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ECONOMIC ACTIVITY AND INTENSITY OF COMPETITION IN POST-SOCIALIST COUNTRIES: A PANEL ANALYSIS

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Abstract

The intensity of competition figures as an important factor in increasing economic activity. The intensification of market competition is one of the key goals of economic policy in post-socialist countries. The aim of this paper is to determine the contribution of the intensity of competition to the level of economic activity in these countries. In this article, a panel analysis is carried out on a sample of 22 post-socialist countries for the period between 2006 and 2019. The indicator of the intensity of local competition from the Global Competitiveness Index of the World Economic Forum is taken as a measure of the intensity of competition. The results of the conducted research indicate that the increase in the intensity of competition has a positive effect on economic activity, expressed by the level of gross domestic product (GDP) in the selected post-socialist countries.

Key words: gross domestic product (GDP), economic activity, intensity of competition, post-socialist countries, panel data.

ЕКОНОМСКА АКТИВНОСТ И ИНТЕНЗИТЕТ КОНКУРЕНЦИЈЕ У ПОСТСОЦИЈАЛИСТИЧКИМ ЗЕМЉАМА: ПАНЕЛ АНАЛИЗА

Апстракт

Интензитет конкуренције представља битан чинилац повећања економске активности. Интензивирање конкуренције на тржишту један је од кључних циљева економске политике постсоцијалистичких земаља. Циљ овог рада је да утврди допринос утицаја интензитета конкуренције на ниво економске активности ових земаља. У овом чланку се спроводи панел анализа на узорку од 22 постсоцијалистичке земље за период између 2006. и 2019. године. Као мера степена интензитета конкуренције узима се индикатор интензитета локалне конкуренције из Ин-

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декса глобалне конкурентности Светског економског форума. Резултати истраживања указују на то да пораст степена интензитета конкуренције позитивно утиче на економску активност, изражену нивоом бруто домаћег производа (БДП) у одабраним постсоцијалистичким земљама.

Кључне речи: бруто домаћи производ (БДП), економска активност, интензитет конкуренције, постсоцијалистичке земље, панел подаци.

INTRODUCTION

Economic theory and empirical research indicate the existence of a relationship between the intensity of competition and economic activity. According to the relevant economic literature, the intensity of competition brings about greater economic efficiency and, consequently, greater economic output (Nielsen, Rolmer, Harhoff, Andersen, & Okholm, 2013, pp. 13-14). Competition drives productivity growth by influencing companies to compete in the market place in terms of improving operational processes, costs reduction, and the production of products and services that better meet consumer needs. Namely, competition leads to allocative, productive, and dynamic efficiency (Motta, 2003, p. 50; Boheim, 2004, p. 154). Competition is especially important for post-socialist countries, as it is a key element of their reform (transition) processes (Vagliasindi, 2001, pp. 1-2). According to the transition theory, competition in these countries contributes to price reduction, excludes inefficient firms from the market, and is important for the development of innovation (Friesenbichler, Boheim, & Laster, 2014, pp. 9-10). Empirical studies provide different and often contradictory results regarding the analysed relationship between the intensity of competition and economic activity. In this context, there are three groups of authors. The first group of authors finds a positive relationship between competition and economic activity. The second group of authors does not find a statistically significant relationship, and they conclude that there is no clear relationship between competition and economic activity. Finally, the third group of authors finds a negative relationship between competition and economic activity.

The aim of this paper is to determine the relationship between the intensity of competition and economic activity in post-socialist countries. Specifically, the paper will analyse the relationship between the intensity of competition and the level of gross domestic product (GDP) on a sample of 22 observed post-socialist countries in the period between 2006 and 2019. The research is conducted using panel data regression analysis.

The article starts from the research hypothesis that the intensity of competition contributes to the level of economic activity. The intensity of competition is measured by the indicator of the intensity of local competition taken from the Global Competitiveness Index of the World Economic Forum, while economic activity is measured by the level of GDP.

In addition to its introductory part, the paper consists of three sections and a conclusion. The second part of the paper presents an overview of existing relevant scientific literature that discusses the relationship between competition and the scope of economic activity at the state level. The third section of the paper discusses the data, research methodology, and selected econometric model. The fourth part of the paper presents and discusses the obtained results of the conducted panel data analysis, while its final part derives conclusions from this analysis.

LITERATURE REVIEW

In their economic studies, many authors indicate that the correlation between the intensity of competition and the GDP level is positive. They conclude that the intensity of competition contributes to greater economic efficiency, which consequently leads to greater output. Contrary to them, other authors prove that there is no statistically significant relationship between competition and economic activity. They show through their empirical studies that the intensity of competition is not correlated with GDP. In addition, some authors claim that the intensity of competition has a negative impact on GDP due to the negative effect of intense competition on the development of innovations. In the following text, the most important authors, and their viewpoints and analyses of the problem of the relationship between the intensity of competition and economic activity are presented.

Dutz and Hayri (1999) analyse the impact of the intensity of competition on the growth of gross national product (GNP) per capita on a sample of 100 countries for the period between 1986 and 1995. The research confirms that the intensity of domestic competition has a positive effect on the growth of GNP per capita. Carlin, Fries, Schaffer and Seabright (2001) perform a regression analysis on a sample of 3300 firms in 25 transition countries to determine whether competition affects firm performance. The research indicates that competitive pressure has a significant positive impact on sales volume growth, labour productivity growth, and product development and improvement at the enterprise level.

In their research, Aghion, Harris, Howitt and Vickers (2001) confirm that competition has a positive impact on economic growth as it urges firms to innovate in order to survive on the market. They find that an increase in economic growth is accompanied by an increase in the intensity of competition, and that the maximum of economic growth is achieved at the maximum of the intensity of competition. Aghion, Bloom, Blundell, Griffith and Howitt (2005) also find that the relationship between competition and innovation can be shown as an inverted 'U' letter. Increasing the intensity of competition from a low level naturally leads to the growth of innovations and a positive impact on economic growth, up to a certain max-

imum point. However, a further growth of the intensity of competition beyond this maximum point leads to a decrease in innovation and a negative impact on economic growth. In other words, the nature of competition's impact on economic growth is determined by the level of competition. In their more recent empirical research, Aghion, Farhi and Kharroubi (2019) point to the existence of a relationship among monetary policy, economic growth and competition in the product market. The research indicates that the easing of monetary policy contributes to the growth of sector (at the firm level), and this is more so when the degree of competition in the country is greater. Aghion, Bergeaud, Boppart, Klenowand Li (2019) problematise the theory of falling economic growth and rising rents. They find that economic growth declines while the concentration of firms rises. The study shows that greater competition from efficient firms influences less efficient firms to enter markets less profitably and, therefore, to innovate less. As a result, incentives for innovation decline, reducing long-term economic growth. Aghion, Cherif and Hasanov (2021) also point to the existence of a relationship among competition, innovation, and inclusive growth that contributes to all layers of society. The study confirms that a lower intensity of competition implies less inclusive economic growth and greater inequality in income distribution.

Ahn, Duval and Sever (2020) identify the relationship between macroeconomic policy, product market competition, and economic growth. The research indicates complementarity between the deregulation of the product market, i.e. intensification of competition and counter-cyclical monetary (and fiscal) policy in encouraging investments and economic growth. Countercyclical macroeconomic policy can strengthen long-term growth, especially in conditions of intense product market competition. Hong (2022) finds a positive correlation among effective competition and competition policy, on the one hand, and the most important macroeconomic variables, such as labour productivity, economic growth, innovation, employment and reducing inequalities, on the other hand. Ultimately, in their research on the impact of competition protection policy on the economic development and by applying correlation and regression analysis on cross-sectional data, Đekić, Radivojević and Krstić (2019) conclude that the growth of the competition policy efficiency has a positive effect on the GDP trend in the observed transition countries.

Krakowski (2005) conducts a regression analysis on a sample of 101 countries and finds that there is a positive correlation between the intensity of local competition and GNP per capita. He concludes that countries with a higher GNP per capita have a higher intensity of competition. Scopelliti (2010) conducts a panel analysis of 20 OECD countries for the period between 1995 and 2005 to examine the relationship among competition, economic growth, and technological progress. Scopelliti uses the Index of Business Freedom as a measure of the domestic competition pressure. This

author also measures innovations by the number of patents, while using the growth rate of total factor productivity (TFP) as a measure of economic growth. The research results indicate that the impact of competition on economic growth depends on the distance of the country from the technological frontier. The positive impact of domestic competition on economic growth is greater for those countries that are closer to the technological frontier than for countries that are further away from the frontier.

Conversely, Monago (2013) suggests that there is no clear relationship between competition and economic development, but that more developed countries simply have a higher intensity of competition. He conducts a panel data analysis on a sample of 100 countries for the period between 2005 and 2011. Monago uses GDP per capita as a measure of economic development, while he uses an indicator of the intensity of local competition as a measure of competition. The research shows that the contribution of the intensity of competition to economic development in the case of low- and lower-middle-income countries does not reach statistical significance. In addition, it confirms a positive relationship for upper middle-income countries, while finding a negative relationship for high-income countries. Gomma (2014) conducts a panel data analysis on a sample of 115 countries for the period between 1995 and 2010, and finds a negative relationship between the intensity of competition and economic growth. He uses the Business Freedom Index as a measure of domestic competition intensity. Gomma concludes that the intensity of domestic competition leads to a decrease in GDP growth, as it has a negative impact on the development of innovations. Finally, Yussef and Zaki (2019), by investigating the nature and influence of competition policy on the economic growth of Middle Eastern and African countries, find somewhat contradictory results. While competition policy measures have a positive and statistically significant impact on the growth of GDP trend component, their impact on the GDP cyclical component is statistically insignificant.

A review of the literature and research results of various authors show that the relationship between competition and economic activity represents an open question in economics. This imposes the need for further empirical analysis of the given problem.

DATA AND METHODOLOGY

The subject of research in this paper is the relationship between the intensity of competition and economic activity in post-socialist countries. The economic activity of countries is measured by their GDP level. The intensity of competition is measured using the indicator of the intensity of local competition from the World Economic Forum Global Competitiveness Index. The value of the intensity of the local competition indicator ranges from 1 to 7, whereby 1 represents the absence of competition and 7

corresponds to the highest intensity of market competition (World Economic Forum, 2017, p. 346).

The analysis is conducted on panel data, which consists of 22 post-socialist countries for the period between 2006 and 2019. The term 'post-socialist countries' refers to all those countries that left behind the socialist system and accepted the capitalist, i.e. market economy. The following post-socialist countries are included in the panel data: Albania, Armenia, Azerbaijan, Bulgaria, Croatia, the Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Mongolia, Montenegro, Poland, Romania, the Russian Federation, Serbia, Slovakia, Slovenia, and Ukraine (Nafziger, 2005, pp. 22-23, & 742; EBRD, 2010, p. 4). The observed panel data is of the balanced type.

In the paper, panel regression analysis is used to determine the relationship between the dependent and independent variables. The dependent variable is a level of GDP (constant 2010 US$), which figures as an indicator of economic activity. The authors decided to use the value of the logarithm of GDP to equalise large-scale data. GDP values were taken from the World Bank database (The World Bank, 2020). The employed independent variables are the following indicators: intensity of local competition (ILC), institutions (INS), infrastructure (INF), macroeconomic environment (ME), higher education and training (HET), labour market efficiency (LME), financial market development (FMD), and technological readiness (TR). The selection of independent variables was made on the basis of economic theory and research, which states that the economic activity of a country is determined by the competitiveness of its economy (World Economic Forum, 2006a, p. 3, & 5-10, 2017b, p. 1, 4, & 12). The values of the independent variables were taken from the Global Competitiveness Index database of the World Economic Forum (World Economic Forum, 2018).

It should be noted here that the Global Competitiveness Index, which was used in this analysis, is based on the twelve-pillar structure that was introduced in 2006 and was valid until the Global Competitiveness Report edition for 2017-2018, after which its calculation methodology had changed (Dudas & Cibul'a, 2019, pp. 50-51). Therefore, in this paper, a linear extrapolation of all considered variables, with the exception of the GDP variable, was performed for two years (2018 and 2019), i.e. until the outbreak of the COVID-19 virus pandemic shock, in order to ensure comparability of data and accuracy of predictions. The paper did not take into account the period after the outbreak of the pandemic, bearing in mind that many pandemic measures of state intervention affected the distortion of market competition, which would also distort the results of this analysis itself.

Taking into account all the noted variables, the research model got the following form:

$$\text{LogGDP} = \alpha_0 + \beta_1\text{ILC} + \beta_2\text{INS} + \beta_3\text{INF} + \beta_4\text{ME} + \beta_5\text{HET} + \beta_6\text{LME} + \beta_7\text{FMD} + \beta_8\text{TR} + \epsilon$$

α_0 - intercept; β_1,β_2, β_3 .... β_8 - coefficients (slopes); ϵ - error term

The main research hypothesis in the paper is that the intensity of competition has a positive effect on economic activity at the state level.

The statistical program used for analysing panel data and the graphical presentation of data in this article is the R program. The following software packages were used within the R program: 'plm,''foreign,''lmtest,''ggplot2,''dplyr' and'car.'

The descriptive statistics of all variables are presented in Table 1.

Table 1. Descriptive statistics

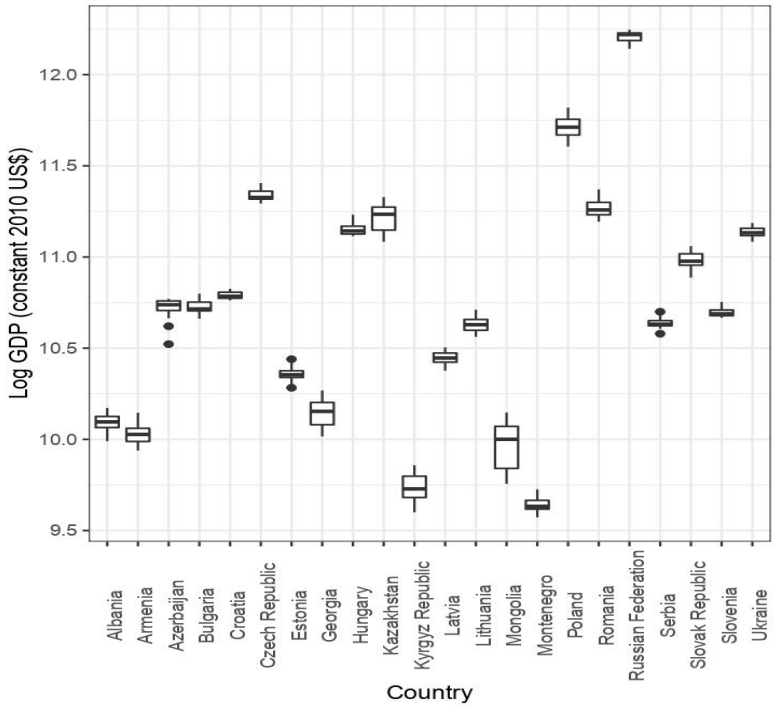
	Mean	Standard deviation	Median	Max	Min
GDP (constant 2010 US$)	1.5909e+11	3.3904e+11	5.0229e+10	1.7624e+12	3.7344e+9
Log of GDP (constant 2010 US$)	10.70173	0.6314511	10.70096	12.24612	9.572227
Intensity of local competition	4.723671	0.6090713	4.648524	5.832775	3.341312
Institutions	3.741536	0.4695952	3.698845	5.156973	2.743351
Infrastructure	3.932577	0.7494491	4.059439	5.475785	1.815446
Macroeconomic environment	4.853972	0.7128711	4.913580	6.4156	3.121060
Higher education and training	4.517824	0.5231843	4.542967	5.569499	2.998960
Labour market efficiency	4.384675	0.3244547	4.397622	5.154612	3.636913
Financial market development	3.933487	0.5118060	3.927632	5.096513	2.423516
Technological readiness	4.150343	0.8343914	4.193604	6.105241	1.972609

Source: Authors' calculations

The mean of GDP for 22 post-socialist countries is 1.5909e+11 dollars, the maximum value amounts to 1.7624e+12, and the minimum value is 3.7344e+9 dollars. The standard deviation of GDP amounts to 3.3904e+11. The coefficient of variation of GDP has been obtained by the following formula: 3.3904e+11/1.5909e+11= 2.131. A coefficient of variation value greater than 1 indicates a large standard deviation and data variability. The mean of the log of GDP is 10.7, the maximum value is 12.2, and the minimum value is 9.6. The standard deviation of the log of GDP is 0.631451, while the coefficient of variation amounts to 0.631451/10.70173 = 0.059. The mean of the indicator of the intensity of local competition for 22 post-socialist countries is 4.7, the maximum value is 5.8 and the mini-

mum value is 3.3. The number of observations for each variable is 22 (countries) x 14 (time periods) = 308.

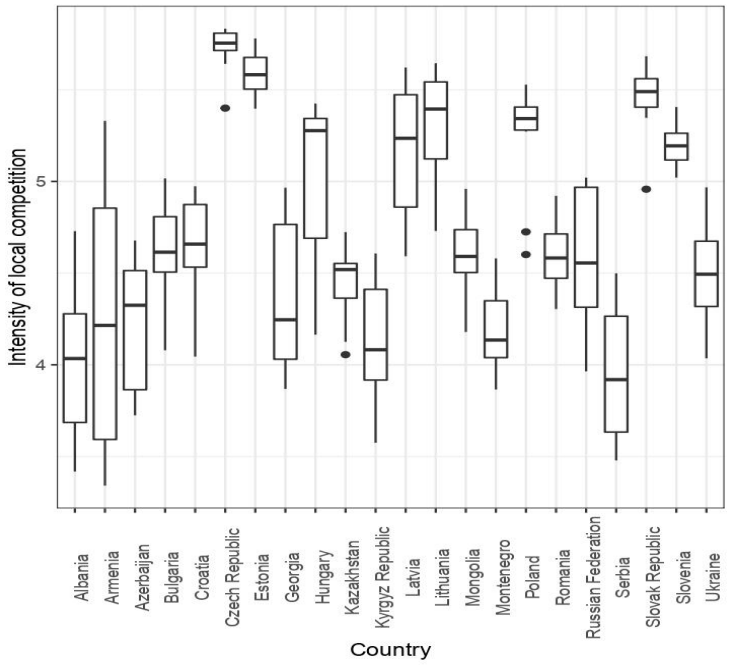
The values of the indicator of the GDP logarithm (log GDP) for all 22 post-socialist countries are presented in Graph 1. More precisely, the mean, maximum, and minimum values of this indicator are given here in the form of bar graphs for each country separately for the period between 2006 and 2019.



Graph 1. Log GDP (constant 2010 US$): Mean, max, and min value
Source: Authors' contribution

An overview of log GDP values of post-socialist countries from Graph 1 shows that the observed sample consists of a heterogeneous group of countries. An overview of the log GDP indicator shows that Russia and Poland have the highest GDP values, while Kyrgyzstan and Montenegro have the lowest values. The length of the bar graphs indicates whether there was a change in the value of GDP in the observed period.

The values of the intensity of local competition indicator for all 22 post-socialist countries are presented in Graph 2. More precisely, the mean, maximum, and minimum values of this indicator are also given here in the form of bar graphs for each country separately for the period between 2006 and 2019. This indicator measures the intensity of domestic competition.



Graph 2. Intensity of local competition: Mean, max, and min value
Source: Authors' contribution

An overview of the indicator of the intensity of local competition from Graph 2 shows that the Czech Republic, Estonia, and Slovakia have the highest values of this indicator, while Albania, Kyrgyzstan, Montenegro, and Serbia have the lowest values of the indicator. The length of the bar graphs indicates whether there was an increase in the intensity of competition during the observed period. It is noticeable that countries starting from a lower position on the graph have longer bar graphs, while countries that are in a higher position have shorter bar graphs. Longer bar graphs represent countries in transition, while shorter bar graphs represent countries that have completed the transition process and have already reached a higher level of competition intensity (United Nations, 2007a, p. 130; 2008b, p. 142; 2014c, p. 145; 2017d, p. 153).

RESULTS AND DISCUSSION

The results of the correlation analysis between the dependent variable of log GDP and the independent variables are presented in Table 2. Correlation coefficients are given in order to find out the strength and direction of the correlation relationship among these variables.

Table 2. Correlation coefficients between the dependent variable of the logarithm of GDP and the independent variables

	Log GDP (constant 2010 US$)
Intensity of local competition	0.35
Institutions	-0.09
Infrastructure	0.38
Macroeconomic environment	0.32
Higher education and training	0.38
Labour market efficiency	-0.04
Financial market development	0.03
Technological readiness	0.27

Source: Authors' calculations

The correlation coefficients presented in Table 2 indicate that there is a satisfactory correlation level for further analysis between the variable of log GDP and the following variables: intensity of local competition, infrastructure, macroeconomic environment, higher education and training, and technological readiness. However, the correlation coefficients between the variable of log GDP and the following variables: institutions, labour market efficiency, and financial market development indicate a non-existent correlation, so these variables were excluded from the model, having no significance for further analysis. At the same time, all the remaining variables have a positive impact on the level of log GDP.

The results of the correlation analysis of independent variables are presented in the form of a correlation matrix in Table 3. The correlation matrix is given in order to determine multicollinearity in the model and thereby to eliminate errors in the regression analysis.

Table 3. Correlation matrix of independent variables

	ILC	INS	INF	ME	HET	LME	FMD	TR
ILC	1.00							
INS	0.49	1.00						
INF	0.55	0.54	1.00					
ME	0.41	0.45	0.34	1.00				
HET	0.74	0.51	0.76	0.24	1.00			
LME	0.11	0.48	0.02	0.39	-0.01	1.00		
FMD	0.48	0.51	0.15	0.46	0.22	0.29	1.00	
TR	0.68	0.57	0.82	0.41	0.78	-0.03	0.29	1.00

Legend: ILC- intensity of local competition, INS- institutions, INF- infrastructure, ME- macroeconomic environment, HET- higher education and training, LME- labour market efficiency, FMD- financial market development, and TR- technological readiness.
Source: Authors' calculations

The data presented in Table 3 indicates a high value of the correlation coefficient between the variables intensity of local competition and

higher education and training (0.74), as well as between the variables intensity of local competition and technological readiness (0.68). Furthermore, there is a high correlation coefficient in the case of the variables infrastructure and higher education and training (0.76), followed by the variables infrastructure and technological readiness (0.82). The correlation coefficient is also high in the case of the variables higher education and training and technological readiness (0.78).The value of the correlation coefficient above 0.7 between two or more independent variables indicates the presence of a multicollinearity problem (Tabachnick & Fidell, 2019, p. 77).

The results of the Variance Inflation Factor (VIF) test are presented in Table 4 in order to assess the possibility of multicollinearity in the model. On this occasion, three models were analysed, namely Model 1, Model 2, and Model 3. Model 1 includes the following variables: log GDP, ILC, INS, INF, ME, HET, LME, FMD, and TR. Model 2 includes: log GDP, ILC, INS, ME, HET, and TR, while Model 3 includes: log GDP, ILC, INF, and ME. The logic of using multiple models in the analysis of the Variance Inflation Factor is to observe the change of this parameter when certain variables are omitted from the model.

Table 4. Results of Variance Inflation Factortest

Variables	Model 1	Model 2	Model 3
Intensity of local competition	3.1532	2.7152	1.5702
Institutions	2.8905	-	-
Infrastructure	3.8726	3.6744	1.4710
Macroeconomic environment	1.7480	1.3645	1.2302
Higher education and training	4.2018	4.1056	-
Labour market efficiency	1.8550	-	-
Financial market development	1.8669	-	-
Technological readiness	4.9274	4.2744	-

Source: Authors' calculations

The results of the Variance Inflation Factor test from Table 4 indicate an increased test value in Model 1 for the variables higher education and training (4.2) and technological readiness (4.9). The values of the Variance Inflation Factor for these two variables exceed the limit of 4 points, which could imply the presence of possible multicollinearity. It is recommended to remove observed collinearity by sequentially excluding the variables with the highest value of the Variance Inflation Factor, until this indicator of all remaining variables from the model amounts to a value below the value of 3 (Zuur, Ieno, & Elphick, 2010, p. 9; O'Brien, 2007, pp. 680-681, & 684).

Based on the results of the correlation matrix and the results of the Variance Inflation Factor test, and in order to avoid the possible problem of multicollinearity, the following two variables: (a) higher education and

training and (b) technological readiness were excluded from the model. Therefore, only three variables remained in the model for further analysis: intensity of local competition, infrastructure, and macroeconomic environment (Model 3).

The existence of a unit root in the observed panel data was tested using the 'Im, Pesaran and Shin' ('IPS') test. The 'IPS' test was chosen due to the length of the time series, T = 13, as well as the fact that it has generally been shown to be more powerful than the 'Levin, Lin and Chu' ('LLC') test and Fisher's tests (Barbieri, 2006, p. 10, & 52). The results of the conducted 'IPS' test are shown in Table 5, in which I(0) represents the regular values of the variables (at the level) and I(1) represents the values of the variables that were transformed by the first differentiation. The obtained p-values of the test are presented in parentheses. When evaluating the results of the unit root test, we are guided by the following rules: If the obtained p-value is not statistically significant, then the time series is not stationary. If the p-value is less than 0.05 at the significance level of α=0.05, then we can reject the assumption that the time series has a unit root.

Table 5. Panel unit root test results

	I(0)		I(1)	
	Intercepts	Intercepts and trend	Intercepts	Intercepts and trend
Log GDP (constant 2010 US$)	5.315 (1)	-6.5655 (2.592e-11)	-8.282 (< 2.2e-16)	-13.133 (<2.2e-16)
Intensity of local competition	-3.7574 (8.585e-05)	-9.2366 (<2.2e-16)	-11.95 (< 2.2e-16)	-8.8979 (< 2.2e-16)
Infrastructure	-0.9652 (0.1672)	-6.5348 (3.185e-11)	-10.718 (< 2.2e-16)	-11.997 (< 2.2e-16)
Macroeconomic environment	-3.2003 (6.865e-05)	-7.0254 (1.067e-12)	-14.113 (< 2.2e-16)	-12.214 (< 2.2e-16)

Source: Authors' calculations; (Kleiber, Lupi, 2011, p. 8)

The results of the unit root test show that the log GDP variable at the level is non-stationary, with a p-value of 1 with the included intercept, indicating that the series has a unit root. The log GDP variable after the first differentiation obtained a p-value less than 2.2e-16 with the included intercept and a p-value less than 2.2e-16 with the included intercept and trend. These values were significantly less than 0.05 in both cases, so the log GDP variable became stationary after its first differentiation. The variables of intensity of local competition, and macroeconomic environment had a p-value less than 0.05, both at the level I(0) and also in the case of order of integration I(1), indicating that they did not have unit roots. Finally, the infrastructure variable had a p-value of 0.1672 with the included intercept and it is not stationary, while it got a p-value less than 2.2e-16 after its first differentiation, which made it stationary.

The results of the panel regression analysis and corresponding summary statistics are presented in Table 6. The authors decided to conduct the panel regression analysis on the variables that were transformed by first differentiation, considering the obtained results of the unit root test. The number of observations in the panel has decreased, and now it amounts to 22 x 13 = 286, since the time series was shortened by one unite due to the transformation by first differencing. Table 6 presents a comparative overview of the panel regression analysis results of the Pooled OLS model, the Fixed effects model (LSDV), and the Random effects model. The authors decided to choose the model with dummy variables (LSDV) as a type of fixed effects model. The reason for choosing this model is that it gives the

Table 6. Panel regression analysis results of the Pooled OLS model, the Model with fixed effects (LSDV), and the Model with random effects

	Pooled OLS	LSDV	Random effects
Intercept			
▪ Coefficient	0.0123671	0.0154977	0.0125237
▪ Std. Error	0.0012698	0.0050728	0.0015982
▪ t value	9.7393	3.055	7.8364
▪ Pr(>|t|)	< 2.2e-16 ***	0.00248 **	4.638e-15 ***
Intensity of local competition	0.0143560	0.0122497	0.0133720
▪ Coefficient	0.0052354	0.0051857	0.0051210
▪ Std. Error	2.7421	2.362	2.6112
▪ t value	0.006495 **	0.01890 *	0.009023 **
▪ Pr(>|t|)			
Infrastructure			
▪ Coefficient	-0.0043103	-0.0068358	-0.0054850
▪ Std. Error	0.0058503	0.0058279	0.0057379
▪ t value	-0.7368	-1.173	-0.9559
▪ Pr(>|t|)	0.461884	0.24189	0.339107
Macroeconomic environment	0.0128906	0.0130992	0.0129876
▪ Coefficient	0.0028430	0.0027976	0.0027724
▪ Std. Error	4.5342	4.682	4.6846
▪ t value	8.559e-06 ***	4.57e-06 ***	2.805e-06 ***
▪ Pr(>|t|)			
R-squared	0.09961	0.218	0.10369
Adjusted R-squared	0.09003	0.1461	0.09415
Total Sum of Squares	0.10555	-	0.099328
Residual Sum of Squares	0.09504	0.082542	0.089029
Degrees of freedom	282	261	261
F - statistics	10.3991	3.032	Chisq: 32.6239
p- value	1.642e-06	6.574e-06	3.866e-07
θ (theta)	-	-	0.2809

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Authors' calculations; (Torres-Reyna, 2010, pp. 8-14)

correct values of the F-statistic (model), the coefficient of determination (R^2), the adjusted coefficient of determination R^2, and the total sum of squares, as opposed to the 'Within' model which generates incorrect values of these parameters (Park, 2011, p. 10 & 32). More detailed results of the panel LSDV regression in the case of dummy variables (countries) are not shown in Table 6 due to the present limitation on the length of the article and overcrowding, i.e. the need for their transparency.

The results of the tests for the evaluation and selection between the Pooled OLS model, the Fixed-effects model and the Random-effects model are presented in Table 7. The following tests were performed: the F test, the Breusch-Pagan LM test, and the Hausman test.

Table 7. The results of the model estimation tests

F test	Breusch-Pagan LM test	Hausman test
F = 1.8819	chisq = 5.779	chisq = 2.3938
p = 0.0125	p = 0.01622	p = 0.4948

Source: Authors' calculations; (Torres-Reyna, 2010, p. 12, 16 & 19)

The result of the F test indicates whether the choice of Pooled OLS model is better than the Fixed-effects model (LSDV). If the p-value is less than 0.05, then the fixed effects model performs better. In our case, the F test records a p-value of 0.0125, so it is concluded that the panel data regression analysis by the Fixed-effects model (LSDV) represents the right choice.

The result of the Breusch-Pagan LM test tells us whether the Pooled OLS model is better than the Random effects model. The Random effects model is superior if the p-value is less than 0.05. In our case, the Breusch-Pagan LM test records a probability p-value of 0.01622, so it was concluded that the panel data regression analysis by the random effects model was a preferred choice over the Pooled OLS regression analysis.

Finally, the result of the conducted Hausman test indicate whether the Fixed-effects model is better to use than the Random-effects model. The Fixed effects model is preferred if the p-valueis less than 0.05; otherwise, the Random effects model is used (Croissant, Millo, 2008, p. 22). In our case, the Hausman test recorded a p-value of 0.4948, so the regression analysis by the Random effects model appeared to be the right choice. Based on the results of the previous three conducted tests (the F test, the Breusch-Pagan LM test, and the Hausman test), the authors opted for the panel data regression analysis using the Random effects model.

The results of the tests for the assessment of serial correlation in the chosen panel model with random effects are presented in Table 8. For this purpose, the following tests were employed: the Durbin-Watson test and the Breusch-Godfrey/Wooldridge test.

Table 8. Serial correlation in the selected panel model

Durbin-Watson test	Breusch-Godfrey/Wooldridge test
DW = 1.6344	chisq = 66.896
p = 0.0009572	p = 2.976e-09

Source: Authors' calculations; (Torres-Reyna, 2010, p. 21)

The results of the Durbin-Watson and Breusch-Godfrey/Wooldridge tests indicate that there was a serial correlation in the model, as the p-value in both tests was less than 0.05. (Croissant, Millo, 2008, p. 26).

Due to the determined serial correlation in the observed model, the paper approached the evaluation of the selected Random effects panel data model with the correction of the obtained coefficients by Newey-West robust standard errors. These results are presented in Table 9. Otherwise, the method of correcting the coefficients with Newey-West standard errors is a robust procedure that takes into account the observed autocorrelation in the model with great precision, among other things (Gujarati, 2012, p. 108).

Table 9. Results of the chosen Rondom effects panel model corrected by 'Newey-West' standard error

	Coefficient	Std. Error	t value	Pr(>|t|)
Intercept	0.0125237	0.0015726	7.9636	4.132e-14***
Intensity of local competition	0.0133720	0.0057807	2.3132	0.0214305 *
Infrastructure	-0.0054850	0.0053815	-1.0192	0.3089606
Macroeconomic environment	0.0129876	0.0033988	3.8212	0.0001634***

Source: Authors' calculations

The outcomes of the conducted statistical procedure indicate that the local competition intensity coefficient, even after the correction of its standard error with the Newey-West technique, remained relevant and statistically significant.

The results of the selected random effects panel regression analysis from Table 6 and their corrections from Table 9 show that an increase in the intensity of local competition had a positive and statistically significant effect on the GDP in the observed post-socialist countries in the period between 2006 and 2019. The value of the β-coefficient of the intensity of local competition indicator amounts to 0.01337, with its p-value of 0.009, while its p-value got the value of 0.0214 after the procedure of its standard error correction, which was still lower than 0.05. In other words, the β-coefficient of the intensity of local competition is positive and statistically significant. Here we also draw attention to the fact that the value of the β-coefficient of 0.01337 was expressed in relation to the logarithmic value of GDP, while the values of GDP were logarithmised with the base of 10. Therefore, the true relationship between the intensity of competition and GDP is calculated by the following formula: $(10^{\beta} - 1) \times 100 = (10^{0.01337} - 1)$

x 100 = 3.126. This further means that an increase in the intensity of local competition by one unit leads to an increase in GDP of 3.13%. The coefficient of determination (R^2) amounts to 0.1036, which means that the model explains 10.36% of the variation in log GDP for the observed countries. On the other hand, the statistically significant value of its F-statistic (Chisq = 32.6239 and p-value = 3.866e-07) indicates that all predictors jointly contributed to the GDP growth of the observed countries, as well as that the selected Random effects panel data model is relevant.

CONCLUSION

The paper investigates the impact of the intensity of competition on the economic activity of post-socialist countries using panel data analysis. The authors decided to use the indicator of the intensity of local competition from the Global Competitiveness Index of the World Economic Forum as a measure of the intensity of competition. The level of GDP is observed as a measure of economic activity, which is used in the model in the form of log GDP. The choice of variables in the model was made based on the relationship between economic activity and the competitiveness of economy. The random effects regression panel analysis was carried out on data that has been transformed by first differencing.

The results of the conducted panel regression analysis unequivocally confirm the basic research hypothesis of the paper, which states that the intensity of domestic competition has a positive effect on economic activity, also confirming the findings of many other cited authors (Nielsen et al., 2013; Friesenbichler et al., 2014; Dutz & Hayri, 1999; Aghion et al., 2001; Aghion et al., 2019; Aghion et al., 2021; Ahn et al., 2020; Krakowski, 2005; Scopelliti, 2010; Hong, 2022; Đekić et al., 2019). Coefficient-β for the indicator of the intensity of local competition amounts to 0.01337 in relation to the logarithmic value of GDP. The relationship between the intensity of competition and log GDP is positive and statistically significant at the 5% level. Furthermore, the calculation determined that each additional unit of competition intensity lead to an increase in the level of GDP by 3.13% in the observed post-socialist countries in the period between 2006 and 2019.

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ЕКОНОМСКА АКТИВНОСТ И ИНТЕНЗИТЕТ КОНКУРЕНЦИЈЕ У ПОСТСОЦИЈАЛИСТИЧКИМ ЗЕМЉАМА: ПАНЕЛ АНАЛИЗА

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Резиме

Конкуренција представља надметање између предузећа на тржишту које за последицу има смањење цена и побољшање квалитета производа. Предузећа под притиском конкуренције теже да смање своје трошкове и да унапреде производне процесе, односно да повећају продуктивност. На нивоу државе, конкуренција подстиче сва предузећа на националном тржишту да повећају продуктивност, а то има за резултат повећање нивоа домаћег производа.

Емпиријска истраживања иду у прилог постојања корелације између конкуренције и економске активности. Резултати истраживања бројних аутора налазе, пре свега, позитивну везу између интензитета конкуренције, с једне стране, и економских величина као што су БДП, БДП по становнику, раст БДП, БНП, БНП по становнику, и продуктивност рада, с друге стране. Један број аутора, пак, налази негативну везу између конкуренције и БДП или чак и одсуство икакве везе између ових величина. Обично су то истраживања конкуренције, иновација и економског раста у којима веће вредности интензитета конкуренције доводе до смањења иновирања, и последично до смањења економске активности. Свакако, област утицаја конкуренције на економску активност представља отворено поље за разматрање и анализу.

Аутори у раду врше анализу панел података на узорку од 22 постсоцијалистичке земље за период између 2006. и 2019. године. Аутори су се одлучили за анализу постсоцијалистичких земаља управо због важности конкуренције као фактора за подстицање њихове економске активности. Ова група земља обухвата земље у транзицији и посттранзиционе земље. Карактеристично за све ове постсоцијалистичке земље јесте спровођење интензивних реформи у области политике заштите конкуренције. Наиме, ради се о земљама у којима је дошло до значајног повећања интензитета конкуренције у посматраном периоду.

Регресиона панел анализа спроводи се ради утврђивања односа између интензитета конкуренције и економске активности у постсоцијалистичким земљама. Овом приликом је као мера конкуренције узет индикатор интензитета локалне конкуренције из Индекса глобалне конкурентности Светског економског форума, док је као мера економске активности узет ниво бруто домаћег производа (БДП). Регресиона панел анализа је спроведена на здруженом Pooled OLS моделу, LSDV моделу са фиксним ефектима и моделу са случајним ефектима. Након спровођења дијагностике модела, изабран је модел са случајним ефектима. Резултати регресионе анализе одабраног модела случајних ефеката указују на то да повећање интензитета локалне конкуренције за један поен доводи до повећања БДП-а за 3,13%. Важно је напоменути да су подаци у моделу трансформисани првим диференцирањем.