

THE IMPACT OF ECONOMIC GROWTH AND HUMAN DEVELOPMENT ON CARBON EMISSIONS (CASE OF WESTERN BALKAN COUNTRIES)

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Abstract: Climate change is one of the most pressing global challenges, and countries worldwide are taking action to tackle this issue. As countries strive to increase their economic growth and human development, it is quite important to assess if that progress is sustainable and aligned with long-term environmental goals.

The object of this paper is to investigate the impact of the gross domestic product and the Human Development index on the carbon emissions in five Western Balkan countries, namely, North Macedonia, Albania, Bosnia and Herzegovina, Montenegro, and Serbia, by analyzing data from 2002-2022. The data in this study were analyzed by using the fixed and random models. In addition, the Hausman test was performed to determine which of the models is more appropriate for this analysis. The obtained results suggest that economic growth and human development in the Western Balkan countries, come at the cost of the environment, so that a one percentage point increase in the GDP per capita, increases 0.049-ton in carbon emissions per capita, and that a one percent increase in the Human Development Index, leads to an 8.5-ton increase in carbon emissions per capita. The result suggests that there are environmental costs associated with the improvement of the economy and human development in the Western Balkans. These countries need to balance growth and development with the sustainability goals, by implementing stronger policies and taking serious action.

Keywords: Environment, Carbon Emissions, Human Development, Economic Growth, Sustainability

1. INTRODUCTION

Concerns about the growing temperatures and global warming and its consequences have led countries to think about a more sustainable development that does not come at the cost of the environment or society. Initiatives have been taken globally in order to reach sustainable development, to create a better, more resilient environment where societies can live. This goal has become a priority and by implementing policies and committing to achieve sustainable development goals, countries aim to create a better quality of life, a stronger society that will work to improve the quality of the environment, so that our planet can be able to sustain the future generations and their needs.

Economic growth and human development are the key factors that drive the development of a country, however, sometimes that development can come at the cost of the environment. As countries aim to reach their economic and human development goals, it is quite important to assess and evaluate the environmental consequences of that growth, in order to make sure that it does not negatively impact environmental sustainability. Unfortunately, this is a big challenge, as it is quite difficult to determine how this progress can be achieved without it having negative consequences on the environment.

Analyzing the Western Balkan Countries, to understand how economic growth and human development impact environmental analysis, the results suggest that in these countries this growth comes at the cost of the environment. The data indicate that there is a significant positive relationship between economic growth and carbon emissions, as well as, a positive significant relationship between Human Development and carbon emissions, suggesting that as these countries improve their economies and develop their societies, their carbon emission levels also increase. These findings are in line with the literature investigating these relationships in developing countries, where growth and development are associated with higher levels of emissions since countries prioritize growth, even if that growth is not sustainable.

2. LITERATURE REVIEW

The effects of economic growth and human development on carbon emissions, is quite an interesting topic to be researched, even though most of the research available investigates only how economic growth impacts emissions, while research on how human development impacts CO₂ emissions is scarce, and should be analyzed further.

The results of the research investigating the topic are diverse, depending on the group of countries analyzed. For example, Abid et al. (2023) found that GDP per capita has a positive effect on CO₂ emissions in West African Countries. Ali et al. (2023) found out that in the short run and in the long run economic growth contributes to an increase in carbon dioxide emissions in the Kingdom of Saudi Arabia. Li et al. (2023), found that economic growth has a positive relationship with carbon emissions, while its square impacts CO₂ emissions negatively. Tokpah et al. (2023) analyzed 15 developed and developing countries and found out that in both groups of countries, an increased

GDP resulted in increased CO₂ emissions, however, in both groups of countries they confirmed the EKC hypothesis, the ratio of carbon emissions to economic growth was higher in the early stages of economic development but decreased beyond a certain level of economic growth in developed countries, and that their results suggest that this hypothesis is also true in developing countries, since according to the results there will likely be a reduction in carbon emissions if squared GDP increases by one unit.

Gonzales (2023) similarly analyzed 31 countries (developed and developing) and found that developed countries were able to grow their economies, without a corresponding increase in the CO₂ emission levels, meaning that their economies were growing while reducing or stabilizing their CO₂ emissions, however, there are countries where an increase in the GDP, led to an increase in the carbon emissions.

Onofrei et al. (2022), researched how economic growth affected carbon emissions in the European Union for the period 2000-2017, and found that on average a 1% change in GDP leads to a 0.072 change in CO₂ emissions in the long run.

Researchers have also investigated this relationship in the Western Balkan countries. The findings of Alili and Thaci (2022) suggest that there exists a strong positive relationship between CO₂ emissions and GDP per capita in WB countries. On the other hand, Beka et al. (2024) when analyzing this relationship in OECD and Western Balkan countries, did not find any significant relationship between economic growth and carbon emissions.

Pjeovic et al. (2021) analyzed this relationship in European Union Countries and Western Balkan countries and found out that there exists a two-way relationship between GDP and CO₂ emissions, where there is a negative relationship from GDP to CO₂, so that as GDP increases, CO₂ emissions tend to decrease, and there is a positive relationship from CO₂ emissions to GDP, so that as CO₂ emissions increase, GDP tends to increase as well.

When researching the impact of human development on carbon emissions, in developing countries, authors have found out that human development increases carbon emissions, while in developed countries it decreases carbon emissions. Opoku et al. (2022) when analyzing data from OECD countries found that a rise in human development reduces carbon emissions. Rahman and Sultana (2024) when researching this situation in low-income and developing countries found out that as these countries improve their human development, the activities that drive the human development result in an increase in CO₂ emissions, reducing the environmental quality, even though also for these countries the EKC hypothesis was confirmed.

3. RESEARCH METHODOLOGY

This paper intends to gain more insight into the relationship between economic growth, human development, and environmental sustainability for the period between 2002-2022 in Western Balkan Countries. The Western Balkan countries analyzed are North Macedonia, Albania, Montenegro, Bosnia and Herzegovina, and Serbia, while Kosovo is excluded from this analysis due to a lack of data in the indicators analyzed. Both economic growth and human development affect the environment, and this analysis intends to evaluate how they affect carbon emissions.

Since the aim of the research is to assess whether economic growth and human development affect the environment, the following hypotheses were tested:

H0a: Economic growth does not impact the carbon emissions

H1a: Economic growth impacts carbon emissions

H0b: Human Development does not impact the carbon emissions

H1b: Human Development impacts carbon emissions

The data were analyzed by using the fixed and random model and the Hausman test to determine which model was more appropriate. The dependent variable in this analysis is Carbon Emissions, expressed as metric tons per capita. Independent variables in the analysis include economic growth, measured by the GDP per capita growth, expressed in percentage; the Human Development Index, which is expressed on a scale from 0-1, while Trade is included as a control variable, and is measured as a percentage of GDP.

Table. 3.1. Variables and explanation

Variable	Acronym	Measured	Source
Carbon Emissions Per capita	CO ₂	Ton per capita	Our World in Data
GDP Per Capita Growth	GDP	Percentage	WDI, World Bank
Human Development Index	HDI	0-1	UNDP
Trade	TR	Percentage of GDP	WDI, World Bank

Source: Authors source

The following equation was considered:

$$CO_2 = \beta_1 + \beta_2 GDP_{PG} + \beta_3 \log_HDI + \beta_4 TR$$

Where

we

have:

CO₂- representing the dependent variable, the carbon emissions per capita

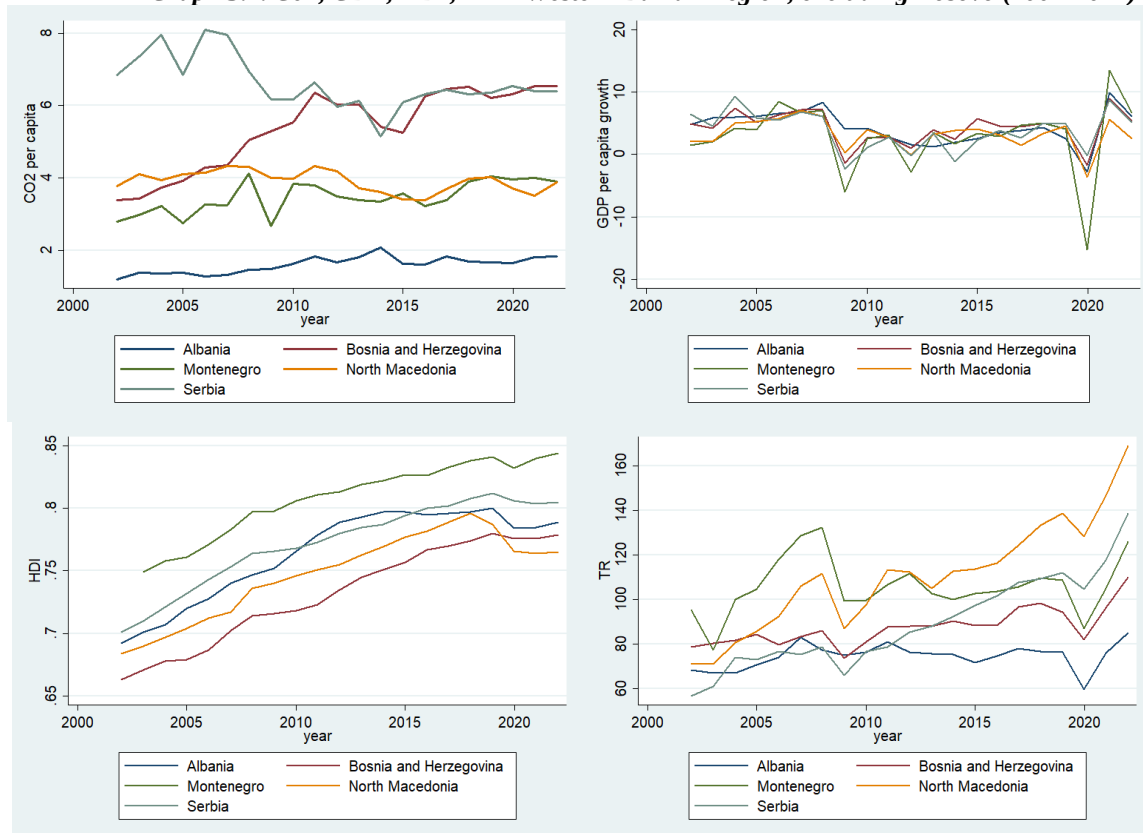
GDP_{PG}- representing the independent variable, the GDP per capita growth

Log_HDI- representing the independent variable, the Human Development Index

TR- representing the control variable, trade as a percentage of GDP

The following graph illustrates the trends in carbon emissions, gross domestic product per capita growth, Human Development, and trade as a percentage of GDP for the Western Balkan countries, North Macedonia, Albania, Bosnia and Herzegovina, Montenegro, and Serbia, excluding Kosovo, for the period 2002-2022.

Graph 3.1. CO₂, GDP, HDI, Tr in Western Balkan Region, excluding Kosovo (2002-2022)



Source: World Bank and Our World in Data

In addition, the following table represents the descriptive statistics of the data included in the empirical analysis. As we can see, the number of observations for CO₂ emissions per capita, GDP per capita growth, and Trade is 105, while for the Human Development Index, the total number of observations is 104, for the countries of Western Balkans for the corresponding period of 2002-2022. According to the data, the average carbon emissions per capita in Western Balkan countries for the analyzed period is 4.19 metric tons per capita. The GDP per capita growth on average is 3.72%, while the average value of the Human Development Index and Trade as a percentage of GDP is 0.76 and 93.5% respectively. The standard deviation of CO₂ per capita has a value of 1.83, for GDP per capita growth of 3.5, HDI 0.04, and for Trade 20.5. Related to the minimum value and maximum value of Carbon emissions they are 1.19 and 8.09 respectively, for GDP per capita growth are -15.2 and 13.4, for HDI are 0.663 and 0.844, while for Trade are 56.8 and 168.8 respectively.

Table 3.2 Descriptive Statistics

Variables	Obs	Mean	Stand Dev	Min Value	Max Value
CO2	105	4.196527	1.832681	1.195967	8.099471
GDP	105	3.731063	3.51987	-15.20847	13.42593
HDI	104	0.7643077	.0430707	.663	0.844
TR	105	93.54624	20.54113	56.86639	168.8249

Source: Authors source

4. RESULTS AND DISCUSSIONS

Considering that the main objective of this paper is to analyze how economic growth and human development impact environmental sustainability, this section reveals the results from the empirical analysis by conducting the fixed and random effect panel model. In addition to the model, the Hausman-Taylor test has been employed to determine which of the models is appropriate for this particular analysis.

The following table presents the results of the fixed and random model, which was carried out in order to test the impact of economic growth and human development on carbon emissions, in the western Balkan countries in the period of 2002-2022.

Table 4.1. The results of Fixed and Random Effects Model

	FIXED EFFECTS model	RANDOM EFFECTS model
CO2- dependent variable		
GDP- independent Variable	.0502504	.0499429
p > t	0.005	0.004
HDI- independent variable	8.604818	8.539224
p > t	0.000	0.000
TR- independent variable	-.0162208	-.01604
p > t	0.001	0.001
Observation	104	104
Nr. of groups	5	5
F test	236.54	
Chi 2		28.81
Model	FE	RE
testparm	F(3, 96) = 9.60 Prob > F = 0.0000	
Hausman test		
chi2(1)	0.12	
Prob>chi2	0.9894	

Source: authors calculations

As we can see, in the model, the dependent variable is Carbon emissions per capita- CO2, data taken from Our World In data database, while the independent variable included in the model is GDP per capita growth, measuring economic growth, obtained by the World Bank Database, Human Development Index, measuring the human development, obtained by the UNDP, and as control variable was taken Trade as percentage of GDP, obtained from the World Bank Database

The number of observations in the models is 104, while the number of groups is 5. Based on the results of the Hausman test, the value of p=0.98 indicates that from the fixed and random effects models, the random effects model is suggested as a more appropriate model for the analysis. Based on the results of this model, there is a significant positive relationship between economic growth and carbon emissions, so with a 1 percentage point

increase in the GDP per capita growth, the carbon emissions increase by 0.0499 tons per capita. The significance of the result is evidenced by the value of $p=0.004$ which is lower than the critical value of $p=0.05$. The results also indicate that there is a significant positive relationship between human development and carbon emissions, as proved by the value of $p=0.000$, which suggests that a one percent increase in the Human Development Index, leads to an increase of 8.5 tones in carbon emissions per capita. The results suggest that there is a negative relationship between trade and carbon emissions, which is proved by the value of $p=0.01$. Given that trade as % of GDP increases by one percentage point, the CO₂ emissions per capita are decreased by 0.016 ton.

The obtained results suggest that both economic growth and human development have a statistically significant positive relationship with CO₂ emissions. This means that in the countries of the Western Balkan, North Macedonia, Albania, Bosnia and Herzegovina, Montenegro, and Serbia, economic and social progress come at the cost of the environment.

5. CONCLUSIONS

Taking into account the importance of achieving a more sustainable and resilient development, the main purpose of this paper is to determine how economic growth and human development, which are also important areas of sustainability, impact the environmental aspect of sustainability in Western Balkan countries. The result of the analysis suggests that in these countries there exists a positive and statistically significant relationship between economic growth and human development with carbon emissions. This means that as these countries improve their economies and societies, the level of carbon emissions increases, indicating potential trade-offs between growth and the environment. According to the results, a one percentage point increase in the GDP per capita growth is likely to increase carbon emissions by 0.049 tons per capita, and similarly, a one percent increase in the Human Development Index is likely to increase the carbon emissions by 8.5 tons per capita.

The existing literature investigating these relationships suggests that this relationship is likely to be positive in developing countries, while it tends to be negative in developed countries. It is indicated that during the earlier stages of development, countries will prioritize growth and not prioritize sustainability in reaching those goals, however, as they become more developed they align their goals to ensure a more sustainable development in their countries.

As the Western Balkan countries continue to develop, it is very important that both the governments and societies work towards fostering growth that aligns with long-term environmental and social goals by improving their policies adopting measures, and take more serious action to make the economies more efficient and reduce CO₂ emissions, ensuring a more sustainable future for the Western Balkan countries.

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