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IS GLOBAL COMPETITIVENESS SPEEDING UP THE GROWTH IN THE EU? A PANEL DATA ANALYIS

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Abstract: The paper documents the impact of global competitiveness on economic growth in the EU Member States. In a panel data approach, for a time span of 10 years (2008-2017), a validated influence of Global Competitiveness Index on annual rate of GDP in the EU countries was found. The impact is higher in the group of Eastern and Central European countries (ECE) than in the Western European (well developed) countries, as well as at European economy level.

Keywords: competitiveness, economic growth, panel data models

JEL Codes: O40, O57, C23

1. Introduction

The notions of competitiveness and economic environment have continuously evolved, as well as the context in which the policy makers decide to foster economic growth.

In a macroeconomic approach, the World Economic Forum defines competitiveness as „the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the economy can achieve" (WEF, 2018).

The concept of competitiveness includes static and dynamic components: the productivity of a country enhances its capacity to sustain a high level of income and also, it is a main determinant of its returns to investment, explaining in this way an economy's growth potential.

At microeconomic level, competitiveness is the ability of firms to mobilise and efficiently employ the productive resources required to successfully offer their goods and services in a global economic environment (EIB, 2016).

A country's economic growth is related to many endogenous and exogenous factors, inside or outside of controls of policymakers, companies or individuals. Its competitiveness could be among these factors.

The present study investigates the influence of global competitiveness measured by Global Competitiveness Index (GCI) on economic growth in the EU countries in a panel data analysis.

The paper is organised as follows: after a short literature review on competitiveness, data and methodology of the research are exposed; Main findings are described in the fourth section, followed by Conclusions sections.

2. Literature review

There is a large spectrum of competitiveness definitions. We resume in the following lines their main components, characteristics and dimensions of competitiveness:

1. Definitions of national competitiveness as productivity and highlighting its consequences:

- Competitiveenss is expressed by national productivity (Porter 1990; Krugman, 1990, 1994) or the expected level of output per working-age individual (Delgado, 2012). Competitiveness can generate wealth for nations and is supporting high wages (Bobba et al., 1971) and generates improved living standard and high employment on a sustainable basis (Porter, 1990) as well as expanding and maintaing the real incomes of population on long term (Barker, Köhler, 1998) or providing for citizens a standard of living that is both rising and sustainable (Tyson D'Andrea, 1992), or the capacity of an economy to support a higher standard of living than other comparable economies (Boltho, 1996).

2. Definitions of country / sector / industry / firm competitiveness showing its relation with business, sales, goods, market share and national or international competitors:

- Competitiveness is the ability to produce and sell products and services of superior quality and lower costs than its domestic and international competitors (Buckley et al., 1988), or the the degree to which it can produce goods or services meeting the test of international markets (Barker, Köhler, 1998; Tyson D'Andrea, 1992), as well as the firm's economic strenghts against its rivals in the global marketplace where products, services, people and innovations move freely despite the geographical boundaries (Chao-Hung, Li-Chang, 2001). Competitiveness is a country's share of world markets for its products (Porter et al., 2008).

The European Commission proposed in 2010 the Europe 2020 strategy with the goal to transform the EU into "a smart, sustainable and inclusive economy". The experts of World Economic Forum assessed the Europe's progress in enhancing competitiveness based on this strategy and they conceived the *EU 2020 competitiveness index*. It is built upon 7 pillars: Enterprise environment (competition, clusters, entrepreneurship, availability of financing) digital agenda

(ICT readiness, usage and impact), innovative Europe (R&D expenditures, researchers, patents, universities, capacity for innovation), education and training, labour market and employment, social inclusion (access to healt care services, Gini coefficient, efficiency in reducing poverty, social safety net protection), environmental sustainability (share of renewable energy production, environmental treaty ratification, quality of natural environment, CO2 intensity). In its 2012 and 2014 EU 2020 Competitiveness reports, the World Economic Forum provides analysis and ranking of European countries, according the scores of this Index.
In the European Investment Bank's (2016) view, the EU's competitiveness needs to be understood at three levels: the enabling environment (institutions&markets, human capital, strategic infrastructure, financial sector), the capacity for change (within firms and accross economy), and economic wellbeing (productivity, trade, employment, growth, convergence). At EU level, all these can be supported by appropriate structural reforms and removal of barriers to investments and EU Single Market integration.
The Global Competitiveness Index (GCI) was developed by Xavier Sala-i-Martin since 2005 in collaboration with the Forum, as a continuation of building on Klaus Schwab's work (1979) (WEF, 2018) and defining country's competitiveness is a set of macroeconomic and microeconomic factors that determine its productivity and economic growth. The GCI is a composit index combining 114 indicators grouped in 12 pillars: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation. These pillars are organised into three subindexes: basic requirements, efficiency enhancers, and innovation and sophistication factors. In the present paper, this definition of competitiveness is used.
The quality of a country's institutions has been proven as a factor of economic growth (Acemoglu at al., 2002; North, 1989, Miller &Holmes, 2014).
The impact of infrastructure on economic growth is highlighted in studies such as: Canning and Pedroni (1999) and Calderon and Serven (2004).
There are evidences of the impact of macroeconomic stability on growth: inflation (Goodfriend, 2007; Temple, 2000), public debt levels (Reinhart and Rogoff, 2010), fiscal policies (Johansson et al., 2008).
Endogenous growth theory generally assumes that economic growth is at least partly a function of stocks of knowledge in the form of human capital or the outcomes of research and development (R&D) activities.
The role of human capital (education and health) was put in light in endogenous growth models as well as the outcomes of research and development activities.

There are a huge number of studies highlighting the positive influence of human capital on productivity and economic growth (Barro, 1991; Mankiw et al., 1992; Bassanini and Scarpeta, 1996; Barro and Lee, 2000; Bils and Klenow, 2000; de la Fuente and Domenech, 2000; Krueger and Lindahl, 2001; Cohen şi Soto, 2001; Simionescu, 2018).

Trade openness and openess to international competition could improve a country's productivity, expanding the productive local industries and widening the acces to advanced technology and knowledge from abroad (Delgado et al., 2012). Trade openness has a positive impact on prosperity (Alesina et al., 2005; Baldwin, 2003) and economic growth (Yanikkaya, 2003).

Efficient access to capital and financial development is important for economic growth (Panicos and Hussein, 1996; Khan, 2001; Arestis et al., 2001; Hassan et al., 2011).

Business sophistication can raise productivity and create greater opportunities for innovation in processes and products (i.e. Delgado et al., 2010).

Starting with the assertions of Romer (1990) regarding the role of integrating and adapting exogenous techologies in the national productivity improvement, the positive impact of technological innovation on productivity was proven by Grossman and Helpman (1991) and Furman et al. (2002).

Korez-Vide, R. & Tominc, P. (2016) found that the growth of a national economy's GDP per capita and the growth of a national economy's competitiveness are positively related in a sample of Central and Eastern EU countries

3. Data and econometric approach

The sets of values of Global Competitivenss Index (GCI) were extracted from World Economic Forum Reports for the period of 2008-2017 and the annual growth rate of GDP for the 28 EU countries from theWord Development Indicators data base.

We analyse the impact competitiveness on economic growth through a panel regression equation, as follows:

$$GDPR_{it} = \alpha + \beta \cdot GCI_{it} + \varepsilon_{it} \quad (1)$$

where: i denotes the country, t denotes the time and ε_{it} is the error term. $GDPR_{it}$ is the annual growth rate of GDP in the country *i* in year *t* and GCI_{it} is the Global Competitivity Index in the country *i* in year *t*.

$$\varepsilon_{it} = \mu_i + v_{it} \quad (2)$$

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where: μ_i means unobservable individual specific effect ehich is time invariant and v_{it} is the remainder disturbance, which varies across time and panels.
There are two main econometric models in the panel data analysis: fixed effect model (FE) and random effects model (RE). In the fixed effects model, characteristics of each individual unit may impact the dependent variable and the effects of time-invariant characteristics are not taken into consideration. In the random effects model, thethe variation across countries is random and uncorrelated with the independent variable (see Hsiao, 2002).

We can select the appropriate model by using the Hausman test (see Clark and Linzer, 2012):

$$H = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[Var\left(\hat{\beta}_{FE}\right) - Var\left(\hat{\beta}_{RE}\right)\right]^{-1} \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)$$

(2)

where: H denotes the chi-square distribution with degree of freedom equals to the number of regressors in the model.
In the case of no correlation between independent variable and country effects, the estimates of β in fixed effects model ($\hat{\beta}_{FE}$) should be similar to the estimation of β in random effects model ($\hat{\beta}_{RE}$). The null hypothesis presumes that the random effects model is appropriate.
When *p* is less than 0.05 (the conventional level of significance), the null hypothesis is rejected in the favour of the fixed effects model. When p>0.05, the null hypothesis is accepted meaning that the random effects model is appropriate (see Clark and Linzer, 2012).
Before performing the panel regression analysis we check the stationarity of all variables by using the Hadri Lagrange Multiplier test in Stata. The Hadri (2000) LM test for stationarity assumes the null hypothesis that all panels are stationary versus the alternative that at least some of the panels contain unit roots. In a panel specific time regression we have:

$$y_{it} = r_{it} + \beta_i \cdot t + \varepsilon_{it}$$

(3)

where: r_{it} is a random walk:

$$r_{it} = r_{it-1} + u_{it}$$

(4)

If u_{it} is zero, r_{it} would be be constant and y_{it} would be trend stationary. In this logic, the Hadri LM tests the null hypothesis H_0 versus alternative H_a :

$$H_0: \lambda = \frac{\sigma_u^2}{\sigma_\varepsilon^2} = 0 \qquad H_a: \lambda > 0$$

In order to carry out the econometric analysis the STATA 13.1 software was used.

4. Main findings

4.1. The global competitiveness level in the European Union in 2017

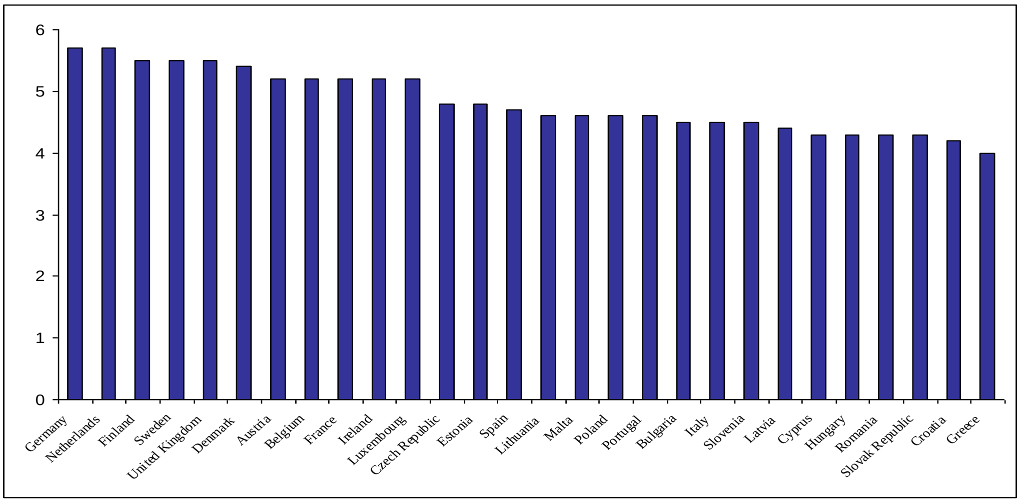

Figure 1 GCI scores in 2017 in EU countries
Source: author's computation based on WEF data

In 2017, the best performers as competitiveness are Germany and Netherlands followed by Finland, Sweden and United Kingdom. There are 11 countries with GCI score above the average of 4.83 (Germany, Netherlands, Sweden, United KIngdon, Denmark, Austria, Belgium, France, Ireland, Luxembourg and Czech Republic). We notice that a country form Central Europe (Czech Republic) belongs to this group. In the second group of countries, with GCI scores under the average, we find all the other developing countries from Eastern and Central Europe, as well as Spain, Malta, Portugal, Cyprus and Greece. The worst performer regarding global competitiveness is Greece (Figure 1).

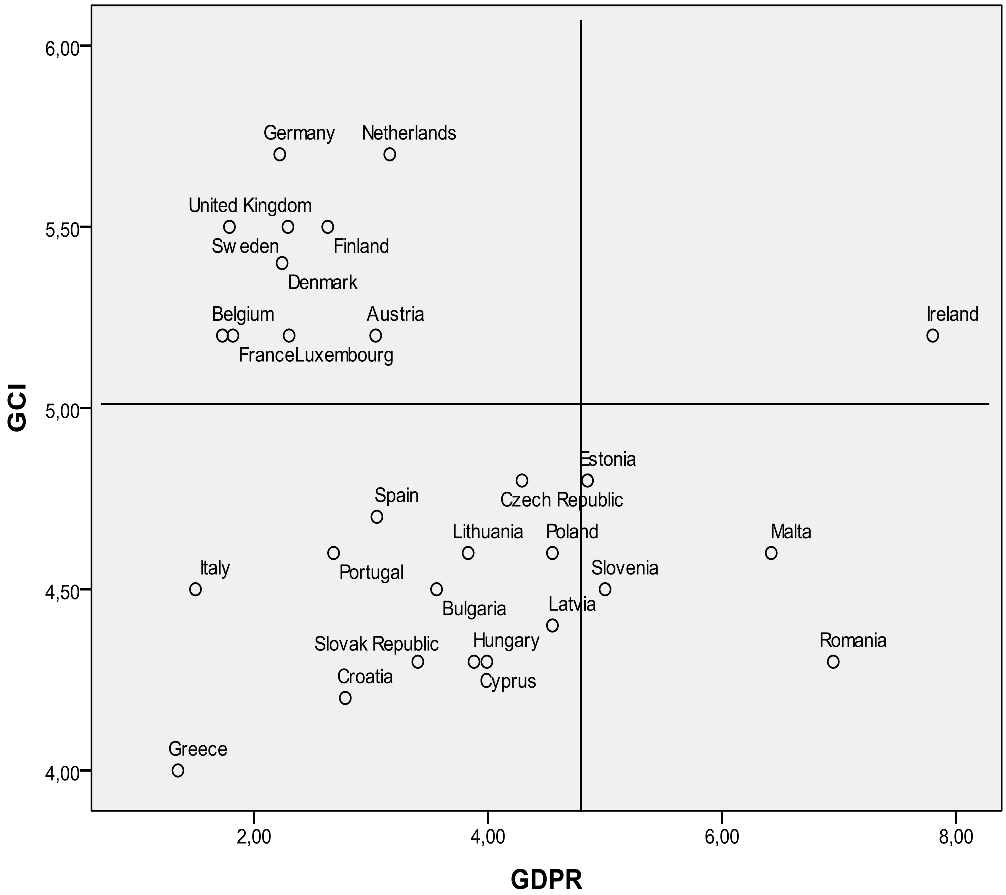

Figure 2 Global Competitiveness Index and growth rate of GDP in 2017, in the EU countries

Source: author's computation based on WEF and WDI data

We notice in the Figure 2 that developed countries in the EU (Germany, Netherlands, United Kingdom, Sweden, Finland, Denmark, Austria, Belgium, France and Luxembourg) registered in 2017 a low rate of growth and high scores for GCI.

In the right top quadrant is located only Ireland with high score of GCI and growth rate.

In the left bottom quadrant we see a mixture of advanced (Italy, Portugal, Greece and Cyprus) and developing (ECE) economies (Czech Republic, Croatia, Slovak

Republic, Bulgaria, Lithuania, Poland, Latvia, and Hungary). In the right bottom quadrant we find Estonia, Slovenia, Romania and Malta. Romania has the highest growth rate in this group.

The best performers as GDP growth in 2017 are: Ireland, Malta and Romania. Only Ireland correlates this performance with competitiveness, Malta and Romania experience under the EU average scores of GCI.

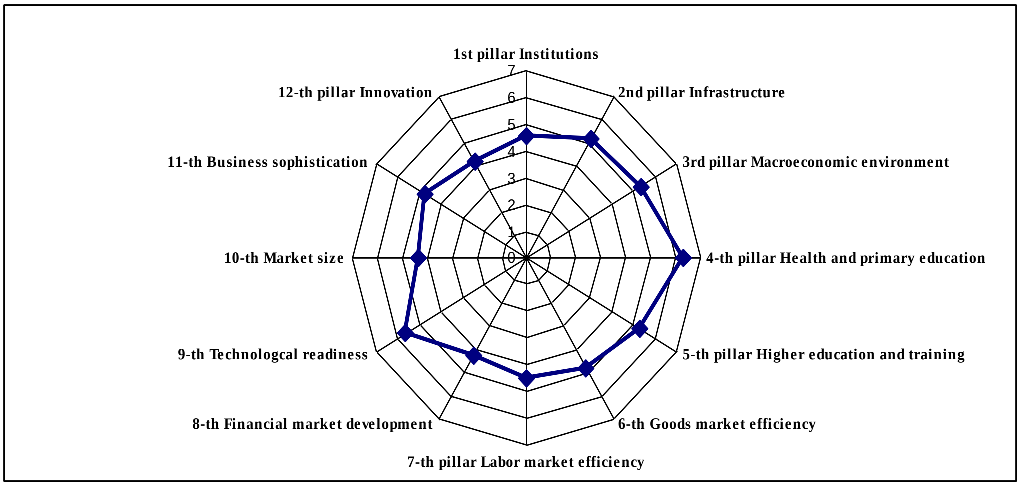

Figure 3 The mean scores of the 12 pillars of GCI at EU level, 2017
Source: author's computation based on WEF data

We notice that the figure 3 is almost similar with figure 4, indicating that the average scores for the components of GCI at EU level and in the group of advanced economies (Western countries) are close to each other.

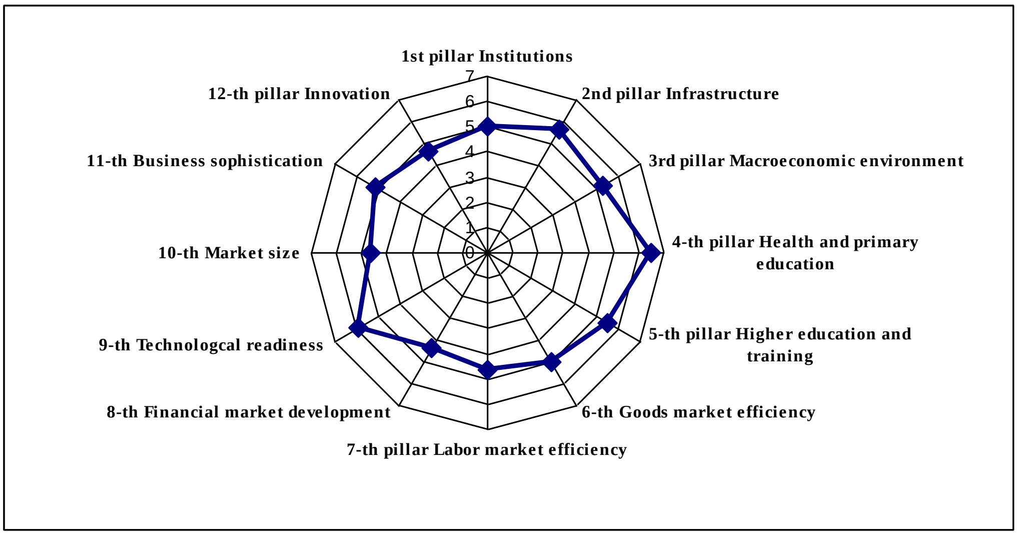

Figure 4 The mean scores of the 12 pillars of GCI in the group of Western European countries, 2017

Source: author's computation based on WEF data

In both groups of countries as well as at EU level, the highest mean score is registered for the component of Health and primary education.

By comparing the performance of the group of ECE countries with the group of Western countries, we notice that Financial development and Labor market efficiency have higher scores in ECE countries, as well as Macroeconomic environment.Technological readiness is slightly less scored in these countries, as well as Business sophistication (Figure 4 and Figure 5).

Institutions, Innovation and Market size as components of global competitiveness have the lowest scores in the group of ECE countries. The best scores of the GCI components in the group are registered for Health and primary education and for Tehnological readiness (Figure 5), but the last one is lower than in the Western countries group.

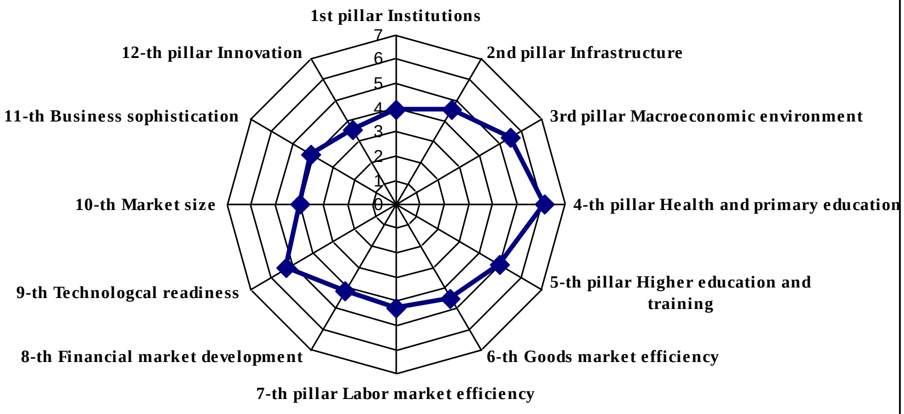

Figure 5 The mean scores of the 12 pillars of GCI in the group of Eastern-Central European countries, 2017
Source: author's computation based on WEF data

4.2. Results of regression estimation

4.2.1. European Union level

The results of unit root tests for our variables (GDPR and GCI) at EU level are displayed in Table 1a (Appendix). For both variables, the p-value is 0.000, indicating the stationarity of the variables series.
After running the commands in STATA for FE and RE models (Table 1b, Table 1c), we selected the appropriate model, by using the Hausman test (Table 1d). The value of Prob chi2 is 0.000 <0.005 indicating that the FE model is appropriate, for a significance level of 0.01.
For FE model, we run the test for robustness of standard errors (Table 1e). The value of Prob is 0.0006, suggesting robustness of standard errors.
The estimation of equation 1 at EU level is:

$$GDPR = -56{,}49 + 12.19 \cdot GCI$$

(10.33) (2.18)
(0.000) (0.000)

The model is statistically validated for a significance level of 0.01, due to the fact that the value of Prob is 0.000 for the model as a whole, as well as for each coefficient.

For an increase of one unit of GCI, the GDP rate can increase with 12.19 units, under caeteris paribus condition.

4.2.2 Western European countries

The results of performing unit root tests for GCI and GDPR show stationarity (Appendix, Table 2a) for these variables in the 17 Western European economies.

The estimation of FE and RE models (Table 2b and Table 2c) is followed by running the Hausman test. The value of Prob chi2 is 0.0004, indicating the FE model as appropriate (Table 2d). The robustness of standard errors (Table 2 e) is proved: the value of Prob is 0.0189< 0.05.

The estimation of equation 1 for the group of Western countries is:

$$GDPR = -53{,}32 + 10{,}92 \cdot GCI$$

(13,2) (2,6)
(0.000) (0.000)

The model is statistically validated for a significance level of 0.01, due to the fact that the value of Prob is 0.000 for the model as a whole, as well as for each coefficient.

For an increase of one unit of GCI, the GDP rate can increase with 10.92 units, under caeteris paribus condition. In proportion of 3% the variation of GDPR is due to the variantion of GCI (the value of R-sq is 0.034).

4.2.3. Eastern and Central European countries

The results unit root tests for GCI and GDPR, displayed in Table 3a (Appendix) show stationarity (Appendix, Table 3a) for these variables in the 11 Eastern and Central European economies.

After the estimation of FE and RE models (Table 3b and Table 3c) is followed by running the Hausman test. The value of Prob chi2 is 0.0016, indicating the FE model as appropriate (Table 3d). The robustness of standard errors (Table 3e) is proved: the value of Prob is 0.0182< 0.05.

The estimation of equation 1 for the group of ECE countries is:

$$GDPR = -58{,}57 + 13{,}76 \cdot GCI$$

(16.8) (3.7)
(0.000) (0.000)

The model is statistically validated for a significance level of 0.01, due to the fact that the value of Prob is 0.000 for the model as a whole, as well as for each coefficient.

For an increase of one unit of GCI, the GDP rate can increase with 13.76 units, under caeteris paribus condition. In proportion of 3% the variation of GDPR is due to the variantion of GCI (the value of R-sq is 0.034).

5. Conclusions

The aim of the paper was to explore the influence of global competitiveness on growth rate at the European economy level. Due to the fact the economic growth has different rates in advanced economies than in developing Member States, a separate panel data analysis for each group is performed.

In each group we found a positive validated (for a significance threshold of 0.01) influence of global competitiveness on annual growth rate of economies and a proportion of 3% explanation of dependent variable's variation of 3% At EU level the influence is stronger than in the group of Western countries and lower than in ECE countries.The strongest influence of global competitiveness on growth rate is identified among ECE countries. This suggests that for these countries competitiveness (trade openess, innovation, techonogy diffusion, market efficiency, and financial development) represents a valuable and critical resource for growth and appropriate public policies are needed in order to enhance it, as well as, adequate institutions to implement and monitor them. EU emerging economies (ECE) should to use this resource in order to narrow the gap with advanced economies, to speed their convergence process and benefit from international trade and mobility of labour and capital or latest development in technology.

For advanced economies of the EU, with high scores of global competitiveness and low growth rates of GDP, competitiveness is needed to sustain their higher living standards and support their reforms in a very challenging socio-economic context, in order to ensure future prosperity for Europe.

The conclusions of the present research are similar with the findings of Dobrinsky and Havlik (2014) and Korez-Vide and Tominc (2016) regarding competitiveness and growth in ECE countries.

It is also, found in the panel regression analysis that we can explain the variation of dependent variable only in a proportion of 3%. This suggests that there are several other factors than global competitiveness driving the economic growth, which were not considered in this research, therefore, we mentioned the condition of caeteris paribus.

Possible other limitations of the present research are related to the relative short period of time taken into analysis and to the fact that the Global Competitiveness Index is a composit indicator, built on other proxy indicators, which cannot capture the mechanisms and channels of other growth resources and factors.

Further studies might go deeper into analysis of the drivers of a country's competitiveness and their impact on economic growth or, other metrics for competitiveness can be considered.

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Appendix

Estimation results of regression model at EU level

Table 1a

Unit root tests

Hadri LM test for GCI

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Ho: All panels are stationary            Number of panels  =    28
Ha: Some panels contain unit roots       Number of periods =    10
Time trend:        Not included        Asymptotics: T, N -> Infinity
Heteroskedasticity: Not robust                   sequentially
LR variance:       (not used)
------------------------------------------------------------------------------------
                 Statistic        p-value
------------------------------------------------------------------------------------
 z               14.4744       0.0000
------------------------------------------------------------------------------------
```

Hadri LM test for GDPR

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------------------------
Ho: All panels are stationary            Number of panels  =    28
Ha: Some panels contain unit roots       Number of periods =    10
Time trend:        Not included        Asymptotics: T, N -> Infinity
Heteroskedasticity: Not robust                   sequentially
LR variance:       (not used)
------------------------------------------------------------------------------------
                 Statistic     p-value
------------------------------------------------------------------------------------
 z                6.0739      0.0000
------------------------------------------------------------------------------------
```

Table 1b

Regression results at EU level- Fixed-effects model

```
Fixed-effects (within) regression              Number of obs     =     280
Group variable: Country                        Number of groups  =      28
R-sq:  within  = 0.1103                        Obs per group: min =      10
       between = 0.0100                                   avg =     10.0
       overall = 0.0092                                   max =       10
                                                 F (1,251)        =    31.12
corr (u_i, Xb)  = -0.9532                        Prob > F         =   0.0000
------------------------------------------------------------------------------------
```

GDPR	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GCI	12.1909	2.185422	5.58	0.000	7.8868	16.495
_cons	-56.49848	10.33302	-5.47	0.000	-76.84895	-36.14801
sigma_u	6.0603262					
sigma_e	3.4560907					
rho	.75459125	(fraction of variance due to u_i)				

F test that all u_i=0: F(27, 251) = 2.81 Prob > F = 0.0000

Table 1c

Regression results at EU level - Random-effects model

Random-effects GLS regression Number of obs = 280
Group variable: Country Number of groups = 28
R-sq: within = 0.1103 Obs per group: min = 10
between = 0.0100 avg = 10.0
overall = 0.0092 max = 10
Wald chi2(1) = 3.34
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0678

GDPR	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
GCI	1.060723	.580825	1.83	0.068	-.0776732	2.199119
_cons	-3.883741	2.761136	-1.41	0.160	-9.295467	1.527986
sigma_u	.98948804					
sigma_e	3.4560907					
rho	.07575929	(fraction of variance due to u_i)				

Table 1d

Hausman test for the regression model at EU level

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt (diag(V_b-V_B))
	fe	re	Difference	S.E.
GCI	12.1909	1.060723	11.13018	2.106825

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 27.91
Prob>chi2 = 0.0000

Table 1e

Robustness of standard errors

```
Fixed-effects (within) regression            Number of obs      =      280
Group variable: Country                      Number of groups   =       28
R-sq:  within  = 0.1103                      Obs per group: min =       10
       between = 0.0100                                     avg =     10.0
       overall = 0.0092                                     max =       10
                                             F(1,27)            =    15.25
corr(u_i, Xb)  = -0.9532                     Prob > F           =   0.0006
------------------------------------------------------------------------------
             |               Robust
        GDPR |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------------------------------------------------------------
         GCI |    12.1909    3.121263     3.91   0.001     5.786598     18.5952
       _cons |  -56.49848    14.75488    -3.83   0.001    -86.77299   -26.22397
------------------------------------------------------------------------------
     sigma_u |  6.0603262
     sigma_e |  3.4560907
         rho |  .75459125   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Estimation results of regression model in Western countries

Table 2a

Unit root tests
Hadri LM test for GDPR

```
------------------------
Ho: All panels are stationary              Number of panels  =     17
Ha: Some panels contain unit roots         Number of periods =     10
Time trend:         Not included           Asymptotics: T, N -> Infinity
Heteroskedasticity: Not robust                              sequentially
LR variance:        (not used)
------------------------------------------------------------------------------
              Statistic      p-value
------------------------------------------------------------------------------
 z               5.7071       0.0000
------------------------------------------------------------------------------
```

Hadri LM test for GCI

```
-----------------------
Ho: All panels are stationary              Number of panels  =     17
Ha: Some panels contain unit roots         Number of periods =     10
Time trend:         Not included           Asymptotics: T, N -> Infinity
```


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Heteroskedasticity: Not robust sequentially
LR variance: (not used)

	Statistic	p-value
z	11.0389	0.0000

Table 2b

Estimation results in Western countries-FE model

Fixed-effects (within) regression Number of obs = 170
Group variable: Country Number of groups = 17
R-sq: within = 0.1000 Obs per group: min = 10
between = 0.0884 avg = 10.0
overall = 0.0347 max = 10
F(1,152) = 16.89
corr(u_i, Xb) = -0.9343 Prob > F = 0.0001

GDPR	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GCI	10.92895	2.658971	4.11	0.000	5.675633	16.18226
_cons	-53.32185	13.20194	-4.04	0.000	-79.40484	-27.23885
sigma_u	5.1301839					
sigma_e	3.1307053					
rho	.72864651	(fraction of variance due to u_i)				

Table 2c

Estimation results in Western countries- RE model

Random-effects GLS regression Number of obs = 170
Group variable: Country Number of groups = 17
R-sq: within = 0.1000 Obs per group: min = 10
between = 0.0884 avg = 10.0
overall = 0.0347 max = 10
Wald chi2(1) = 5.30
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0214

GDPR	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
GCI	1.893883	.8228337	2.30	0.021	.2811586	3.506607

_cons	-8.46967	4.105392	-2.06	0.039	-16.51609	-.4232498

sigma_u	1.3070158	
sigma_e	3.1307053	
rho	.14842301	(fraction of variance due to u_i)

Table 2d

Hausman test for the regression model in Western countries

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fe	re	Difference	S.E.
GCI	10.92895	1.893883	9.035063	2.528452

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 12.77
Prob>chi2 = 0.0004

Table 2e

Robustness of standard errors

Fixed-effects (within) regression — Number of obs = 170
Group variable: Country — Number of groups = 17
R-sq: within = 0.1000 — Obs per group: min = 10
between = 0.0884 — avg = 10.0
overall = 0.0347 — max = 10
F(1,16) = 6.81
corr (u_i, Xb) = -0.9343 — Prob > F = 0.0189

GDPR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
GCI	10.92895	4.186865	2.61	0.019	2.053188	19.8047
_cons	-53.32185	20.78458	-2.57	0.021	-97.3832	-9.260496

sigma_u	5.1301839	
sigma_e	3.1307053	
rho	.72864651	(fraction of variance due to u_i)

Estimation results of regression model in the ECE countries

Table 3a

Unit root tests
Hadri LM test for GCI

Ho: All panels are stationary — Number of panels = 11
Ha: Some panels contain unit roots — Number of periods = 10
Time trend: Not included — Asymptotics: T, N -> Infinity sequentially
Heteroskedasticity: Not robust
LR variance: (not used)

	Statistic	p-value
z	9.3118	0.0000

Hadri LM test for GDPR

Ho: All panels are stationary — Number of panels = 11
Ha: Some panels contain unit roots — Number of periods = 10
Time trend: Not included — Asymptotics: T, N -> Infinity sequentially
Heteroskedasticity: Not robust
LR variance: (not used)

	Statistic	p-value
z	3.0502	0.0011

Table 3b

Estimation results in ECE countries-FE model

Fixed-effects (within) regression — Number of obs = 110
Group variable: Country — Number of groups = 11
R-sq: within = 0.1231 — Obs per group: min = 10
between = 0.0024 — avg = 10.0
overall = 0.0344 — max = 10
F(1,98) = 13.76
corr(u_i, Xb) = -0.7833 — Prob > F = 0.0003

GDPR	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]

GCI	13.76045	3.709804	3.71	0.000	6.398464	21.12243
_cons	-58.57075	16.18243	-3.62	0.000	-90.68425	-26.45725

sigma_u | 2.5926543
sigma_e | 3.9166466
rho | .3046806 (fraction of variance due to u_i)

F test that all u_i=0: F(10, 98) = 1.69 Prob > F = 0.0930

Table 3c

Estimation results in ECE countries- RE model

Random-effects GLS regression — Number of obs = 110
Group variable: Country — Number of groups = 11
R-sq: within = 0.1231 — Obs per group: min = 10
between = 0.0024 — avg = 10.0
overall = 0.0344 — max = 10
Wald chi2(1) = 3.85
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0499

GDPR	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
GCI	3.861705	1.969266	1.96	0.050	.0020134	7.721396
_cons	-15.40323	8.596428	-1.79	0.073	-32.25192	1.445462

sigma_u | 0
sigma_e | 3.9166466
rho | 0 (fraction of variance due to u_i)

Table 3d

Hausman test for the regression model in ECE countries

	---- Coefficients ----			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
GCI	13.76045	3.861705	9.898744	3.143984

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 9.91
Prob>chi2 = 0.0016

Table 3e

Robustness of standard errors

```
Fixed-effects (within) regression          Number of obs      =     110
Group variable: Country                    Number of groups   =      11
R-sq:  within  = 0.1231                    Obs per group: min =      10
       between = 0.0024                                   avg =    10.0
       overall = 0.0344                                   max =      10
                                           F(1,10)            =    7.94
corr(u_i, Xb)  = -0.7833                   Prob > F           =  0.0182
------------------------------------------------------------------------------
             |               Robust
        GDPR |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------------------------------------------------------------
         GCI |   13.76045   4.882953     2.82   0.018     2.880552    24.64035
       _cons |  -58.57075   21.29411    -2.75   0.020     -106.017   -11.12451
------------------------------------------------------------------------------
     sigma_u |  2.5926543
     sigma_e |  3.9166466
         rho |   .3046806   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```