AGORA International Journal of Economical Sciences, http://univagora.ro/jour/index.php/aijes
ISSN 2067-3310, E-ISSN 2067-7669
Vol. 18, No. 1 (2024), pp. 65-73

IMPACT OF INNOVATION ON ECONOMIC GROWTH IN BALKAN COUNTRIES

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***Abstract*:** *Innovation plays a crucial role in the daily activities of economic units and its impact extends to the macroeconomic level as well. After the last pandemic, firms and even nations are aiming to adopt the new reality. They are employing advanced technology to develop innovative products and approaches for customers and markets. This study analyzes the impact of innovation on economic growth in Balkan Countries by using annual data for the period between 2011 and 2022. This study uses the individual pillars of the Global Innovation Index as the explanatory variables of GDP Growth rate. Through a panel data analysis, the findings of the study suggest that creative output and infrastructure have a positive significant effect on the GDP growth rate, while the effect of institutions is negative. The test employed failed to prove any impact of other pillars of innovation on economic growth meaning that the impact of other pillars is still insignificant. The findings of this study may serve policymakers to work on the direction of enhancing the impact of all innovation pillars on the economic growth rate.*

Keywords: *innovation, GDP growth, sustainable development, innovation pillars*

INTRODUCTION

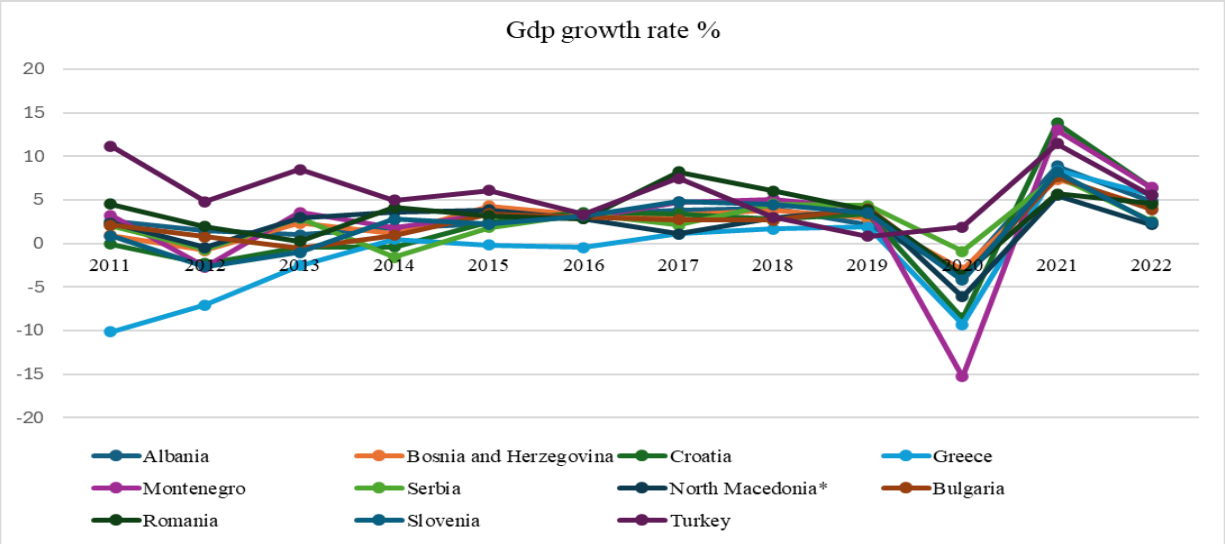
With the fast development of informational technology and the involvement of artificial intelligence in every activity, the competitiveness among regions, countries, industries, firms, and even individuals and professionals has known significant growth. It is difficult to achieve growth and development without the involvement of innovation and innovative processes (Živanović et al. 2023). Operating in a globally dynamic environment and context has shifted the attention of policymakers to the innovation and exploration of new opportunities and economic activities. The governments and monetary authorities seek to achieve a high economic growth rate by focusing on factors that will serve this aim.

All the economic theories emphasize the significance of technological advancement and innovation in increased productivity and economic growth. Adam Smith the most important representative of classical theory, in his book Wealth of Nations (Smith, 1776), defines that the determinants of output are the factors of production such as land, labor, and capital. Classical theory highlights the role of technological advancement and innovation as a key driver of the increased productivity of land and labor. Schumpeter (1911) is the first to emphasize the role of innovation and entrepreneurship in economic growth (Ziemnowicz, 2013).

Solow (1956) and Swan (1956) shaped the neoclassical economic growth theory (Dimand, 2009). Based on their model, economic growth is a function of factors of production such as capital, labor, and technology. While acknowledging the limited sources of capital and labor, the authors emphasize technological advancement as the primary driver of economic growth. The endogenous economic growth theory considers technological change as an endogenous factor. (Romer, 1994) highlights that the combination of human capital with knowledge brings innovation which contributes to economic growth by higher productivity.

The purpose of this study is to analyze how innovation has impacted the economic growth in the Balkan region the recent years. Figure 1 gives information regarding the GDP growth rate of Balkan countries as e proxy for economic growth. As seen in the figure, the economic growth of all Balkans except Greece follows the same trend. As an aftermath of the financial crisis, the Greek economic growth had a downtrend, and it reached a value of -10.01% in 2011. In 2020, because of the Covid-19 pandemic crisis, all countries besides Turkey had negative economic growth with the lowest value of -15.3% reached by Montenegro.

Figure 1.
GDP growth annual %

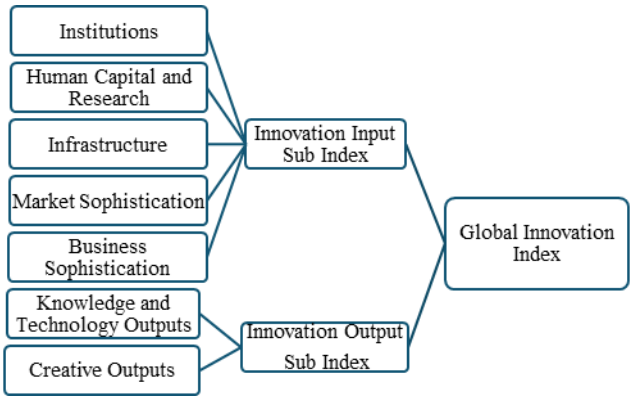


Source*:* World Bank Database

This study utilizes the change in the Global Innovation Index (GII), which is measured and published by the World Intellectual Property Organization for 132 nations, as an indicator of innovation. Two sub-indexes constitute the Global Innovation Index. The first sub-index, Innovation Input, measures elements such as institutions, human capital, research, infrastructure, and market sophistication. The second sub-index, Innovation Output, gauges knowledge and technology outputs as well as creative outputs.

Figure 2

The composition of the Global Innovation Index (GII)

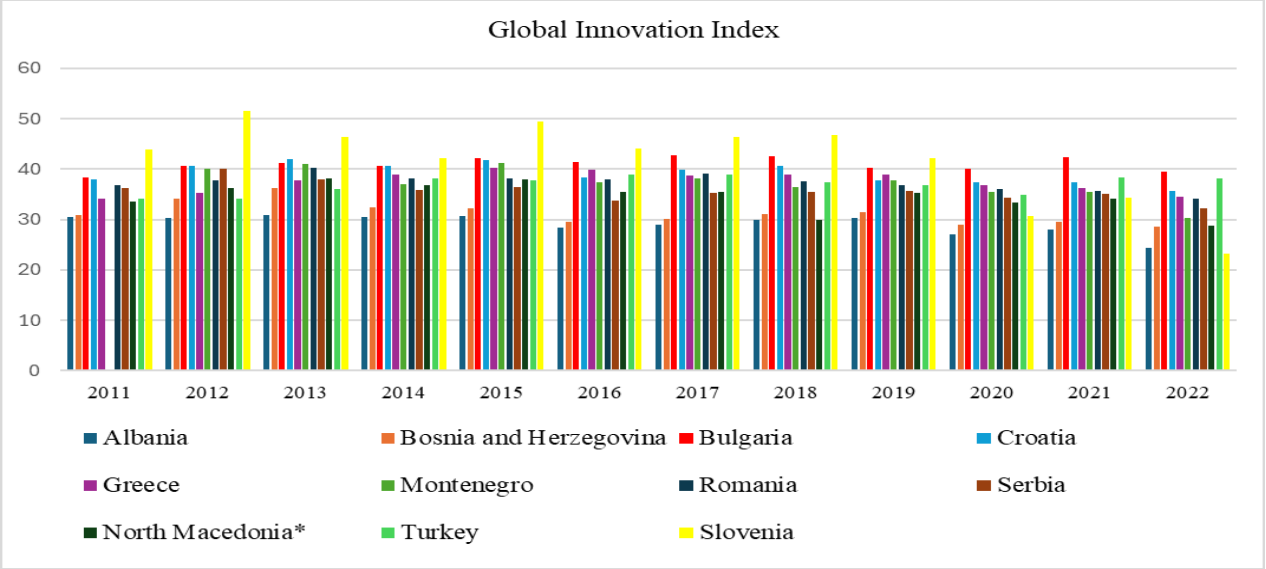


Source: World Intellectual Property Organization

Based on a report published by the World Intellectual Property Organization for 2022, Slovenia has been the leading country to embrace innovation in the region with the highest GII value for many years. In recent years, starting from 2020, Bulgaria has emerged as the most innovative Balkan country, ranking 35th, followed by Turkey and Croatia for 2022.

Figure 3

Global Innovation Index (GII) Value



Source: World Intellectual Property Organization

(Cvetanovic et al, 2014; Despotovic et al, 2014) investigate the level of innovation and the relationship between innovation and competitiveness for a group of chosen Western Balkans and European Union countries. The authors find that EU countries' level of innovation is higher compared to Western Balkan countries. There is no evidence of a relationship between innovation and competitiveness in Western Balkan, while there is a strong correlation in EU countries. Although macroeconomic factors, monetary and fiscal policies, country competitive advantages, and political risks explain economic growth, this study's focus is the investigation of the role of innovation on economic growth. The next section briefly introduces the existing literature on the research topic, followed by the methodology, main findings, and conclusions.

LITERATURE REVIEW

The growing significance of innovation has heightened the curiosity of researchers and scholars about its impact on growth and development. In their studies spanning from 1989 to 2014, Maradana et al. (2017; 2019) investigate the enduring relationship between innovation and economic growth in the European Economic Area. They reveal the presence of both unidirectional and bidirectional causality relationships between innovation and economic growth. The authors observe that in various countries, this relationship is influenced by diverse indicators of innovation utilized. Kacprzyk & Doryń (2017) make a comparison analysis between the EU's old and new members regarding the role of innovation in economic growth. The authors find that growth strategies might be different for different countries, and to strengthen the impact of innovation on economic growth, governments should focus on policies that will contribute to innovation.

Nihal et al. (2023) examine the impact of innovation on economic growth in G8 countries. They find that innovation positively affects economic growth in those countries, which is especially significant in the fields of technology and research and development. Sarangi et al. (2022) investigate the causal short-term and unidirectional long-run relationship between innovation and economic growth in G20 countries. They find that this relationship is significant, even though different variables of innovation impact economic growth differently.

Ulku (2004) investigates the role of innovation on GDP per capita from 1981 to 1997. The empirical analysis suggests a positive relationship between innovation and economic growth in both OECD and non-OECD countries. Another study that suggests a positive relationship between innovation and economic growth was conducted by (Pece et al., 2015)The authors employ multiple regression analysis to explore the relationship between economic growth and various innovation variables, including research and development expenses, as well as the number of trademarks and patents, across Central and East European countries.

Dempere et al. (2023) investigate the relationship between innovation, economic growth, and other macroeconomic variables, using the main pillars of the Global Innovation Index as a proxy for innovation. Through a panel data analysis of 120 countries, the authors conclude that innovation positively affects the economy and that all pillars of innovation have a crucial role in the economy. Besides the impact on the economy, innovation has a significant role in recovering the economy from crises and financial distress (Hausman & Johnston, 2014).

(Özdener, 2020) analyzes the impact of innovation on economic development in the Turkish economy from 2006 to 2017. By analyzing the pillars of the Global Innovation Index the authors find a positive impact of innovation on economic development and other macroeconomic variables. Cameron (1996) investigates the role of innovation in economic growth. The study suggests a spillover of innovation from one country to another by emphasizing the importance of each country's effort toward innovation.

METHODOLOGY

This study employs panel data analysis to investigate the role of innovation on economic growth in Balkan countries from 2011 until 2022. The GDP growth rate serves as the dependent variable in this study, which will be explained by the pillars of the Global Innovation Index such as Institutions, Human capital and research, Infrastructure, Market sophistication, Business sophistication, Knowledge and technology outputs, and Creative outputs. The data

utilized are sourced from the databases of the World Bank and the World Intellectual Property Organization, which also publishes the Global Innovation Index.

The hypotheses that are assessed are:

H1. Institutions positively affect economic growth.

H2. Human capital and research positively affect economic growth.

H3. Infrastructure positively affects economic growth.

H4. Market sophistication positively affects economic growth.

H5. Business sophistication positively affects economic growth.

H6. Knowledge and technology outputs positively affect economic growth.

H7. Creative outputs positively affect economic growth.

Preliminary tests are conducted to ensure that ordinary least square estimates yield optimal and unbiased results. The stationarity of the series is assessed using the Philips Perron test. The test indicates that series such as GDP growth rate, human capital and research, infrastructure, institutions, knowledge and technology market sophistication and business sophistication are stationary at level, while the creative outputs variable is stationary at the first difference.

Table 1

Series stationarity estimation.

Variable	Philips-Perron	Probability	Order of cointegration
GDP Growth rate	101.42	0.000	I(0)
Business Sophistication	128.53	0.000	I(1)
Creative Outputs	102.26	0.000	I(1)
Human Capital and Research	73.07	0.000	I(0)
Infrastructure	69.48	0.000	I(0)
Institutions	34.99	0.039	I(0)
Knowledge and Technology	49.12	0.000	I(0)
Market Sophistication	36.81	0.025	I(0)

Source: Author | E-views 10

Multicollinearity analysis is utilized to demonstrate the absence of correlation among explanatory variables, ensuring unbiased results.

Table 2

Correlation Matrix

Variables	LBS	LCO	LHC_R	LINF	LINS	LKN_T	LMS
LBS	1						
LCO	0.538	1					
LHC_R	0.454	0.427	1				
LINF	0.089	0.025	0.042	1			
LINS	0.391	0.380	0.259	0.217	1		
LKN_T	0.545	0.472	0.380	0.231	0.256	1	
LMS	-0.261	-0.001	-0.138	-0.112	0.098	-0.194	1

Source: Author | E-views 10

As the values are lower than 80%, the correlation matrix indicates that the independent variables are not correlated to each other, thus the no correlation assumption is satisfied.

The Hausman test is utilized to determine the appropriateness of either a fixed effect or random effect model for the panel data analysis. Based on the results of this test, a random effect model will be used.

Table 3

Hausman Test

Hausman test	Coefficients
Chi-Sq. Statistic	7.956012
Prob.	0.3365
Degree of freedom	7

Source*:* Author | E-views 10

Zero conditional mean is another important assumption. Based on the results of the test it is noticed that the mean value of error residuals equals 3.74E-15. A further step is analyzing the correlation between the error term residuals and explanatory variables. As shown in table 4 the correlation coefficients are remarkably close to zero. Both results indicate that the zero conditional mean assumption is satisfied.

Table 4

Correlation matrix of residuals

Variables	RESID01
LBS	-5.093e-14
LCO	-0.0244828
LHC_R	1.129e-14
LINF	-7.673e-14
LINS	-2.183e-16
LKN_T	-2.899e-14
LMS	5.428e-14

Source: Author | E-views 10

The two last assumptions that should be satisfied are independence of error terms which is related to the lack of serial correlation and a constant variance of residuals for all levels of independent variables, known as homoskedasticity.

Table 5

Heteroskedasticity - Breusch-Pagan Test.

Depended variable	Resid01^2			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.472601	0.878759	6.227645	0.0000
GDP	-3.979918	0.171216	-23.24496	0.0000
GDP^2	0.827515	0.019193	43.11569	0.0000

Source: Author | E-views 10

Based on the results of the heteroskedasticity test, as both the probabilities of the dependent variable and the square of dependent variables are zero, the homoskedasticity assumption is not satisfied.

Table 6

Serial Correlation Durbin-Watson Test.

Depended variable	Resid01			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.177068	0.303211	0.583976	0.5605
AR(1)	-0.169178	0.091089	-1.857282	0.0660

Source: Author | E-views 10

The results of the test indicate that as the probability of AR (1) is higher than 5%, the regression is free of serial correlation. As a result, only the homoskedasticity assumption is violated thus it is necessary to use a model that adjusts the standard errors of coefficients to address the presence of the heteroskedasticity.

THE RESULTS

According to the Hausman test, the random effect model is deemed suitable for analysis. Equation (1) is the equation estimated, while Table 7 shows the regression estimation output by using the White Diagonal coefficient covariance method.

GDP Growth% = β_0+$\beta_1 LBS_{it}$+$\beta_2 LCO_{it} + \beta_3 LHC\_R_{it} + \beta_4 LINF_{it} + \beta_5 LINS_{it} + \beta_6 LKN\_T_{it} + \beta_7 LMS_{it}$ +μ (1)

Table 7

Regression estimation output

Dependent Variable: GDP Growth rate %				
Method: Panel EGLS (Cross-section random effects)				
Total panel (unbalanced) observations: 120				
White diagonal standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
BS	5.402	6.967	0.775	0.4397
D(CO)	13.233	4.689	2.822	0.0056
HC_R	-3.981	3.970	-1.003	0.3182
INF	12.069	4.420	2.730	0.0074
INS	-19.392	8.127	-2.386	0.0187
KN_T	-2.654	3.416	-0.777	0.4389
MS	3.066	5.159	0.594	0.5535
C	14.795	14.588	1.0141	0.3127
R-squared	0.129	Adjusted R-squared		0.0746
F-statistic	2.371	Prob(F-statistic)		0.0268

Source: Author | E-views 10

The results of the regression estimation output show that only three variables such as creative outputs, infrastructure, and institution are significant determinants of GDP growth rate in Balkan countries. The impact of creative output and infrastructure is positive, thus the third and seventh hypotheses cannot be rejected. Those results are in line with Özdener (2020), and Dempere et al. (2023), who suggest a positive impact of innovation in economic growth. The impact of institutions is negative so the first hypothesis cannot be accepted. Institutions as a pillar include the political, regulatory, and business environment. Because in Balkan countries the informal economy and corruption still have a significant presence, innovation may not have the desirable impact on economic growth. As the probability value of all other coefficients is higher than 5% none of the other hypotheses can be accepted, suggesting that the role of other pillars of innovation on economic growth is still insignificant and limited.

CONCLUSIONS

This study investigates the impact of innovation on economic growth in Balkan countries from 2011 until 2022 using the Global Innovation Index, its sub-indexes, and pillars as a proxy for innovation. Panel data analysis and a random effect model are employed in the analysis. The findings of the study suggest that creative output and infrastructure have a positive significant effect on the GDP growth rate, while the effect of institutions is negative. The test employed failed to prove any impact of other pillars of innovation on economic growth. Apart from the modest contribution in enriching the existing literature, the findings of this study may serve policymakers to work on the direction of enhancing the impact of all innovation pillars on the economic growth rate.

The main limitation of this study is the brief period considering the annual frequency of data. Another limitation stands on the fact that the subject of this study is the unidirectional relationship between innovation and economic growth, while the bidirectional relationship is significant to be studied as well. Including other variables that affect the economic growth rate, analyzing the effect of corruption in each country, dividing the EU countries from non-EU countries, and making a comparison analysis may be a suggestion for future research.

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