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Global Competitiveness Index 4.0 and export performances of the European economies

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Abstract. *The aim of this paper is to examine the impact of national competitiveness on export of goods and services of European economies. The paper looks at three groups of countries: the CEFTA, the European Union, and the European Monetary Union. Panel regression models are used to test the hypothesis: OLS, model of fixed and random effects. GCI 4.0 is used as an indicator of national competitiveness. The results show a positive and statistically significant impact of GCI 4.0 on the export of European economies collectively and of economies in the EU and EMU, while this impact is absent in CEFTA.*

Keywords: Global Competitiveness Index 4.0 (GCI 4.0), export of goods and services, foreign trade, economic policy, European economies.

JEL Classification: F10, F14, F40, C12.

1. Introduction

One of the key economic goals, along with economic growth, high employment and price stability, is the stability of foreign trade, which is the result of the country's international competitiveness. At a time of ubiquitous globalization of economic activities, resulting from economic integration of countries, it is important to emphasize that the level of foreign trade benefits primarily depends on the degree of ability of the domestic economy to cope with international competition. In this sense, it is necessary to continuously work on strengthening export competitiveness, in order to increase purchasing power in the domestic market through the inflow of funds, which ultimately reflects on increasing economic growth and living standards in general. In order to systematically approach the strengthening of export competitiveness of domestic economic entities, it is necessary to work on building capacities that can significantly determine the growth of exports. Identifying these factors and capacities is by no means a simple process, and therefore, the focus of this paper is to test the importance of building pillars of national competitiveness GCI 4.0 for the growth of exports of goods and services.

Today, the concept of national competitiveness is the most widely accepted concept in the creation of macroeconomic policies. It has been measured by the Global Competitiveness Index 4.0 since 2018 and related data is published annually by the World Economic Forum publishes. Motivated by the challenges related to the complexity of creating an adequate economic model in the function of increasing export competitiveness of domestic companies, the designed research aims to provide an overview of empirical results on the impact of national competitiveness GCI, as a competitive measure by 2017, on the export of goods and services, then to assess the impact of GCI 4.0 on exports and, lastly, to establish whether the concept of national competitiveness 4.0 can serve as a basis for creating macroeconomic policies in order to improve the export competitiveness of European economies.

Recognizing the fact that European economies are in a continuous process of economic integration, this study will present the impact of national competitiveness on exports of goods and services in three groups of countries at three levels of economic integration, namely CEFTA, EU common market, and the European Monetary Union (EMU), but also collectively as European economies. Research conceived in this way ought to provide answers to the questions of whether national competitiveness affects the exports of goods and services of European economies and whether this impact varies depending on the level of economic integration of countries. Based on this defined research area and research problem, the central research hypothesis has been set as follows: “National competitiveness, measured by GCI 4.0, has a positive and statistically significant impact on exports of goods and services of European economies in the CEFTA, the EU common market and the EMU collectively, but the impact varies depending on the level of integration”.

In addition to the introduction, the paper is structured in five parts. The second part presents and overview of previously conducted research and the third describes the variables,

research methodology, econometric model and data. The fourth part presents the results and discussion of the research results. Finally, the conclusions of the research are presented and recommendations for future studies are given.

2. Literature review

The analysis of available literature and previous research on the impact of national competitiveness on countries´ macroeconomic performance shows that research on this topic is scarce, especially related to GCI 4.0, as GCI 4.0 is a relatively recent measure of national competitiveness. Schwab (2015) states that the defined concept of competitiveness, measured through the GCI, includes static and dynamic competitiveness, and that as such it can explain the growth potential of the economy. Furthermore, Schwab (2018) notes that the defined concept of competitiveness measured through the GCI includes in the assessment also the emerging factors critical to productivity in the Fourth Industrial Revolution (4IR). The 2019 Competitiveness Report states that, based on empirical research for 2018, GCI 4.0 explains more than 81% of the difference in income levels between countries. This part of the paper presents the results of previous research based on GCI as a measure of national competitiveness until 2017 as well as research results including the impact of pillars and indicators of national competitiveness on exports of goods and services.

Lechman (2014) investigates the impact of national competitiveness growth, measured by the GCI Global Competitiveness Index, on the value of exports of high-tech products to nine Central and Eastern European countries in the time interval from 2006 to 2011. The results of the research show that in the mentioned period there was a decrease in competitiveness in six of the nine observed countries, and that in parallel there was a continuous increase in the share of exports of high technology products in total exports in seven of the observed countries. The author concludes that four countries have experienced a slight decline in GCI (Czech Republic, Hungary, Latvia and Slovak Republic), and the share of exports of high-tech products has increased. In the same period, only Bulgaria, Romania and Poland achieved an increase in the value of GCI and this growth was accompanied by the share of exports of high-tech products. The greatest relative progress in the growth of international competitiveness was achieved by Bulgaria, which in parallel with the growth of competitiveness achieved the second best result in the growth of exports of high-tech products from a total of 9 observed countries.

In addition to the scientifically proven positive and statistically significant impact of institutional development, as a pillar of national competitiveness, on economic growth (Agazade et al., 2020; VITOLA and SENFELDE, 2015), improving the institutional environment has a positive and statistically significant impact on exports of products and services (Bierut and Kuziemska-Pawlak, 2016). In the study on the impact of national competitiveness on the export potential of Central and Eastern European countries, using panel regression analysis of a series of data, Bierut and Kuziemska-Pawlak (2016) show

that, within the global competitiveness index, the institutional environment as a pillar of national competitiveness has a direct and positive impact on the export competitiveness of the observed countries. The authors conclude that in the future it is necessary to consider building pillars of non-price competitiveness that will ensure competitiveness in the international market in the long run. Similar results are obtained by Abreo et al. (2021) while analyzing the impact of institutional quality on Colombian exports to 136 most important trading partners – countries in the period 2005-2018, showing that improving institutional quality has a positive and statistically significant impact on increasing volume of exports. In the study on the impact of national competitiveness on products and services on the example of 45 OECD countries, OZDERMIR (2018) comes to opposite conclusions, showing that there is exists a negative impact of institutional development on exports of products and services. The author explains that the development of institutions in OECD member countries causes a decrease in export activity, because entry into foreign markets is realised through foreign direct investment.

Rehman et al. (2020) investigate the short-term and long-term impact of infrastructure development on exports and trade deficits in selected South Asian countries between 1990 and 2017, using the Global Infrastructure Index as described in Donaubauer et al. (2015), which consists of 30 indicators that include the quality and quantity of infrastructure. Empirical results show that there is a significant positive impact of infrastructure development on exports, while infrastructure development has a negative impact on the trade deficit. In this paper, the authors also prove that the used control variables, namely exchange rate, human capital, GDP p.c. and institutional development have a positive effect on exports and significantly slow down the trade deficit in the long run. Celbis et al. (2013) investigate the impact of infrastructure development on international trade flows using meta-analysis and meta-regression synthesized by 36 primary studies. The authors point out that the low level of quality and quantity of infrastructure can create trade barriers, which increases transportation costs. The results of this research show that the improvement of infrastructure by 1% leads to an increase in exports by 0.6%, and to an increase in imports by 0.3%.

Ozcan (2018) explores the impact of ICT, as a component of national competitiveness, on bilateral trade flows between Turkey and its most important foreign trade partners, 35 countries to which Turkey exports the most and 34 countries from which Turkey imports the most goods, for the period 2000-2014. To measure ICT, the author calculates four different ICT indices, namely the composite ICT development index and three disaggregated indices: the access sub-index, the usage sub-index and the ICT skills sub-index. The results of the research show that ICT has a positive and statistically significant impact on Turkish exports and imports of goods, with the greater importance of ICT for Turkish imports. At the same time, the research results show that the sub-indices of ICT access and ICT skills are key to increasing exports, while the sub-index of usage does not have a significant impact on exports from Turkey. When it comes to imports, all indices used have a positive and statistically significant impact on increasing the volume of imports. Finally, the author points out that in order to improve foreign trade, it is necessary

for economic policy makers to pay special attention to improving ICT infrastructure. The results of the Ozcan (2018) study are also compatible with the results obtained by Liu and Nath (2013) examining the impact of ICT on exports and imports of 40 developing countries in the period from 1995 to 2010. Liu and Nath (2013) confirm that there is a positive and statistically significant impact of ICT on both exports and imports of the observed countries.

Using data on national competitiveness of the WEF and WEF methodology, Mićić et al. (2015) analyze the impact of 6 indicators as components of the GCI, or pillars of national competitiveness, on real economic indicators of 6 countries in Southeast Europe (Bosnia and Herzegovina, Croatia, Serbia, Montenegro, Romania and Bulgaria) in the period from 2009 to 2014. In their research, the authors use panel regression analysis to examine the impact of 6 GCI indicators as a measure of national competitiveness, namely higher education and vocational training, commodity market efficiency, labor market efficiency, financial market development, technological readiness and market size, on economic growth and export growth rate. Research results show that the higher education and vocational training indicator does not have a positive and statistically significant impact on the rate of real economic growth and growth rate of exports of goods. However, it should be taken into account that the higher education and vocational training indicator has been measured using the GCI calculation methodology prior to year 2017. In researching the impact of infrastructure development on exports of selected countries in South Asia, Rehman et al. (2020) use human capital, among others, as a control variable. The results of the research show that the development of human capital has a positive effect on exports and significantly slows down the trade deficit in the long run.

Sandu and Ciocanel (2014) investigate the impact of research and development investments/expenditure and innovation on high-tech exports of EU member states. The authors take the volume of research and development expenditures, both in private and public sector, the human resources employed in knowledge-intensive activities, or a preference for international commercial relations as independent variables and important reasons for increasing high-tech exports. The results of the econometric analysis confirm the cause-and-effect relationship between the mentioned independent variables and the level of high-tech EU exports. In addition, the research results also confirm a positive correlation between total R&D expenditure and the level of high-tech exports, with some variations between countries and with the impact of private R&D expenditure on high-tech exports stronger than the impact pf public R&D expenditure. An increase in R&D expenditure by 1% in the business sector (as % of GDP) leads to an increase in exports of high-tech products in the same year by 3.68% (of total product exports), while public R&D expenditure has a positive effect on medium and high-tech products with a 2-year delay. Harris and Moffat (2011) come to similar results on the impact of R&D expenditure and innovation on exports on the example of the United Kingdom. The results of this study show that in production and services, the involvement of companies in export business increased the likelihood that the company invested in research and development. The results also show that R&D spending in manufacturing had a much greater impact on the

likelihood of exports, while R&D investment in non-manufacturing activities increased the likelihood of innovation. However, these investments did not have a direct significant impact on whether the subject will export, but rather the innovation increased the likelihood of export.

Using panel data from Spanish manufacturing companies, Cassiman and Golovko (2011) show that there is a strong positive relationship between company productivity and exports, but argue that this is due to earlier company decisions on innovation and that when controlling product innovation in innovative companies, the positive relationship between productivity and exports disappears. The authors believe that successful product innovation leads to the small and medium enterprises (SMEs) entering the export market, emphasizing that in addition to the direct impact of innovation on exports, the product innovation through its impact on the company productivity also increases the probability of company´s entrance into the export market.

3. Variables, research methodology, model and data

Based on the defined research area, the set research hypotheses and defined study topics, the dependent variable in the research is the export of goods and services, and the independent variable is national competitiveness. The independent variable national competitiveness GCI 4.0 is a measure created by the World Economic Forum (WEF) and it consists of four areas of competitiveness, namely favorable environment, human capital, market, and innovation ecosystem. Each of the areas of competitiveness under GCI 4.0 is measured by the values of the corresponding pillars of competitiveness, using four pillars of national competitiveness to measure the favorable environment: institutions, infrastructure, adoption of information and communication technologies, and macroeconomic stability. Indicators for measuring human capital include two pillars: health and skills. The area of competitiveness related to the market includes four pillars: commodity market, labor market, financial system and market size, while the innovation ecosystem includes 2 pillars of national competitiveness, namely business dynamics and innovation capacity.

The description of individual pillars of competitiveness, as indicators of the independent variable, is given in the following table.

Table 1. *Description of GCI 4.0 national competitiveness pillars*

Competitiveness pillars	Description
Favorable environment	
I. Institutions	Institutions are measured by 20 indicators in 2018 and 26 indicators in 2019, which are divided into the following areas: security, social capital, controls and conditions, public sector efficiency, transparency, property rights, corporate governance, future government orientation.
II. Infrastructure	Infrastructure is measured by 12 analytical indicators which are divided into 2 areas, namely transport infrastructure and communal infrastructure.
III. Adoption of ICT	This pillar of national competitiveness is measured by 5 analytical indicators, which include subscription to mobile phones, mobile broadband networks, fixed networks, subscription to optical internet, and percentage of the population using the Internet.

Competitiveness pillars	Description
IV. Macroeconomic stability	Macroeconomic stability is measured by 2 indicators: inflation percentage and debt dynamics.
Human capital	
V. Health	This pillar of national competitiveness is measured by only one indicator, which implies the expected healthy life expectancy expressed in years.
VI. Skills	Skills are measured by 9 indicators, which are divided into the following areas: education of the current workforce, skills of the current workforce, education of the future workforce and skills of the future workforce.
Market	
VII. Commodity market	The commodity market is measured by 8 indicators in 2018 and 7 indicators in 2019, which are divided into 2 areas, namely domestic competitiveness and market openness.
VIII. Labor market	This pillar of national competitiveness is measured by 12 indicators that are divided into 2 areas, namely labor market flexibility and meritocracy and labor market incentives.
IX. Financial system	The financial system is measured by 9 indicators divided into 2 areas: the depth of the financial system with 5 indicators, and the stability of the financial system with 4 indicators.
X. Market size	The market size includes only 2 indicators, namely the value of gross domestic product and imports of goods and services as a % of GDP.
Innovation ecosystem	
XI. Business dynamics	Business dynamics is measured by 8 indicators which are divided into 2 areas, namely administrative conditions and entrepreneurial culture, with 4 indicators in each.
XII. Innovation capacity	This pillar of national competitiveness is measured by 12 indicators that are divided into 3 areas, namely: interaction and diversity, research and development, and commercialization.

Source: Adapted from the 2018 and 2019 WEF Global Competitiveness Reports.

A description of the data collection methodology and the method of calculating the values of individual indicators of the pillars of national competitiveness is extensive and is available in Appendix A of the Global Competitiveness Report 2019. These indicators are organized in 12 pillars, and the pillars are organized in 4 areas of national competitiveness. The pillars and results of the index are expressed on a scale from 0 to 100 and are interpreted as "progress results", and show how close the country is to the "ideal state" (FZZPR FBIH, 2018, p. 24). The total score of the index is a simple average of 12 pillars, so that the weight of each pillar is 8.3% (1/12), while the "development phases" that represented the weighting of the previous version of the index (until 2017) are no longer used (FZZPR FBIH, 2018, p. 24). Instead, the methodology of the same aggregation is now applied to all countries regardless of the level of development.

The dependent variable *exports of goods and services* includes all transactions between residents of one country and the rest of the world involving changes in ownership of general merchandise from residents to non-residents and net exports of goods in circulation, non-monetary gold and services.

The research area includes 34 European countries, which are classified into three groups depending on the level of economic integration. Three levels of economic integration have been selected: Free Trade Area (CEFTA), Common Market (EU) and Monetary Union (EMU). Depending on the economic integration of a country, countries are divided into 3 groups:

1. Free Trade Area – CEFTA: Albania, Bosnia and Herzegovina, Montenegro, Moldova, North Macedonia and Serbia.
2. Common Market – European Union: Bulgaria, the Czech Republic, Denmark, Croatia, Hungary, Poland, Romania, Sweden and the United Kingdom.

3. Monetary Union – European Monetary Union: Austria, Belgium, Estonia, Finland, France, Greece, the Netherlands, Ireland, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, Germany, Portugal, the Slovak Republic, Slovenia and Spain.

The study covers the time period 2018-2019, as data on GCI 4.0 values are available for these two years. Given that in the observed time period all data for both dependent and independent variable exists, it can be concluded that this is strictly balanced panel data. It is important to point out that GCI 4.0 has been published since 2018 and that data are available only for 2018 and 2019, while in 2020 the Global Competitiveness Report was published, but not including the ranking of countries based on GCI 4.0. For this reason, the time series covers a period of 2 years, which can be accepted as a shortcoming in the research and is certainly taken into account, but mitigated by the use of panel regression models that increase the number of observations and gain a set of N×T observations. When applying regression models, the sample size is determined by the number of independent variables within the regression model, where five observations for each independent variable are assumed to be the minimum below which one should not go (Hair et al., 2006).

Databases from the World Bank and the World Economic Forum were used for the research. Data on exports of goods and services were collected in the World Bank's online database and are expressed in current US dollars. Data for National Competitiveness (GCI 4.0) were taken from the World Economic Forum database. These data sources were used for all 34 observed countries, so there is no risk of different data calculations for the observed variables. All data analysis, as well as model construction will be conducted using the STATA software package.

Regression models allow the value of a dependent variable to be estimated and predicted with a certain degree of reliability based on the value of the independent variable (Nagahara, 1999, p. 252). In this research, panel regression models will be used to test the hypothesis, given the shorter time coverage of the research and the availability and structure of data (this is strictly balanced data – available data on the same observation units in a time series). The panel regression model has the following form (Baltagi, 2005, p. 11):

$$Yit = \alpha + X'_{it}\, x\, \beta + uit,\ i = 1,\ldots,N;\ t = 1,\ldots,T$$

where i denotes households, individuals, firms, countries, etc., while t denotes time. Therefore, i represents the cross-sectional dimension, t represents the time series dimension, α is the vector, β is $K \times 1$ and X_{ij} is the ij observation for K of explanatory variables (Omerika and Hadžović, 2019, p. 94).

There are three basic models for working with panel data which will be used in this paper, namely Pooled OLS Model, fixed model (FEM) and random effects model (SEM). The OLS model ignores the existence of differences between observation units (countries) and observation periods, neglecting the heterogeneity of observation units. The model of fixed effects implies variations of the constant term in relation to the units of observation, but it is constant in time. A model of random effects is based on the assumption that the

observation units were randomly selected, and that the difference between them is random (Omerika and Hadžović, 2019, p. 94).

Based on the defined research problem, and considering that we have the dependent variable *Exports of goods and services* and the independent variable *Global Competitiveness Index 4.0 (GCI 4.0)*, we can define the econometric model as follows:

$ln\_EXPORT_{it} = ln\ \alpha + ln\ GCI\_4.0'_{it}\ x\ \beta + ln\ \varepsilon_{it}$

ln_EXPORT → logarithmic value of exports of goods and services of the country *i* in the year *t*.

$\ln\_GCI\_4.0'_{it}$ → logarithmic value of the Global Competitiveness Index 4.0 of the country *i* in the year *t*.

$\ln\varepsilon_{it}$ → logarithmic value of the model error.

i = 1,…, 34 → number of observation units (countries) ∑European economies= CEFTA+EU+EMU.

i = 1,…, 6 → number of observation units (countries) in CEFTA.

i = 1,…, 9 → number of observation units (countries) in the EU.

i = 1,…, 19 → number of observation units (countries) in the EMU.

t = 1, 2 → observation period.

Considering that countries can be observed collectively as European countries (economies), but also separately in 3 different groups depending on the level of economic integration, the research will create a panel regression models that include observation of 34 European countries collectively, but also individually according to the level of integration, in order to examine the impact of national competitiveness on exports of goods and services collectively at the level of observed European countries, and then at the level of each integration separately, and identify possible differences in impact. For each combination, we will create an OLS model, a fixed effects model, and a random effects model and then, with the help of appropriate tests, choose the model that best represents the relationship between the variables. In the model setup, we decided to use the logarithmic values of the variables and we obtained the potential or so-called log-log model, which in our case increases the corrected coefficient of determination R^2 of the created models and better approximates the relationship between variables.

The regression model is based on several assumptions related to residual distribution, namely: a) normal residual distribution; b) lack of heteroskedasticity and c) lack of autocorrelation (Agić, 2018, p. 70). In order for testing the significance of regression coefficients to be valid, it is necessary to meet these assumptions, and in that sense we use appropriate tests to check the fulfillment of these assumptions. Testing the normal distribution of residues when using panel data is not so important, but we will conduct testing nevertheless. We will use the Jarque-Bera test to examine the shape of the residual distribution. We will use the Breusch-Pagan/Cook-Weisberg test to test the absence of

heteroskedasticity in OLS models, while the Breusch-Godfrey LM test will be used to test the absence of serial autocorrelation.

After estimating the parameters using the OLS model, we will estimate the regression parameters using a panel regression model of fixed effects (FEM) and random effects (SEM). In the decision-making process for the final model that we will use in the discussion of the research results in comparing the FEM and OLS models, we will use the F-statistics of the FEM model. In comparison between the use of SEM and OLS models, we will use the Breusch-Pagan Lagrangian multiplication test for random effects, which we will also use to test the absence of heteroskedasticity in SEM. To test the absence of heteroskedasticity problems in FEM, we will use the modified Wald heteroskedasticity test in FEM. In cases where there is a pronounced problem of heteskedasticity, parameter estimation using robust standard errors (RSE) will be used to solve the problem, which will not affect the size of the estimated regression coefficients, but standard errors will be corrected so that the testing of the significance of the regression coefficients would be impartial (Agić, 2018, p. 75). If we estimate the parameters of FEM or SEM with the help of robust standard errors, we cannot use the Hausman test to make a decision about using the SEM or FEM model. Instead, decision will be based on Sargan-Hansen statistics, which, unlike the Hausman test, expands to heteroskedastic and cluster robust versions.

4. Research results and discussion

The results of the analysis of the impact of national competitiveness on exports of goods and services of European economies using OLS regression with pooled panel data, which neglects the nature of panel data, i.e. differences between observation units and differences between observation periods, are shown in the following table. Four OLS regression models were created, as follows: a) collective OLS model, looking at European economies (CEFTA + EU + EMU) together; b) OLS model for CEFTA integration level; c) OLS model for the level of EU integration; d) OLS model for EMU integration level. This methodology allows us to investigate the impact of GCI 4.0 on exports of goods and services by looking at European economies together, but also individually at the level of economic integration, and thus identify possible differences in impact depending on the appropriate observed integration. In addition to the results of OLS regression models, the table also shows the results of correlation analysis.

Table 2. *The impact of national competitiveness on exports (OLS model and correlation analysis)*

Independent variable and model characteristics	**Dependent variable ln_EXPORT**			
	European economies (CEFTA+EU+EMU)	**CEFTA**	**EU**	**EMU**
lnGCI4_0	**11.9152** (0.9792)	3.4031 (7.2714)	**6.8216** (1.3714)	**13.2359** (2.0412)
Jarque-Bera residual normality test chi (2)	3.043 0.2184	0.7523 0.6865	1.978 0.372	1.585 0.4526
Breusch-Pagan/Cook-Weisberg test chi2 (1) Prob > chi2	0.00 0.9604	4.50 0.0338	0.16 0.6877	0.43 0.5104
Breusch-Godfrey LM test chi2 Prob > chi2	0.716 0.3976	0.020 0.8880	0.029 0.8645	0.325 0.5685

Independent variable and model characteristics	Dependent variable ln_EXPORT			
	European economies (CEFTA+EU+EMU)	CEFTA	EU	EMU
F-statistics	148.08	0.22	24.74	42.05
Prob > F	0.0000	0.6498	0.0001	0.0000
Determination coefficient R^2	0.6917	0.0315	0.6073	0.5387
Corrected coefficient of determination R^2	0.6870	-	0.5828	0.5259
Number of observations N	68	12	18	38
Correlation analysis				
Pearson´s correlation coefficient	**0.8317***	0.1776	**0.7793***	**0.7340***
P-value	0.0000	0.5809	0.0001	0.0000

Note: Standard errors are shown in parentheses. Statistically significant coefficients at the 95% confidence level were bolded.
Source: Author calculations.

The results of F-statistics show that the created OLS models for European economies are collectively significant, and for the levels of EU and EMU integration statistically significant, which means that in relation to the arithmetic mean they better predict the change of the dependent variable ln_EXPORT based on changes of the independent variable lnGCI4_0. The obtained results for these three models show that the variable lnGCI4_0 has a directly proportional, positive impact on the variable ln_EXPORT and that this impact is statistically significant at the level of 95% reliability, i.e. 5% error. This means that the growth of the value of lnGCI4_0 affects the increase in exports at the level of European economies collectively, and at the level of EU and EMU integration individually. The results of F-statistics also show that the created OLS model for the level of CEFTA integration is not statistically significant, which means that according to this model the variations ln_EXPORT cannot be explained by variations of the variable lnGCI4_0.

The results of the Jarque-Bera test show that the residues are normally distributed in all created models. The results of the Breusch-Pagan/Cook-Weisberg test of heteroskedasticity show that the assumption of homoskedasticity of residues for European economies collectively, as well as for the levels of EU and EMU integration, has been met. This assumption is not met for the created model for the CEFTA integration level. Therefore, the assessment for the level of CEFTA integration was done using robust standard errors. The application of the Breusch-Godfrey LM test showed the absence of serial autocorrelation of residues in all 4 created models.

The value of the determination coefficient R^2 shows that 69.17% of the variance of the variable ln_EXPORT at the level of total observed European economies (CEFTA + EU + EMU) is explained by the predictor lnGCI4_0, while at the EU level 60.73% and at the EMU level 53.87% of the variance of the variable ln_EXPORT is explained by the predictor lnGCI4_0. The value of the determination coefficient for the CEFTA integration level shows that variations in the logarithmic value of exports cannot be explained by variations in the logarithmic value of GCI 4.0 within this group of countries.

The calculated value of the correlation coefficients shows the existence of a high positive correlation of the variables ln_EXPORT and lnGCI4_0 looking at European economies

collectively, and the levels of EU and EMU integration. The calculated correlation coefficients for these three groups of countries are statistically significant at the 95% confidence level. The calculated correlation coefficient of the mentioned variables for the level of CEFTA integration also shows the presence of a positive correlation, but this coefficient is not statistically significant, which means that the stated correlation of the variables is random.

The results of the analysis of the impact of national competitiveness on exports of goods and services of European economies using the fixed effect regression model (FEM) and the random effect regression model (SEM) are shown in the following table. A model of fixed and a model of random effects have been created, as follows: a) FEM and SEM, looking at European economies (CEFTA + EU + EMU) together; b) FEM and SEM for the level of CEFTA integration; c) FEM and SEM for the level of EU integration; d) FEM and SEM for EMU integration level. After the models that meet the assumptions on which they are based were created, the model that best approximates the relationship between the observed variables was selected.

The results of the panel regression models of fixed effects show that the variable lnGCI4_0 has no statistically significant impact on the variable ln_EXPORT in 3 observed groups of countries (European economies, CEFTA and EU), while this impact is statistically significant for the level of EMU integration, at 95% confidence. F-statistics of created models of fixed effects show that the models for European economies collectively, CEFTA and EU are not statistically significant, and suggests that variations of the variable ln_EXPORT cannot be explained by variations in the variable lnGCI4_0 in the observed groups of countries, which implies inexistence of significant fixed effects, while significant fixed effects exist at the level of EMU integration.

The results of the modified Wald test of heteroskedasticity in the fixed effect model for all 4 created models show a violation of the assumption of residual homoskedasticity, i.e. indicate the presence of the problem of heteroskedasticity. Therefore, FEM models are created using robust standard errors. The results of the Breusch-Godfrey LM test show the absence of serial autocorrelation problems in all created panel regression models of fixed and random effects.

Table 3. *Impact of national competitiveness on exports of goods and services (FEM and SEM)*

Independent variable and model characteristics	**Dependent variable ln_EXPORT**							
	European economies (CEFTA+EU+EMU)		**CEFTA**		**EU**		**EMU**	
	FEM	**SEM**	**FEM**	**SEM**	**FEM**	**SEM**	**FEM**	**SEM**
lnGCI4_0	-0.2963 (0.4799)	0.7520 (0.5128)	1.3232 (0.8377)	1.3524 (0.8684)	0.0922 (0.2460)	0.2804 (0.2091)	**-2.0501** (0.6474)	**-1.3839** (0.7041)
Determination coefficient R^2	0.6917	0.6917	0.0315	0.0315	0.6073	0.6073	0.5387	0.5387
F-statistics Prob > F	0.38 0.5412		2.50 0.1750		0.14 0.7175		10.03 0.0053	
F-test all u_i=0	4321.75 0.0000		1802.52 0.0000		6873.38 0.0000		6470.94 0.0000	
Modified Wald test heteroskedasticity	9.4e+28 0.0000		2.1e+25 0.0000		8.1e+25 0.0000		7.8e+28 0.0000	

Independent variable and model characteristics	Dependent variable ln_EXPORT							
	European economies (CEFTA+EU+EMU)		CEFTA		EU		EMU	
	FEM	SEM	FEM	SEM	FEM	SEM	FEM	SEM
Wald chi2 Prob > chi2		2.15 0.1425		2.43 0.1194		1.80 0.1799		3.86 0.0494
Breusch-Pagan Lagrangian test		33.20 0.0000		5.98 0.0072		8.76 0.0015		18.61 0.0000
B-G LM test chi2 Prob > chi2	0.716 0.3976		0.020 0.8880		0.029 0.8645		0.325 0.5685	
Sargan-Hansen test	No model is significant		No model is significant		No model is significant		chi-sq(1) = 24.387 p-value = 0.000	
Number of observations N	68	68	12	12	18	18	38	38

Note: Robust standard errors are shown in parentheses. Statistically significant coefficients at the 95% confidence level were bolded.
Source: Author calculations.

The results of Wald chi2 statistics in the random effects model for the level of EMU integration show that there are significant random effects, and that this model is preferred over the created OLS model, but not over the created FEM model. The SEM models created for European economies collectively, and for the levels of CEFTA and EU integration are not statistically significant. The Breusch-Pagan Lagrangian multiplication test shows the presence of residual heteroskedasticity problems in all 4 created SEM models. Therefore, the estimation of the parameters in this case was done using robust standard errors, in order to ensure an unbiased estimation of the significance of the regression coefficients. Given that none of the created FEMs and SEMs for European economies collectively, the CEFTA and the EU are significant, Sargan-Hansen statistics for these groups of countries have not been calculated. In addition, for the EMU level of integration both SEM and FEM are statistically significant, and Sargan-Hansen statistics showed that FEM better represents the relationship between the observed variables. Accordingly, OLS models for European economies collectively and the level of EU integration, and FEM for the level of EMU integration will be used to estimate the regression coefficients and approximate the relationship between the observed variables, and to discuss the obtained results. For the CEFTA level of integration, variations of the variable ln_EXPORT cannot be explained by variations of the variable lnGCI4_0 based on the results of FEM and SEM models, as well as OLS models, and as such will not be interpreted in the context of coefficient estimation.

Based on the results of the created OLS, FEM and SEM models for analyzing the impact of national competitiveness GCI 4.0 on exports of goods and services, we can conclude that for European economies collectively FEM and SEM are not statistically significant, and that OLS model is statistically significant. Therefore, the OLS model will be used to estimate values of the dependent variable ln_EXPORT under the influence of variations in the value of independent variable lnGCI4_0. The results of the created models for the CEFTA integration level show that neither the OLS, nor the FEM and SEM models are statistically significant, which indicates the absence of a statistically significant impact of lnGCI4_0 on ln_EXPORT at the CEFTA integration level. The created FEM and SEM models for the level of EU integration are not statistically significant, and a statistically

significant OLS model will be used for the assessment. The OLS, FEM and SEM models created for the level of EMU integration are statistically significant. F-statistics showed that there were significant fixed effects, and the Breusch-Pagan Lagrangian multiplication test showed that there were significant random effects, meaning that both FEM and SEM were preferred over the OLS model, while Sargan-Hansen statistics showed that FEM is the final model for the EMU integration level, because it better represents the mutual influence between the observed variables. Therefore, in this part the discussion of the results refers only to the final selected models that best approximate the relationship between the observed variables.

Analyzing the results obtained on the impact of national competitiveness measured by GCI 4.0 on the value of exports of European economies, we can conclude the following: increasing the value of the Global National Competitiveness Index 4.0 by 1% leads to an increase of 11.9152% in 34 observed European economies (CEFTA, EU and EMU). An increase in GCI 4.0 by 1% within the EU leads to an increase in exports by 6.8216%, while an increase in GCI 4.0 by 1% at EMU level leads to an increase in exports by 13.2359% according to OLS, or a decrease in exports by 2.0501% according to FEM. When it comes to the level of CEFTA integration, in the observed period there is no impact of changes in the value of GCI 4.0 on changes in export values. Based on these results we can conclude that national competitiveness measured by the created Global National Competitiveness Index 4.0 has a directly proportional, positive and statistically significant impact on export growth of observed European economies collectively, and for EU and EMU integration levels, while this impact, based on OLS, FEM and SEM, is completely absent for the level of CEFTA integration.

The results of the research show that the impact of GCI 4.0 on the value of total exports of the observed groups of countries differs depending on the affiliation to the group. In addition, a statistically significant impact on export growth exists in those groups of countries with higher GCI 4.0 values, while, of course, no statistically significant impact on export growth can be expected in groups of countries without significant GCI 4.0 values that could significantly determine this impact.

The results obtained on the different impact of GCI 4.0 on export values are to some extent compatible with the results of Lechman (2014) who analyzes the impact of GCI on exports of high-tech products in nine Central and Eastern European countries for the period 2006-2011. The results show that in some countries exports of high-tech products are increasing with the growth of the GCI, while in the case of certain countries there has been an increase in these exports, although there has been a slight decline in competitiveness measured through the GCI. Given the above, Lechman (2014) does not accept the hypothesis that there is a statistically significant and positive impact of GCI on the value of exports of high-tech products. However, the results of Lechman (2014) showed that Bulgaria, which achieved the highest growth in competitiveness, was also the country with the second highest growth in exports of high-tech products. When it comes to the Lechman (2014) research, it is important to emphasize that this research is based on GCI, while the research

within this dissertation is based on GCI 4.0, a more recent measure of competitiveness. It is additionally important to point out that, as with the GCI, the impact differs depending on the spatial scope of the impact analysis, given that different results were obtained for different countries.

In addition to the compatibility of the obtained research results with Lechman (2014), observing the impact of the GCI composite national competitiveness index on exports of high-tech products, the obtained research results are also compatible with the results of positive and statistically significant impact of individual pillars of national competitiveness on exports of goods and services. In this sense, the pillars of national competitiveness that have a positive and statistically significant impact on exports of goods and services, according to previous research, are: institutions (Bierut and Kuziemska-Pawlak, 2016; Abreo et al., 2021), infrastructure (Rehman et al., 2020; Celbis et al., 2013), ICT (Ozcan, 2018; Liu and Nath, 2013), human capital (Rehman et al., 2020), research and development (Sandu and Ciocanel, 2014; Harris and Moffat, 2011; Cassiman and Golovko, 2011). Based on the research results obtained here and the results of previous research, it can be pointed out that the defined pillars of national competitiveness GCI 4.0 can be a good basis for improving export competitiveness.

Conclusion and recommendations for further studies

The results of the research on the impact of national competitiveness, measured through GCI 4.0, on exports of goods and services of European economies in the CEFTA free trade zone, the common market of the European Union and the European Monetary Union, showed expected results and are in line with conclusions by the WEF regarding European economies collectively and the levels of EU and EMU integration. This means that the development of national competitiveness, i.e. by improving the pillars and indicators of national competitiveness according to the WEF methodology, directly contributes to the growth of export competitiveness of European economies collectively and individually at the EU and EMU levels. However, there is no statistically significant impact on the level of CEFTA integration, and given that this group of countries has the lowest value of GCI 4.0, it can be concluded that this impact is absent due to the low level of development of national competitiveness pillars.

Given that when testing the impact of GCI 4.0 on exports of goods and services of European economies together (34 economies) we have a positive and statistically significant impact, but that this impact varies depending on the level of integration, it can be concluded that the central research hypothesis, “National competitiveness, measured by GCI 4.0, has a positive and statistically significant impact on exports of goods and services of European economies in the CEFTA, the EU common market and the EMU collectively, but the impact varies depending on the level of integration”, is not rejected.

Based on the obtained results, and in order to better prepare for increased competition in the liberalized EU and EMU market and avoid significant negative consequences of trade

liberalization, CEFTA member countries in the EU accession process should work on improving indicators, pillars and areas of national competitiveness GCI 4.0, which will strengthen export competitiveness.

Taking into account that only the synthetic indicator GCI 4.0 was used in this study, it would be useful in the following studies to examine the impact of individual areas, pillars and indicators of national competitiveness on exports of goods and services, all with the aim of identifying factors on which the economic policy program should be based in the function of strengthening export competitiveness. Furthermore, a recommendation for further research may be to examine the impact of GCI 4.0 on other types of macroeconomic performance of economies, so that limited public resources can be directed to improving those indicators and pillars of national competitiveness that contribute most to macroeconomic stability in the narrower and broader sense. It is also particularly important to examine the impact of the COVID-19 pandemic on the economic growth of economies with higher GCI 4.0 values compared to economies with lower GCI 4.0 values, and whether GCI 4.0 provides mitigation of negative effects in times of severe economic crises. The main limitation in the research is the short observation period and the fact that in 2020 the WEF was not ranked according to GCI 4.0 due to lack of data, but the use of panel data ensured an increase in the number of observations, which significantly eased this limitation.

Notes

(1) Kosovo has been excluded from CEFTA, as data on GCI 4.0 values have not been published for 2018 and 2019.

(2) The United Kingdom is included in the analysis because the analysis covers 2018 and 2019, when the GCI 4.0 values were published and when the United Kingdom was part of the European Union.

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