K. and the U.S. production sectors has improvedemore in comparison to other countries while achieving higher level of competitiveness in sugar production and processing sector.

Arjchariyaartong (2006) analyzed the costs and returns between sugarcane and its competing crops in Thailand (Central, Northeastern and Northern Thailand) as one of the leading sugar exporters in the world. The Observed period was from 1982 to 2006. The author emphasized low sugarcane productivity in Thailand, needed assistance from government, research and development, product differentiation, lower energy costs as key factors which improve Thai's sugar industry competitiveness.

Boland and Marsh (2006) examined marginal costs of 7 vertically integrated sugar beet plants representing three different companies in the USA between 1978 and 2000. Their research included inputs such as labor, capital, energy, marketing costs, average quality sugar beet, and above average quality sugar beet categories. The result quantified relationship between high quality sugar beets and lower processing costs. One of the important implications of this research is that higher quality sugar beets reduce costs of production.

Banerjee (2008) conducted SWOT and PESTEL analysis of Australian, Brazilian and the EU sugar industry. Special emphasis is put on company, industry, strategy and socio-political effects. The results stress out the variations of international competitiveness as is pursued in Australia, Brazil, and the EU and as reflected through firm effects from these three economies. The Author concluded that companies have strong monopoly power and efficiencies through scale and scope which has resulted in industry characteristics with strong R&D activities, industry stability, high profitability, and high industry standards. Banerjee highlighted the importance of these four effects that are very solid and interactive for EU companiess and thus, placing them in a unique position of being highly internationally competitive.

Nicoleta Pop et al. (2013) compared evolution of price indices for Romanian sugar market within the period from 2001 to 2012. Authors concluded that volatility of sugar prices is derived from its origins on the shocks and transformations of Romanian market. They concluded that the Romanian sugar industry has experienced transformations (low productivity levels, inadequate funding) which had an important influence on efficiency and international competitiveness.

According to Collis (1991), Brazilian sugar producers have individual characteristics due to the different accumulation of physical assets based primarily on the nation's vast natural resources with adequate climate. Likewise, firms' irreversible investments made in various inter-related assets (Collis, 1991) such as sugarcane processing, power generation, and ethanol production, have led to in securing the individual value of the company (Ghemawat, 1991). Brazilian companies have reached their 'strategic move' determined by its specific assets – technological assets, complementary assets, market (structure) assets, and the degree of integration (vertical, lateral, and horizontal) (Teece, Pisano and Shuen, 1997) and through related diversification (Chatterjee and Wernerfelt, 1988).

If we recapitulate results of previously mentioned research papers, it can be concluded that technology (R&D), market prices an, energy cost of, sugar production represent key factors for competitiveness in sugar industry. These factors will be presented and quantified within the following methodological part of the paper.

3. Methodology

In this research paper, the competitiveness of the EU sugar industry is tested using the system GMM (2-step) dynamic panel method with asymptotic standard errors function. To present unbiased results, we have selected the two-step estimator method. The 2-step estimator is asymptotically efficient and robust to whatever patterns of heteroskedasticity and cross-correlation between the sandwich covariance estimators exist. Additionally, some authors often described 1-step results as well, because of the downward bias in the computed standard errors in the 2-step estimator. Moreover, 1-step GMM has certain limitations (Ullah et al. 2018). To escape possible data loss owing to the internal transformation problem with the 1-step GMM, Arellano – Bover (1995) suggested the use of a second order transformation (2-step GMM).

Two types of dynamic estimators were constructed while using GMM methods: differentiated GMM estimator (Arellano – Bond 1991) and system GMM estimator (Arellano – Bover 1995; Blundell – Bond 1998). Differentiated and system GMM estimators have been formed for dynamic panel analysis and have certain assumptions on data generating process (Roodman 2009), such as:

- the possibility of autonomously distributed individual time-invariant effects,
- such a situation is contrary to the temporal regression model,
- some of the regressors can be endogenous,

- the occurrence must be dynamic in nature, with the realization of the current dependent variable that is influenced by the variable from former periods,
- idiosyncratic disorders (except for time-invariant effects) have specific forms of heteroscedasticity, autocorrelation, and
- idiosyncratic disorders are uncorrelated between individual variables.

The dynamic model with a single time-shifted (lagged) variable can be shown by the following equation (1):

$$y_{it} = \beta y_{it-1} + u_i + v_{it}, |\beta| < 1 \quad (1)$$

Where y_{it} represents the value of the dependent variable in period t; y_{t-1} is marked as dependent variable with a shift (lag) for one period from t; u_i indicate individual time-invariant effects, and v_{it} represents the random error. Individual impacts are treated as stochastic. Further assumption that is crucial for the consistency of the model are errors v_{it} which are serially uncorrelated. Individual time-invariant effects are primarily associated with the former impact of the dependent variable of the model, which points to the above-mentioned problem of endogeneity.

The GMM method removes endogeneity by "internally transforming the data". This transformation refers to a statistical process where a variable's past value is subtracted from its present value (Roodman 2009: 86).

In some situations, when there is no serial correlation (autocorrelation) in the random error, the lagged differences i.e. shift of endogenous variables can be incorporated as the instruments of the model (Arellano – Bond 1991; Greene 2005).

This study indicates major impact of inputs on the competitiveness of the EU sugar industry. We have chosen relevant inputs (share of firm's operating revenue in EU average operating revenue from previous year, investments in tangible fixed assets, average cost of employee, sugar price index, gas price index, sugar beet crop production, R&D expenditure) and output (share of firm's operating revenue in EU operating revenue of EU sugar industry). Most variables are transformed in natural logarithms. Visible and statistically significant impact is expected for all variables. The variables for average cost of employee, investments in tangible fixed assets, sugar price index, sugar beet crop production, R&D expenditure should have a positive sign except gas price index. Competitiveness represents a process that changes over time. Verifying the above estimates may demonstrate the significance of input variables on the share of firm's operating revenue in EU average operating revenue.

These assumptions will be subject to econometric validation process to confirm the main hypothesis of this study. Based on the model, relevant variables are chosen and verified. The econometric model is constructed as following:

$$\begin{aligned} ORshare_{it} &= \beta_0 + \beta_1\, ORshare\,(\text{-}1)_{i(t-1)} + \beta_2 Averagecostofe \sim_{it} + \\ &+ \beta_3 LNTangiblefixeda \sim_{it} + \beta_4 Indexsugar_{it} - \beta_5 Indexgas_{it} + \\ &+ \beta_6 LNsugarproductio \sim_{it} + \beta_7 LNRDpps2005\_3_{it} + \sum_{t=2010}^{2016} year_t + u_{it} + v_{it} \end{aligned} \quad (2)$$

The share of firm's operating revenue in EU operating revenue of EU sugar industry (*ORshare*) is chosen to be a dependent variable of the econometric model. The following variables were selected as independent variables of the model, share of firm's operating revenue in EU average operating revenue from previous year (*ORshare(-1)),* average cost of employee (*Averagecostofe~*), natural logarithm of investments in tangible fixed assets (*LNTangiblefixeda~*), sugar price index (*Indexsugar*), gas price index (*Indexgas*) and natural logarithms of sugar beet crop production (*LNsugarproductio~*) and R&D expenditures (*LNRDpps2005*).

We analyze competitiveness of sugar industry through perspective of 3 crucial factors which affect the competitiveness of sugar production; economic location factors, political location factors and natural location factors (Zimmermann and Zeddies (2001). Average cost of employees and investments in tangible fixed assets represent economic location factors. Capital investments are essential because the sugar beet and cane processors conduct highly capital-intensive actions and tend to take a long-term perspective of the market (Nicoleta Pop et. al. (2013)). Sugar price and gas price indexes indicate political location factors. One of the factors that influences the sugar price instability is the volatility in production cycles that are large sugar-consuming markets. There is another factor with high influence on sugar price volatility, and this is the price of inputs (gas and/or oil). Sugar beet production is marked as natural location factor (Zimmermann and Zeddies (2001)).

Although technology was not clearly stated as a factor within Zimmermann's and Zeddie's competitiveness of sugar production model, we can connect it to productivity of sugar industry which is part of economic location factors According to Arjchariyaartong (2006) technology represents one of the vital sources that impact competitiveness. These sources are classified into two categories: those that affect the firm's relative cost of production and those that affect the quality, or perceived quality, of its product and/or business enterprise. The relevance of technology (which is product of successful R&D expenditures) within sugar production is explained by Arjchariyaartong (2006). Author supposed that a technology is developed, such as a new fertilizer application technique or a hybrid plant variety, which increases yields in the sugar sector. Upon implementation of this improved method, the producer could apply the same amount of inputs as before, resulting in increased production. On the other hand, an appropriate decrease for inputs applied will result in production levels equal to those achieved with the old technology. Finally, lower priced inputs lead to reduced costs for the downstream firms and an increase in their competitiveness relative to rivals. Average cost of employees and investments in tangible fixed assets were initially denominated in thousands of Euros. Sugar price index was denominated in Euros per ton; gas price index in Euros (all taxes and levies included); sugar beet crop production is expressed in area of 1000 ha and R&D expenditures were expressed in purchasing power standard (PPS) per inhabitant at constant 2005 prices. The values of investments in tangible fixed assets, sugar beet crop production and R&D investments are transformed in natural logarithms.

The variable *u* represents the individual time-fixed effects, while *v* represents the random error of the model. The influence of omitted variables is measured by the effects of the constant.

4. Empirical data and analysis

The secondary research was used within empirical part of the study. The observed period is from 2008 to 2016. The research includes 213 observations. We have examined total 189 companies from the EU sugar industry (including countries Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden and United Kingdom). To measure competitiveness of the EU sugar industry, NACE Rev. 2 (1081 - Manufacture of sugar) classification was implemented within the research. The values of independent variables were collected from both AMADEUS (2018) and EUROSTAT databases (2018).

By implementing a dynamic model, the possible limitations of endogeneity and measured errors can be prevailed by including instruments, i.e. temporal shifts (lags) of the dependent variable. Implementation of the dynamic panel eliminates the difficulties that can affect reliability and assessment of the empirical analysis results. Model diagnostics were conducted initially, and the relationship will be verified by the selection of the dynamic panel.

The significance of independent variables on the EU sugar industry competitiveness is confirmed by the implementation of system 2-step GMM estimator. The dynamic panel analysis results are projected by econometric software tool named GRETL. The results indicate the impacts of chosen independent variables of share of firm's operating revenue in EU average operating revenue from previous year (*ORshare(-1)*), average cost of employees (*Averagecostofe~*), investments in tangible fixed assets (*LNTangiblefixeda~),* sugar price index (*Indexsugar*), gas price index (*Indexgas*) and natural logarithms of sugar beet crop production (*LNsugarproductio~*) and R&D expenditures for EU food industry (*LNRDpps2005*). The diagnosis and calculation are presented on the example of the dependent variable. Detailed printout of the results of the system two-step GMM estimator can be found in Table A1 (see Appendix).

Table 1: The results of the Dynamic panel of 2-step system GMM estimator from 2008 to 2016 (dependent variable *ORshare*)

INDEPENDENT VARIABLE	VALUE
Lagged dependent variable *ORshare(-1)*	0.773***
Averagecostofe~	0.002***
LNTangiblefixeda~	0.067***
Indexsugar	0.024***
Indexgas	-6.967***
LNsugarproductio~	0.010***
LNRDpps2005	0.031***
Constant	-10.268
MODEL DIAGNOSTICS	
Number of observations	213
Number of instruments	43
Wald test	723148
Prob>chi2	0.0000
Sargantest	36.8132
Prob>chi2	0.1827
Arellano-Bond test for AR(1) in the first differentions	-2.02468
Prob>chi2	0.0429
Arellano-Bond test for AR(2) in the first differentions	0.56328
Prob>chi2	0.5732

Note: P-values in parentheses and labels *** indicate the level up to 1% significance. P – values were obtained by calculating the two-step dynamic procedure.

Source: Authors' calculations

Table 1 shows the impact of independent variables on competitiveness of 189 EU sugar industry companies. The calculation of Wald test indicate acceptable explanatory power of the variables. Additionally, the respective test significance is confirmed. According to diagnostic results we can conclude that the model is well specified. Models are suitable to econometric analysis of the impact of independent variables on the share of firm's operating revenue in EU average operating revenue of sugar industry.

The resulting value (Prob>chi2) of the Sargan test amounts to 0.18, which is higher than 0.05. It means that model is satisfactory and precise. The Arellano-Bond test is used to test the existence of autocorrelation of the first (AR1) and the second order of errors (AR2) in the first differences of the equations. Furthermore, the results of the AR2 for don't imply the presence of second-order autocorrelation due to higher coefficient, which is significantly higher than the allowable limit of 0.05 (0.57). Therefore, the null hypothesis of no second-order autocorrelation is completely accepted. The coefficients have the expected signs and satisfying statistical significance.

5. Results and discussion

After analyzing the diagnostics of the model, the results are interpreted from two-step GMM estimation. The results imply positive, very high and significant coefficient of temporally shifted (lagged) dependent variable, which justifies the thesis that the current values are positively related to the previous realizations.

The magnitude of the coefficient indicates that 1% growth of share of firm's operating revenue in EU average operating revenue from previous year results with an growth of 0.77% in the current period, while keeping other variables constant. Furthermore, the share of firm's operating revenue in EU average operating revenue will be reduced by 6.9% if the gas price index increases by 1%, given the other variables of the model unchanged. It must be noted that gas represents one of the key inputs of EU sugar production. That is why its price volatility has vital impact on the competitiveness of EU sugar industry.

Taking from the EU sugar industry perspective, the share of firm's operating revenue in EU average operating revenue results in an increase of 0.06% if investments in tangible fixed assets are increased by 1% provided the other variables remain constant. Sugar production is capital-intensified business activity which requires investments to remain certain level of competitiveness. This is the reason why investments in tangible fixed assets have higher impact on the share of firm's operating revenue in the EU sugar industry.

The coefficient of model indicates that 1% increase in *LNRDpps2005* results in an increase of 0.03% of the share of firm's operating revenue in EU average operating revenue while the other variables of the model remain constant. Successful R&D investments represent technological advance. Technological advance is often manifested through process, product, organization and marketing innovations. From the input point of view, process innovations contribute to higher level of productivity that increases higher level of firm's competitiveness. According to the econometric results, R&D expenditures have lower, but still visible and major impact on the competitiveness of EU sugar sector.

In the case of EU sugar industry, share of firm's operating revenue in EU average operating revenue decreases by 0.02% if the variable *Indexsugar* increases by 1%, given the other variables of the model remain same. Moreover, dependent variable *ORshare* will be reduced by 0.01% if the independent variable *LNsugarproductio~* rises by 1%, ceteris paribus. Finally, the coefficient *Averagecostofe~* indicates that 1% increase in results in an increase of 0.002% of the share of EU sugar industry firm's operating revenue in EU average operating revenue while the other variables of the model remain constant. We can stress out that the impact of variables *LNsugarproductio~* and *Averagecostofe~* are weaker than other variables of model.

6. Conclusions

The main contribution of this research is confirmation of relationship between competitiveness and economic location factors, political location factors and natural location factors of the EU sugar industry. The present study covers a total of 189 EU firms of EU sugar industry for years 2008-2016. Chosen the 2-step GMM estimator of dynamic panel analysis provided more non-bias and objective scientific results.

The main hypothesis is confirmed, emphasizing that "sugar production inputs and market prices have significant impact on EU sugar industry firm's operating revenue in EU average operating revenue.

This study proved that energy costs, the share of firm's revenues in average EU revenues from previous period, technology (R&D), market prices, and sugar production indicate crucial factors for competitiveness in EU sugar industry. Gas price has the highest impact on EU sugar industry firm's competitiveness (firm's operating revenue in EU average operating revenue). Cost effectiveness often depends about the level of production costs. Gas price as an input is essential factor of firm's competitiveness. The second most influential factor on EU sugar industry competitiveness is firm's operating revenue in EU average operating revenue from previous period. Past revenues have visible impact on financial picture of a certain company. Higher revenues (with same level or slower increase of costs) boosts profitability and future investment activities while parallelly elevates level of competitiveness. Investments in fixed asset represent third influential factor of EU sugar industry competitiveness. Capital intensive activity requires higher level of capital investment. Investments in production capacity can result in lower production costs which can boost competitiveness as well. Sugar beet crop production, sugar index prices, average costs of employees, R&D expenditures undoubtedly indicate group of factors which have recorded weaker but statistically significant impact on EU sugar industry competitiveness.

The presented model can be systematically upgraded and depending on the objectives and interests of scientists and experts, it can be upgraded with other variables. For example, future studies could include other aspects of economic location factors, political location factors and natural location factors which influence world sugar industry. The model can be estimated by alternative econometric methods and the results can be compared. However, these drawbacks do not influence the significance of the research findings. The application of the results may contribute to a broader awareness of the impacts EU sugar industry competitiveness.

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Konkurentnost industrije šećera u EU[1]

Tomislav Galović[2], Heri Bezić[3]

Sažetak

Ovo istraživanje promatra konkurentnost industrije šećera EU-a. Industrija šećera predstavlja vitalni dio industrije hrane i pića u EU. Cilj istraživanja je prikazati kako proizvođači šećera u EU mogu biti konkurentniji na unutarnjem i globalnom tržištu šećera. Metodologija se temelji na primjeni modela dinamičkih panel podataka pomoću uzoraka koji obuhvaćaju 189 poduzeća za proizvodnju šećera iz 25 država članica EU-a u razdoblju 2008. – 2016. Ključni rezultati pokazuju različiti utjecaj tehnologije (istraživanja i razvoja), ulaganja, proizvodnju šećerne repe, troškove zaposlenika, cijene plina i šećerne repe na prosječne prihode industrije šećera u EU. Rezultati potvrđuju važnost inputa kao što su prirodni plin, prihodi iz prethodnog razdoblja i ulaganja kao ključni čimbeniki konkurentnosti industrije šećera u EU. Na temelju rezultata istraživanja daju se preporuke i prijedlozi.

Ključne riječi: *konkurentnost, industrija šećera, Europska unija, GMM procjenitelj*

JEL klasifikacija: *D24, O32, L66*

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Appendix

Table A1: The results of the Dynamic Panel of two-step System GMM Estimator from 2008 to 2016 (dependent variable *ORshare*)

Model 26: 2-step dynamic panel, using 213 observations

Included 45 cross-sectional units

Time-series length: minimum 1, maximum 5

Including equations in levels

H-matrix as per Ox/DPD

Dependent variable: ORshare

Asymptotic standard errors

	Coefficient	*Std. Error*	*z*	*p-value*	
ORshare(-1)	0,773298	0,00411714	187,8	<0,0001	***
const	−10,2682	0,108114	−94,98	<0,0001	***
Averagecostofe~	0,00271200	0,000324866	8,348	<0,0001	***
Tangiblefixeda~	0,0677913	0,00651130	10,41	<0,0001	***
Indexsugar	0,0242076	0,000265476	91,19	<0,0001	***
Indexgas	−6,96794	0,682134	−10,21	<0,0001	***
sugarproductio~	0,0104564	0,00296421	3,528	0,0004	***
RDpps2005_3	0,0313562	0,00371025	8,451	<0,0001	***
T5	0,309581	0,00693712	44,63	<0,0001	***
T6	0,822029	0,00749513	109,7	<0,0001	***
T7	1,41965	0,0183586	77,33	<0,0001	***
T8	1,71132	0,0196133	87,25	<0,0001	***
T9	1,06222	0,0163602	64,93	<0,0001	***

Sum squared residuals 17,11149 S.E. of regression 0,292502

Number of instruments = 43

Test for AR(1) errors: z = -2,02468 [0,0429]

Test for AR(2) errors: z = 0,56328 [0,5732]

Sargan over-identification test: Chi-square (30) = 36,8132 [0,1827]

Wald (joint) test: Chi-square (7) = 723148 [0,0000]

Wald (time dummies): Chi-square (5) = 17669,3 [0,0000]