ISSN 1648-0627 / eISSN 1822-4202

BUSINESS: THEORY & PRACTICE

2025
Volume 26
Issue 2
Pages 305–322
https://doi.org/10.3846/btp.2025.23716

THE EU GREEN AGENDA LEGAL FRAMEWORK AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES: A PANEL EKC APPROACH

Besime Fekri ZIBERI [1], Xhemazie IBRAIMI [2]✉, Nawaz AHMAD [3, 4], Jolita VVEINHARDT [5]

[1] *Faculty of Economics, AAB College, Pristina, Kosovo*
[2] *Faculty of Public Administration, AAB College, Pristina, Kosovo*
[3] *Shaheed Benazir Bhutto University, Nawabshah, Sindh, Pakistan*
[4] *GOVCOPP, University of Aveiro, Aveiro, Portugal*
[5] *Vytautas Kavolis Transdisciplinary Social and Humanities Research Institute, Vytautas Magnus University, Kaunas, Lithuania*

Article History:
- received 14 April 2025
- accepted 3 June 2025

Abstract. With the rapid rate of climatic change and environmental degradation, sustainable economic growth with conservation of the environment has turned into a question of highest priority and concern for the world, especially for developing nations. The study aims to interpret the European Green Agenda legal framework and its implications for the green economy of developing countries using the Environmental Kuznets Curve EKC as a basis of panel estimation. The research method used is quantitative, using data from 1990 to 2024 from the World Bank Indicators. The econometric approach is based on panel data employing the Environmental Kuznets hypothesis for further empirical estimation. The variables included in the model are Carbon Intensity CO_2, and GDP per capita growth in a panel of 6WB countries such as Kosovo, North Macedonia, Albania, Montenegro, Bosnia and Herzegovina and Serbia. The main hypothesis testing is that the developing countries face greater CO_2 emission in their attempt to grow economically, which is also the main hypothesis under the Environmental Kuznets Curve. The study finds a U-shaped relationship function between GDP per capita growth and Carbon Intensity CO_2 in the case of the Western Balkans under study circumstances. The greater the GDP per capita growth (above the turning point level of 4259.69), the greater the Carbon intensity. The study further concludes that the EKC hypothesis does not have universal implications depending on the stage of country development and the period under investigation. This study is very important for several reasons: first, it is the first testing the basic EKC hypothesis for the Western Balkan countries and adds to the literature the fact that the EKC hypothesis is not universal; second, by using econometric models of panel data, it tests the EKC hypothesis and proves the opposite, an U function; between CO_2 and GDP per capita growth and third, the study emphasizes the importance of the European Green Agenda towards sustainable economic growth and environmental protection.

Keywords: Green Agenda, legal framework, Environmental Kuznets Curve, CO_2, GDP per capita growth.

JEL Classification: C12, C23, K32, O44.

✉Corresponding author. E-mail: ***xhemazie.ibraimi@universitetiaab.com***

1. Introduction

Implementation of the European Union's Green Agenda is a challenge but also an opportunity for the developing world, particularly those countries in the Western Balkans. As countries walk on the path toward EU integration, they must also address pressing environmental issues while striving to achieve sustained economic growth. An example of how energy use, economic growth, and the environment are related is the environmental Kuznets curve (EKC), named by Simon Kuznets (Stern, 2004). Since the EKC is a worldwide study, nations have worked harder. China, the US, Turkey, Malaysia, England, and other nations have contributed the most to the global literature database and have the greatest potential for advancement in this area (Wang et al., 2024). Additionally, this study is the first to use EKC testing in the context of Western Balkan countries.

The Western Balkans have been selected for analysis based on their strategic location in the EU enlargement process, their shared transitional economic characteristics, and increasing pressure to align with EU environmental policy in the context of structural development issues. The conceptual link of this study is supported by the interaction between EU-led environmental regulations, patterns of national economic development, and responses to environmental sustainability. The EU Green Agenda is an institutional tool that is implicated in shaping environmental governance in developing countries, such as the Western Balkans. This relationship is theoretically built through the Environmental Kuznets Curve (EKC), which postulates a non-linear trend between environmental degradation and economic growth. By including these factors, the research looks into how far EU environmental directives push or hinder sustainable development in the selected states.

The Western Balkan countries, including Kosovo, North Macedonia, Albania, Montenegro, Bosnia and Herzegovina and Serbia, are part of the Western Balkans Economic Investment Plan adopted by the European Commission on 6 October 2020, according to which the main goal is to integrate the Western Balkan countries towards the green transition. Within the framework of this plan, investments are foreseen in transport and energy, the green economy and digitalization, increased competition in the private sector, health, education and social protection. Moreover, the inclusion of youth in employment (European Commission, 2020b). The Instrument for Pre-Accession Assistance III (IPA) for the period 2021–2027 foresees 9 billion euros to be mobilized and also foresees the withdrawal of 20 billion euros from European development banks and international financial institutions The EU's capacity to coordinate and guarantee the political conditionality of IPA funding is one of the particular issues brought about by the scope and goals of the EIP and its ten Flagship projects (European Parliament, 2022). Regarding the green transition in the case of the Western Balkans, The European Commission highlights the main pillars within the framework of the European Green Agenda for the Western Balkan countries, which include: decarbonization, circular economy, biodiversity, protecting the environment from pollution, as well as sustainable food systems and rural areas (European Commission, 2020c).

Climate change is a challenge for the economy in general, including all countries worldwide. However, these climate changes, which are challenging and at the same time equally tricky in terms of addressing the problems that they carry within the economy, are potentially a topic of debate for all countries in the world, and in particular for developing countries that do not have the potential to increase GDP more than the average of European countries. This means that in the future, to address the problems of climate change, it will undoubtedly be necessary to take measures to confront climate change with a greater commitment to implementing the proposals foreseen in the European Green Agenda. The European Union makes an extraordinary contribution to international environmental law by establishing harmonization of standards between European countries and those candidate countries for the European Union. In this case, the European Green Agenda for the Western Balkans is an example of this common goal towards environmental protection and economic growth (Đurić & Lalatović, 2023).

The European Green Agenda deals with the tools and practices for an economy to go green. The green economy is becoming a topic of debate, and it is crucial for developing countries that lack the resources and have low GDP growth, thus the high level of CO_2. Based on Sabato et al. (2022), curbing emissions may call into question Western societies' developmental model, which essentially prioritizes continuous economic growth and competitiveness, often at the expense of environmental sustainability and social justice. Based on Almeida et al. (2023), the "Green New Deals (GND) has emerged as a comprehensive policy package involving states, civil society, and private actors in the fight against climate change and ecological breakdown". Sustainable energy refers to energy primarily produced and utilized from renewable sources, which are emission-free and do not release greenhouse gases into the atmosphere (Debus & Tosun, 2021). The Western Balkans could benefit from sustainable economic growth, energy security, and environmental protection through the green transition. However, implementing this requires understanding the principles and interplay of activities to ensure efficient project implementation and long-term planning. Furthermore, Western Balkan Countries aspiring to join the EU must reduce GHG emissions. However, their high energy and carbon intensity economy leads to environmental pollution and high energy import dependence.

Many researchers examine the importance of climate change, carbon intensity, energy consumption, fossil fuel, and biodiversity towards economic growth. Furthermore, the researcher also investigated the application of the EKC hypothesis in different countries.

Although the Environmental Kuznets Curve (EKC) hypothesis is presented as a structural approach to theoretical and empirical analysis, many researchers across disciplines criticize the EKC hypothesis. Stern (2017) study examines the Environmental Kuznets Curve (EKC) critically and points out its drawbacks as a popular framework for pollution and emission modeling. Despite being widely used by economists, the EKC has long been criticized, and other methods – like decomposition and convergence models – have become more popular in fields related to climate change.

Different authors have studied the reduction of carbon dioxide, and it is a topic of debate due to the specificities of different countries' Environmental theory, otherwise known as the Kuznets environmental hypothesis EKC. The EKC application is a critical analysis conducted by various researchers, academics, scientists, environmentalists, etc. The attitude "too poor to be green according to Beckerman (1995), presented by Leal and Marques (2022), says "clear evidence that, although economic growth usually leads to environmental deterioration in the early stages of the process, in the end, the best and probably the only way to attain a decent environment in most countries is to become rich". The main aim of this study lies under this EKC philosophy. The study by Tutak et al. (2021) provides a thorough assessment of sustainable development initiatives in the EU energy sector, highlighting the relationship between socioeconomic factors, energy policy, and climate protection. The study evaluates the performance of

EU nations from 2009 to 2018, identifying advancements and differences among member states, using 14 sustainability indicators and the COPRAS methodology. The results provide a strong foundation for future policy changes by shedding light on the efficacy of sustainable policies within the framework of Agenda 2030 and the European Green Deal.

The primary purpose of this study is to present the importance of the green agenda for the Western Balkan countries, its legal framework, the proposals it foresees and the possibilities for its implementation. The unique feature of this study is that it goes further by evaluating the impact of CO_2 on economic growth based on the Environmental Kuznets Curve (EKC) hypothesis using panel data estimation techniques. The research objective of this study is to emphasize the relationship between the European Green Agenda through panel EKC estimation and further to estimate the Environmental Hypothesis EKC under WB countries.

1.1. Research questions

1. What is the legal framework of the European Green Agenda for WB countries?
2. Does the Environmental Hypothesis EKC finds its application in the case of WB countries?
3. Does GDP growth impact the environmental degradation in the case of the WB countries?
4. What are the reasons behind the increasing trends of CO_2 within GDP per capita growth?
5. What are the opportunities for the Western Balkans towards green transformation?

1.2. The main hypothesis of the study

H_1: The relationship between GDP per capita and Carbon intensity is an inverted U-shape function based on the Environmental Kuznets Hypothesis.

H_2: The Greater the GDP per capita, the lower the Carbon Intensity.

The study's significance lies in many directions and is of interest to many parties. Specifically, this study is the first to evaluate the application of the EKC hypothesis in the case of the Western Balkan countries. Moreover, this study not only highlights the importance of the European Green Agenda but also elaborates on the relevant laws and evaluates the Kuznets curve for the Western Balkan countries with an econometric panel data model. Although in various scientific articles that are also presented as a reference point in this study, the topic of economic greening for the Balkan countries is treated, the studies are more descriptive and argumentative, while this study, in contrast to previous studies, goes further and applies the econometric panel data model under the Kuznets hypothesis, including a model with fixed and random effects. The study brings innovation to the whole by emphasizing that the Kuznets Hypothesis does not find generalized application; this is because different countries have different economic characteristics and stages of development and economic growth, which at the same time are faced with limited resources towards economic greening. The study from Qamruzzaman et al. (2025) reveal that technological and environmental innovations play vital roles in reduction of carbon emissions, lending weight to the Environmental Kuznets Curve theory in that economic growth causes more environmental degradation in the beginning and less in the end. Also, the study by Dinda (2004) foresees that during the analysis of the EKC hypothesis, the economy under study should be taken into account by analysing how fast the economy of the country under review is growing, whether the economy of the country under analysis is purely agricultural, industrial-polluting or purely service, and also further presents the analysis in terms of the wealth of the people assessed with per capita income. Therefore, more prosperous people also have higher social demands for the environment and environmental protection. Furthermore, Chowdhury and Moran (2012) argue that EKC is critical for comparative scientific research of dynamic systems and is also related to the human environment.

1.3. Structure of the study

This study is structured as follows: Section one presents the introduction, including the research aim, objectives, research questions and the main hypothesis of the study. In the second section, the study presents the literature review, including the laws on the European green agenda, theoretical definitions of EKC and its empirical implications. Section three presents the research methodology, data used and period, and econometric panel models such as Pooled OLS, Fixed Effect (FE), Random Effect (RE), and the Environmental Kuznets Curve estimation. Section four presents the study results and the discussion of the findings, and section five presents the conclusions of the study and further research paths and study limitations.

2. Literature review

Economic growth and environmental policies have been topics of debate for years. Many studies have evaluated different aspects to understand the relationship between economic growth and carbon intensity because this is of great importance for policymaking and further awareness of countries of green practices. A study by Mardani et al. (2019) using the meta-analysis technique finds a twofold relationship between economic growth and CO_2, thus indicating further that sometimes economic growth causes CO_2 to increase and sometimes to decrease. Industrial development has increased energy demand, increasing greenhouse gas and carbon emissions. The continuous energy demand has increased the dependence on the use of greenhouse gases. This results in the growth of a country's wealth, which is explained by the increase in the energy demand in this case, the use of greenhouse gases and carbon emissions increases. This process has a negative impact on the long-term capabilities of the country's economy and society's general well-being. According to Leal and Marques (2022), the world faces 51 billion tons of greenhouse gas emissions each year due to the production of goods and services, energy, the agricultural sector, transportation, and the heating and cooling systems of homes and buildings throughout the year. Considering climate change, a more incisive reflection towards green economic agendas and the circular economy is necessary. However, developing countries face various difficulties with sustainable economic development and environmental protection due to limited resources, low gross domestic product, and energy sectors with outdated infrastructure. In endogenous economic growth, the environmental Kuznets curve is applied, according to which developing economies use their total stock to produce goods and thus generate more pollution, damaging the environment.

Horobet et al. (2024) find that the European EKC, can be implemented in the short term, but it is critical for the long term due to the complex relationship that specifically addresses the relationship between economic growth and environmental pollution. In this case, the work in question also emphasizes that generalized strategies for economic growth and at the same time for environmental protection cannot be implemented. In this case, personalized strategies for the respective countries are required, because as the study finds, in some European countries, EKC is implemented, while in some other European countries it is not implemented. A study based on Tchapchet-Tchouto et al. (2024) related to Nordic European countries finds a U-shaped EKC, which also highlights that there is much work to be done towards the "Green Deal and Action Plans". Specifically, the study highlights the importance of green practices for the Nordic countries and sees them as a basis for reducing carbon dioxide in their respective economies and further suggests the efficient use of energy.

According to Dinda (2005), it is suggested that developing economies allocate a part of their existing capital, through which they will be able to reduce their activity and reduce environmental pollution. The empirical estimation of the EKC hypothesis should be given special importance since CO_2 is the most significant environmental pollutant (Shahbaz & Sinha, 2019). Empirical assessments, including time factors, circumstances, economic variables, and environmental ones, will provide a clearer perspective on the circumstances and opportunities to protect the environment and to gain sustainable economic growth further.

Many researchers have studied EKC, such as van Alstine and Neumayer (2008); Ansuategi et al. (1988); Chowdhury and Moran (2012); Cole et al. (1997); Sarkodie and Strezov (2019), who studied the theoretical and empirical aspects and come to different results from the theory in applying the EKC hypothesis. The impact of CO_2 on economic growth has also been analyzed for the ASEAN 8 countries, which finds the application of the EKC hypothesis (Borhan et al., 2012). Antonakakis et al. (2017) assess energy consumption, air pollution, and economic growth for 106 countries and find that the EKC hypothesis does not apply. Otherwise, a study on the case of Algeria using the ADL technique finds the application of the EKC hypothesis. However, it adds that the turning point represents a very high value of GDP per capita, so economic growth in the case of Algeria will increase CO2 emissions (Bouznit & Pablo-Romero, 2016). Also, Acheampong (2018) concludes the application of the EKC function according to the results of PVAR and SGMM models investigated for 166 countries (1990 to 2014). Furthermore, Chen et al. (2016) conclude that developed countries should increase their care for energy use and, as they grow economically, should consider regulations to prevent environmental degradation. An interesting study comes from Choi et al. (2010), which using time series data, categorizes countries as China, an emerging market country, Korea as a newly industrialized country, and Japan as a developed country and finds a U-shaped EKC for China and Japan and an N-shaped EKC for China. These empirical findings suggest that the EKC does not have universal application.

The study further emphasizes that even developed countries with economic growth worsen air pollution. Furthermore, a study conducted for 20 OECD countries with panel data found mixed results within the analysis according to the countries' specificities. The study confirms that the EKC is applied differently for countries with different specificities. The study further finds evidence of an EKC for nine of the 20 countries, where five show a traditional inverted U-shaped relationship, three show an N-shaped relationship and one an inverted N-shaped relationship (Churchill et al., 2018). A study by Shahbaz et al. (2013) uses the VECM approach to the case of Turkey for the period 1970–2010 with annual data and finds a two-way causal relationship between CO_2 and economic growth, such that economic growth increases environmental costs.

2.1. Legal framework on Green Agenda

The European Green Agenda was first presented in 2020 as part of the strategic plan for the Western Balkan countries as part of the economic and investment plan. The European Green Agenda for the Western Balkan countries provides strategies for sustainable growth, inclusive environmental protection, renewable energy, and decarbonization, with the purpose of climate neutrality by 2050. The implementation of the agenda is regulated by relevant laws and regulations.

The European Green Deal, presented by the European Commission (2019), implies a strategy of economic growth including a fair, modernized and efficient society towards the use of resources without greenhouse gas emissions by 2050.

Sofia Declaration on the Green Agenda for the Western Balkans – On November 10, 2020, the Western Balkans Summit was held in Sofia. The leaders' declaration on the Green Agenda was adopted, which aligns with the European Union's Green Deal. The declaration is based on the region's support for addressing the challenges of climate change (Regional Cooperation Council, 2020). The economic and investment plan for the Western Balkans highlights the five main pillars of the green agenda, based on the European Commission (2020a) including:

1. The climate: decarbonisation, the energy and the mobility,
2. The circular economy, waste, recycling, sustainable production and efficient use of resources,
3. The biodiversity, protecting and restoring the natural wealth of the region,
4. The air pollution, water and soil sustainable food systems and rural areas.

The Circular Economy Action Plan was adopted in March 2020 and represents one of the main pillars of the European Green Deal. This new action plan, which stems from European initiatives towards the circular economy, foresees initiatives throughout the product life cycle in concrete terms. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented and that resources used are kept in the EU economy for as long as possible (European Commission, 2024).

The European Union has also envisaged the Carbon Border Adjustment Mechanism (CABM) as an important mechanism that sets a price for carbon emissions during the production process of carbon-intensive goods entering the European Union. Furthermore, it aims to encourage cleaner industrial production in non-member countries (European Commission, 2025). The Aarhus Convention represents the environmental convention on accountability, transparency and responsiveness of governments, which gives rights and obligations to parties in access to information, public participation and justice as well as the negotiation of international agreements (United Nations Economic Commission for Europe, 2025).

The above Table 1 presents a summary of references from various researchers. The table presents data on the

Table 1. Literature review summary on EKC findings (source: Authors' contribution)

Reference	Sample used and time period	Models used	Findings
Shahzad and Rahman (2025)	G-7 Countries	Panel Ordinary Least Squares (POLS)	Proved EKC in the long run
	1970–2018	ARDL model	Inverted U relationship
Naqvi et al. (2025)	Country Pakistan	Stochastic Differential Equations	Proved EKC – Inverted U-shape
	1960–2023		
Cutcu et al. (2025)	17 Countries	Quantile Regression Panel Data (QRPD)	Proved EKC-inverted U relationship
	1997–2022	OLS (Ordinary Least Squares)	
Horobet et al. (2024)	European Countries	CS-ARDL	Reject EKC
	Eastern European Countries	MMQR	U – shape relationship
	2004–2021		
Yessymkhanova et al. (2024)	BRIC Countries	Panel FMOLS test results	Inverted U EKC
	1980–2021	Panel test cointegration	
Muratoğlu et al. (2024)	38 OECD Countries	ARDL (PNARDL)	Not a valid EKC in the sector of industry
	1990–2022		
Gogoi and Hussain (2024)	Country India	Time series model	EKC rejected
	1994–2021		
Fukuda (2024)	Egypt, India, Mexico, Pakistan, Thailand, and Turkey	ARDL	Proved EKC (India, Pakistan, Turkey)
	1970–2020	VECM	Rejected EKC (Egypt, Thailand
Mata et al. (2024)	30 High-income countries	CS-ARDL Model	Proved EKC
	2000–2020		
Wang et al. (2024)	BRIC Countries 1990–2018	LM-Bootstrap Cointegration Driscoll-Kraay	Proved EKC
Achuo and Ojong (2024)	46 African Countries	Quantile regression	N-shape EKC
	1966–2022		
Guo and Shahbaz (2024)	100 EKC studies	Meta analysis	EKC proved for sectoral level
	1991–2023		
Pavlović et al. (2021)	Balkan Countries 1998–2019	Polynomial Linear Regression	Reject the EKC hypothesis
Verbič et al. (2021)	Southeastern Europe	Panel techniques	Proved EKC in long run – Inverted U shape
	1997–2014		
Jóźwik et al. (2021)	Central European Countries	Autoregressive Distributed Lag	Proved EKC on long run only in Poland
	1995–2016		
Boubellouta and Kusch-Brandt (2020)	30 European Countries	GMM	Proved EKC for e-waste
	2000–2016	2SLS	

reference, the countries under analysis, the time period, the econometric models used as well as the findings on the application of the EKC hypothesis. From the findings presented in the table, we note that the application of the EKC is not universal. The EKC has numerous limitations, which are due to the fact that the relationship that the EKC investigates between economic growth and carbon dioxide is a complex relationship in itself. In this principle, we can distinguish several interconnected macroeconomic indicators that empirical theory includes in the analysis during the testing of the application of the EKC as well as environmental indicators such as: economic growth measured by GDP, GDP per capita, inequality in income distribution GINI index, Foreign Direct Investment, Corruption, Trade open, Poverty, Consumption growth, digitalization, growth in Energy Demand, CO_2, Fossil resources, biodiversity, land area, population growth rate, etc.

Due to the complexity of the relationship that the EKC deals with, researchers have also attempted to combine different variables for different econometric models, such as panel data, time series models, panel models in long and short periods, etc. In general, the findings from the literature review confirm the non-universal application of the EKC, different findings for different countries and, most importantly, different findings for application within sectors such as industry, trade and services. Thus, it is necessary to unify national strategies towards green practices in their sustainable economic growth trends.

3. Methodology

The methodology section elaborates on the models and techniques used, the data and their source, the econometric model used, the variables included in the analysis and the reasons behind the choice of econometric models. This study uses panel data, including an analysis of the WB; these are: (i) Kosovo, (ii) North Macedonia, (iii) Albania, (iv) Montenegro, (v) Bosnia and Hercegovina and (vi) Serbia. The selection of these countries results from their specificities, the current conditions of transition and the challenges they face during the green transformation. Ibraimi et al. (2025) also employed panel data in their study focusing on Western Balkans. Precisely starting from the too poor to go green hypothesis and taking into account climate change and the requirement to preserve the environment, which is also foreseen by the European green agenda for the Western Balkans cited in the first section, it is essential to assess the real situation of the possibilities for green transformation. As also emphasized in the title of the study, the basic Environmental Kuznets Curve EKC hypothesis has been taken as the basis of the econometric model, which states that GDP per capita will increase in the first stages of the country's development and thus will cause the increase of CO_2 but after a breakpoint, as much as GDP per capita increases and countries achieve sustainability in their economic development, this will cause further a decrease in CO_2. The econometric models and the variables included in the analysis are developed based on the EKC hypothesis.

The data presented the three leading indicators: GDP per capita growth, CO_2 and quadratic GDP per capita, as suggested by EKC theory. The data are obtained from the official site of the World Bank Indicators (World Bank, 2025) from 1990 to 2024. It is worth noting that there are missing data for the CO_2 indicator; this is also the reason behind the main first study limitation, which is the small number of observations or small panels. The strong point of this analysis is that it is the first in the case of Western Balkan countries and will further serve as a reference for other studies.

The econometric models used for panel data in the case of this study are set Pooled OLS (POLS), Fixed Effect (FE) and Random Effect (RE). The Hausman Test is further used for between models' estimation. Previous studies such as Ziberi and Alili (2022), Fetai et al. (2017), Zhigolli and Fetai (2024), Bilalli (2025), and Khan et al. (2025), also support the chosen models.

The following table (Table 2) shows the variables used in the analysis by indicator name, the definition and the data source.

Table 2. Indicator name, their definition and the source (source: World Bank, 2025)

Indicator Name	Long definition	Source
Carbon intensity of GDP (kg CO_2e per constant 2021 US$ of GDP)	Annual emissions of carbon dioxide (CO_2), one of the six Kyoto greenhouse gases (GHG), from the agriculture, energy, waste, and industrial sectors, excluding LULUCF divided by the GDP in constant 2021 US$.	EDGAR (Emissions Database for Global Atmospheric Research) Community GHG Database, a collaboration between the European Commission, Joint Research Centre (JRC), the International Energy Agency (IEA), and comprising IEA-EDGAR CO2, EDGAR CH4, EDGAR N2O, EDGAR F-GASES version 8.0, (2023) European Commission, JRC (Datasets). https://edgar.jrc.ec.europa.eu/dataset_ghg80
GDP per capita (constant 2015 US$)	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2015 U.S. dollars.	World Bank national accounts data, and OECD National Accounts data files.

The Table 2 presents the variables used in the model as their indicator name, definition and the source of the data.

The subsection below goes further with econometric models' techniques, the equations and the description.

3.1. The econometric model specification

Based on the Environmental Kuznets Curve hypothesis EKC, the econometric models used for panel data estimations are pooled OLS, the econometric model with fixed effect FE and the econometric model with random effect RE. The Hausman test is also used for model specification and validity. The first equation is presented below:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + e_{it}, \quad (1)$$

where: Y in the panel data regression model equation is defined as a dependent variable. In our case of estimations, as dependent variable is defined as the variable Carbon emissions as a percentage of GDP – CO_2; i, in the case of the panel data regression model, presents the countries. In our case, there are WB countries; t presents the time period under investigation, in our case, the time period is 1990–2024; β_0, β_1 presents the parameters in the panel data regression model; X represents the independent variables within the model or predictors. The predictors set in this study are the GDP per capita growth and GDP per capita quadratic as a basis from the EKC hypothesis.

Upon variables used in econometric estimation, the following equation presents the study model equation:

$$Carbon\ Emmissions_{it} = \beta_0 + \beta_1 GDP\ per\ capita_{it} + \beta_2 GDP \wedge 2\ per\ capita_{it} + e_{it}. \quad (2)$$

The second equation presents the econometric model in this study, specified and adopted based on the EKC hypothesis. The econometric equation includes panel data for six WB countries (1990–2023). The variables included in the model are Carbon Emissions as a percentage of GDP, which is based on the Kuznets hypothesis and is defined as the dependent variable in the Kuznets econometric model. The independent variables in the specification of our econometric model are GDP per capita and GDP per capita squared to estimate the nonlinear effects as predicted by the Kuznets environmental hypothesis.

CO_2 has been used as a dependent variable in the study to test the hypothesis of the Environmental Kuznets Curve (EKC), as it is one of the key measures of pollution and environmental degradation and an essential measure of economic development. Numerous empirical studies (e.g., Stern, 2004) have demonstrated that CO_2 is a good variable to use for measuring the severity of economic development and environmental degradation, and hence is necessary for our model.

GDP and GDP per capita are used as independent variables since they track economic development and living standards, which are most basic to test the EKC. According to the EKT theory, incomes stimulate the increasing demand for a clean environment after an increasing pollution phase. The usage of these two variables finds place in the extensive literature of EKC studies on various regions (e.g., Grossman & Krueger, 1995 and Panayotou, 1997).

Some other potential variables, such as energy use, technology and urbanization, impact CO_2 emissions in this document. They have been excluded for simplicity and so that focus could be narrowed to the link between economic growth and pollution. It can also be argued that their impacts are indirectly captured via GDP and GDP per capita because they directly correspond with the level of energy use and industrialization.

To ensure that the omission of the aforementioned variables did not damage the validity of the results, Fixed Effects (FE) and Random Effects (RE) models were used, which allow controlling for country heterogeneity and factors not engaged in shaping the ultimate outcome.

Hausman Taylor:

$$\gamma_{it} = x_{it}\beta + \gamma_{it}. \quad (3)$$

Fixed effects and random effects

$$\gamma_{it} = x_{1i}\beta_1 + x_{2i}\beta_2 + Z_{1i}\lambda_1 + Z_{2i}\lambda_2 + c_i + \mu_{it}. \quad (4)$$

The third equation presents the Hauman test estimation, and the fourth equation determines the FE and RE equations. The models are estimated using STATA and presented with a proper discussion in section four of this study.

The results obtained from the econometric model estimations are presented in the section below.

4. Results

This section presents the econometric results obtained from the Pooled OLS POLS, Fixed-Effect FE estimation, and Random-Effect RE estimation. It follows with descriptive statistics, a correlation matrix, and econometric tests for panel models, precisely the Hausman test results, as it is usually used in panels to distinguish the appropriate model for hypothesis testing. Furthermore, this section calculates the turning point based on the EKC hypothesis.

Table 3. Descriptive statistics (source: Authors' calculations)

Variable	Obs	Mean	Std. Dev.	Min	Max
CO_2	99	1.177778	1.097265	0.3	7
GDP per capita	174	4213.028	1696.156	705	8403.3

The above Table 3 presents the descriptive statistics of the main variables included in the EKC panel estimation for Western Balkan countries. The number of observations for CO_2 is 99, and for GDP per capita growth, it is 174. The table also presents the variables' mean and standard deviation, the minimum of the cases and the maximum. For the CO_2 variable, the number of observations is 99; because of the data availability, the average value of the variable is 1.18, with the standard deviation of 1.0973, with a lower value of 0.3 and a higher value of 7. The CO_2

value has a distribution with a low mean (1.18) and a wide range (0.3 to 7), indicating that some observations have significantly higher levels of emissions. In the case of the GDP per capita growth, the number of observations is 174 due to data availability. The mean is 4213.028; thus, the standard deviation is 1696.156, indicating that GDP per capita growth varies between countries under investigation. The minimum value of GDP per capita is 705, and the maximum is 8403.3. This indicates further that there is a significant variation between observations.

Table 4. POLS, FE and RE (source: Authors' contribution)

VARIABLES	Pooled OLS POLS	Fixed Effects FE	Random Effects RE
GDP per capita growth	–0.0012525***	–0.0011342***	–0.0012525***
	(0.0002968)	(0.0002472)	(0.0002968)
GDP per capita squared	1.47e-07***	1.15e-07***	1.47e-07***
	(4.24e-08)	(3.51e-08)	(4.24e-08)
Constant	3.445833***	3.482632***	3.445833***
	(0.4790189)	(0.4040463)	(0.4790189)

Note: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$ * $p < 0.1$.

The Table 4 above presents the results obtained from the econometric models used in this study. The first column presents the variables used in the model, when, as explained previously, the dependent variable in the econometric models used is CO_2, and the independent variables used in the models are GDP per capita growth and GDP per capita Squared, as it is based on the EKC hypothesis. Based on the Hausman test (see Appendix, Table A4), the appropriate model as a basis for this study is the Random Effect model. Based on the econometric results from the RE model in our circumstances, the negative coefficient of the GDP per capita growth means that in the lower level of the GDP display turning point 4259.6924, the CO_2 decline, but further, as GDP per capita increases above the display turning point level 4259.6924 in line with the increment of the GDP per capita the CO_2 will also increase. As is seen from the positive coefficient of quadratic GDP per capita growth, the results show that with a one per cent increase in the GDP after the point level of 4259.6924, the increment of the GDP will cause further t increments in CO_2. Our results indicate a U relationship opposite to the U inverted relationship in the EKC hypothesis.

The turning point level is calculated as follows:

$$CO_2 = \beta_0 + \beta_1 GDP + \beta_2 GDP \wedge 2 + \varepsilon ; \quad (5)$$

$$CO_2 = 3.445833 - 0.0012525 \cdot GDP + 1.47e - 07 \cdot GDP \wedge 2; \quad (6)$$

$$GDP\ per\ capita = -\frac{\beta_1}{2\beta_2}; \quad (7)$$

$$GDP\ per\ capita = -\frac{-0.0012525}{2 \times 1.47e - 0.7}; \quad (8)$$

$$GDP^* = \frac{0.012525}{2.94e - 0.70}; \quad (9)$$

$$GDP^* \approx 4259.69. \quad (10)$$

Based on the econometric results obtained from the Random Effect model, we can conclude that increasing the GDP per capita above the tuning point level of 4259.6925 will cause an increase in CO_2 in the Western Balkan Countries.

Table 5. Correlation matrix (source: Author's contribution)

	Carbon Intensity	GDP per capita	GDP per capita^2
Carbon Intensity	1		
GDP per capita	–0.331	1	
GDP per capita^2	–0.249	0.9727	1

The above table (Table 5) presents the correlation matrix of variables included in the analysis. The correlation indicates the value +1, which means a perfect correlation 0 means no correlation, and –1 means perfect negative correlation. As we can see, GDP per capita is negatively associated with Carbon Intensity at a coefficient of –0.331. The negative relationship of the variables means that when the GDP per capita increases, carbon intensity tends to decrease. This is a statistical relationship. Otherwise, the GDP per capita squared is also negatively associated with carbon intensity at a coefficient level of –0.249 and shows a non-linear relationship.

The negative relationship between Carbon Intensity and GDP suggests that richer countries tend to have lower carbon per unit of output. The fact that GDP per capita^2 has a weaker relationship with Carbon Intensity may suggest a non-linear relationship, supporting the idea of an environmental Kuznets curve.

The above Figure 1 presents the EKC hypothesis, which is precisely the association between GDP per capita and carbon intensity in the case of the WB countries. The graph presents the U association between GDP per capita growth and carbon intensity in the case of WB countries. The graph also shows the opposite of the Inverted U association of EKC. The results indicate that increasing the GDP per capita growth above the turning point level will increase the carbon intensity. Thus, it is worth noting that there is much to do to promote green transformation in the case of the Western Balkans. It is necessary to carefully address and implement the laws, regulations and frameworks of the European Green Agenda. The richer the people, the higher the demands for preserving the environment and the quality of the environment where they live. The Figure 2 presents the inverted Environmental Kuznets Curve.

The Western Balkans' environmental sustainability results from weak institutional enforcement, growth driven by non-green innovation, consumption-based emissions, and incoherent policies. Economic development alone cannot generate environmental sustainability because

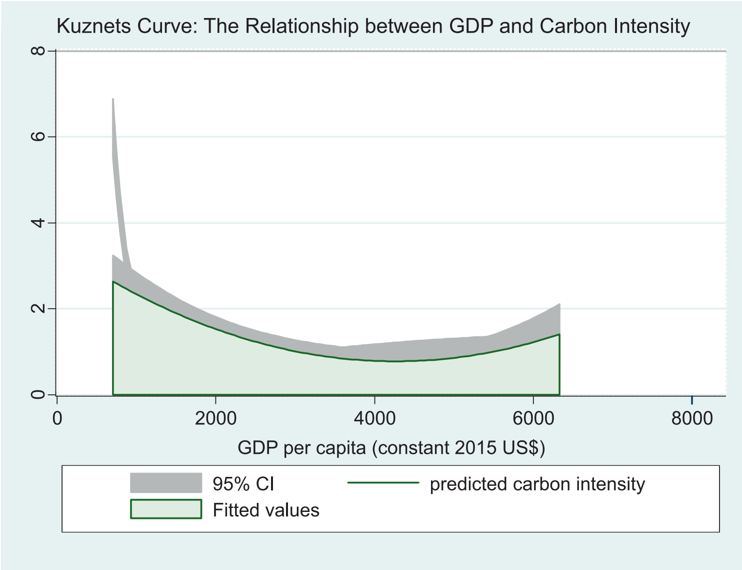

Figure 1. Kuznets Curve: The Relationship between GDP per capita and carbon intensity in the case of Western Balkan countries (source: author's contribution)

wealthier populations consume more energy-intensive goods and services, offsetting efficiency or cleaner production benefits. The EU Green Agenda frameworks, even after adoption, may be incoherent or postponed, weakening intended environmental impacts. This implies that the EKC need not be universal, particularly in developing economies where environmental governance is weaker.

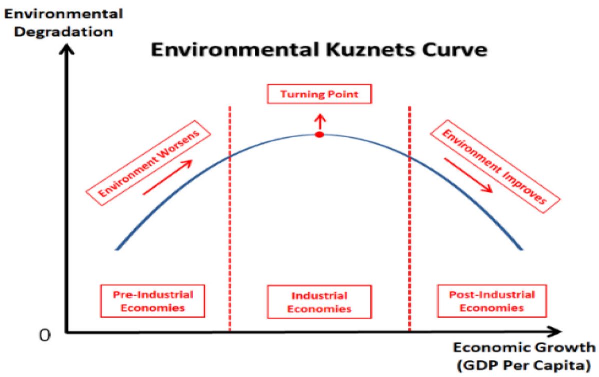

Figure 2. Environmental Kuznets Curve (source: Ansari, 2023)

The above Figure 2 presents the EKC curve, which foresees that in pre-industrial economies, the environment worsens. After a turning point in GDP per capita, which presents the period of post-industrial economies, the environment improves.

The Figure 3 presents the GDP per capita and the GDP per capita squared. The data shows an increasing trend of GDP per capita growth in all the countries under investigation for 1990–2023. The Carbon Intensity of GDP 2023 in North Macedonia is 0.7, Albania is at 0.3, and Bosnia and Herzegovina are at 1.3.

As we can see from the presented graphs (Figure 4), the GDP per capita growth in almost all countries of the Western Balkan shows an increasing trend for the period under investigation (1990–2023). Based on the data availability, the trends are presented for each country. Kosovo

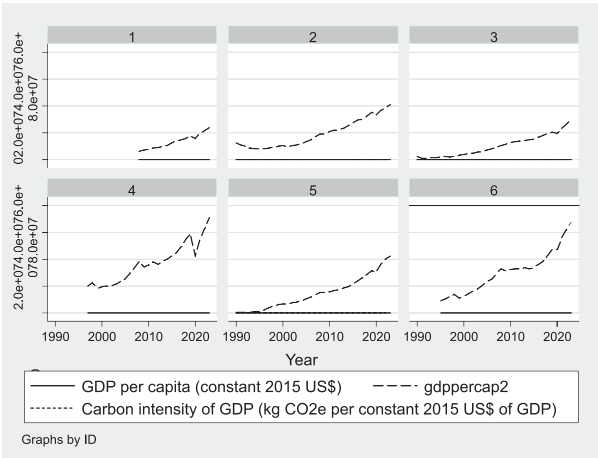

Figure 3. GDP per capita and Carbon intensity (source: author's contribution)

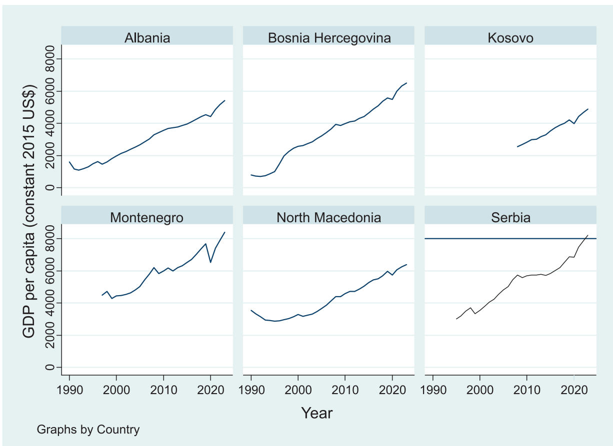

Figure 4. GDP per capita in the case of the Western Balkan countries (source: author's contribution)

in 2008 recorded a GDP per capita of 2543.6, while in 2023 it reached 4888.6. North Macedonia in 1990 recorded a GDP per capita of 3534.3, while in 2023 it reached 6393.8. Albania in 1990 recorded 1606.3, while in 2023 it reached 5419.6.

Montenegro in 1997 recorded a GDP per capita of 4488.8, while in 2023 it reached 8403.3. Bosnia and Herzegovina in 1990 recorded a level of 791.2 GDP per capita growth, while in 2023, it reached the level of 6507.0. Serbia in 1995 recorded a level of GDP per capita of 3012.5, while in 2023, it reached 8210.5.

The increasing trend of GDP per capita in Western Balkan countries corresponds with the convergence hypothesis, which is the normalize of the countries with lower GDP per capita catching up in magnitude and growth to the countries with higher GDP per capita as stated by Solow (1956) and Barro and Sala-i-Martin (1992, 2004). The evidence in the data suggests steady progress in income levels, with Kosovo, Albania, and Bosnia and Herzegovina demonstrating the most significant increases in income and hence positive long-run development trajectory, albeit varying in pace.

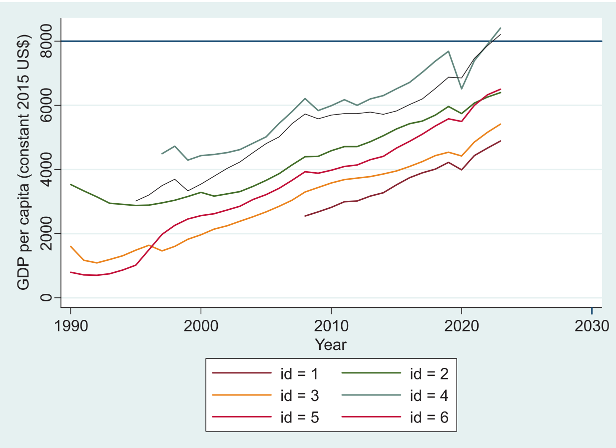

Figure 5. GDP per capita in six Western Balkan Countries and Carbon Intensity for each country (source: author's contribution)

The above graphs (Figure 5) present the data for WB6 about the GDP per capita growth and Carbon Intensity. The countries within the panel have their IDs, such as Kosovo under ID – 1, North Macedonia under ID – 2, Albania under ID – 3, Montenegro ID – 4, Bosnia and Herzegovina ID – 5, Serbia under ID – 6 (see Appendix, Table A5).

As we can see from the above graph related to the GDP per capita growth rate within six Western Balkan Countries, the lower rate of GDP per capita growth in 2023 has Kosovo, which is presented under ID – 1 at level 4888.6, followed by Albania (ID – 3) at 5419.6 point and North Macedonia (ID – 2) point 6393.8, followed by Bosnia and Hercegovina (ID – 5) with GDP per capita growth of 6507.0.

The highest GDP per capita growth in Montenegro, under ID – 4 at level 8403.3, ranked below, followed by Serbia (ID – 6), with GDP per capita growth at 8210.5 points.

The above graph presents the data about the Carbon intensity in the case of three WB countries as a result of missing data. In this study, we lack data for three countries of the Western Balkans, such as Kosovo ID – 1, Montenegro ID – 5 and Serbia under ID – 6. This is also the main study limitation explained in the section below. The Carbon Intensity remains between 0.3 in Albania, 0.7 in North Macedonia and 1.3 in Bosnia and Herzegovina (see Appendix, Table A5).

Albania's low carbon intensity is reflective of its large amount of hydropower, North Macedonia's mid-level value implies transitional energy, and Bosnia and Herzegovina's high carbon intensity implies reliance on coal and carbon-intensive industries. These results are consistent with the Environmental Kuznets Curve, illustrating environmental degradation increases with economic growth, and sketch a gradual decline in the chart as economies begin adopting sustainable practices.

5. Discussion

The findings of this study show the importance of the European Green Agenda for the Western Balkan countries in terms of their economic growth and environmental protection. The econometric results of this study, which were tested based on the EKC hypothesis and applied in the case of the Western Balkan countries for the period 1990–2024, using POLS, FE, RE and the Hausman Test indicates that the increase in the GDP per capita growth in the Western Balkan countries will be accompanied by an increase in CO_2. In line with our studies, other studies, such as Pejović et al. (2021), find that CO_2 emissions can only be reduced with continued GDP growth in the Western Balkans and European countries. In line with our findings that the higher the GDP per capita in the case of the Western Balkans, the higher the CO_2 will be, there is also a study that finds that the higher the GDP growth, the higher the CO_2 will be and any additional growth above the average according to the study in question will emit 0.08 per cent more CO_2 and further the study concludes that this growth damages the environment in the Western Balkans (Mitić et al., 2022). Furthermore, our results are supported by Popescu et al. (2024) which estimates environmental factors related to GDP in the case of the Western Balkans, including other economic factors such as energy and industry, under analysis and finds that the EKC hypothesis does not apply in these countries. However, economic growth also increases pollution, which is an inverse U to the EKC. On the other hand, Zhigolli and Fetai (2024) find that the increase in GDP per capita decreases the CO_2 level in the case of the Western Balkan; thus, the study suggests further that the Western Balkans countries should invest in new technologies, green regulatory frameworks and good practices and also to cooperate further internationally in raising so the public awareness for sustainable development and green economy. In contrast, Petrushevska and Trpkova-Nestorovska (2023) find that GDP, trade, and household consumption increase carbon dioxide growth in the long run. A study on the Western Balkans concludes that the countries in question should consider the possibility of environmental taxation, such as carbon dioxide taxes, and orienting themselves towards renewable energy sources (Mitić et al., 2020). Based on Beka et al. (2024), the more economically developed a country is, the more likely it is to provide and stimulate technology and a more appropriate regulatory framework for environmental protection.

Furthermore, unlike the Kuznets hypothesis, the results show a normal U and not an inverted U relationship between GDP per capita and carbon intensity. This proves that the EKC hypothesis does not apply in the case of the Western Balkan countries under the model conditions. The primary study hypotheses are:

H_1: The relationship between GDP per capita and Carbon intensity is an inverted U-shape function based on the Environmental Kuznets Hypothesis – is rejected under the study circumstances. Otherwise, we accept that the relationship between GDP per capita growth and carbon intensity is a U-shaped relationship. Further can be concluded that in the lower stages of GDP per capita growth, the carbon intensity is lower. Thus, the more the GDP per capita increases, the more the Carbon intensity will increase in the case of countries under investigation. Thus, we reject the second study hypothesis under:

H2: The greater the GDP per capita, the lower the Carbon Intensity, and it is accepted that in the case of the Western Balkan countries, the greater the GDP per capita, the greater the opportunity for environmental degradation or carbon intensity.

It is further concluded that the Western Balkan countries are far from green practices, and achieving sustainable economic growth at a point when CO_2 will decrease will be a challenge in itself.

The findings of the study reveal that the Kuznets Environmental Hypothesis itself is of great importance, but it does not have the same application in all countries. Specifically, the Western Balkan countries, which are in a protracted economic transition and candidates for European Union membership, have several conditions to meet, including the reduction of CO_2 emissions in the long term by 2050, as envisaged in the European Green Agenda for the Western Balkan countries.

Thus, special importance should be given to European good practices towards green economy to preserve the environment at a time when countries claim to grow economically since the Western Balkan countries, including Kosovo, Albania, North Macedonia, Montenegro, Bosnia and Herzegovina, and Serbia, are specific countries in terms of the challenges they have faced towards transition and in terms of inherited energy infrastructure. The energy structure is outdated, with all countries relying mainly on fossil sources except Albania. Different sectors, such as technology, agriculture, and environmental practices, pose challenges for the economies of the Western Balkan countries.

The study is first in its nature, which estimates the Environmental Kuznets Hypothesis in the case of the Western Balkan, and its implications are theoretical and empirical. This study adds to the literature that the Environmental Kuznets Curve hypothesis does not find universal application. Thus, its application depends on the development of the nations under investigation. Thus, the poorer the country, the greater the environmental degradation and the wealthier the nation, the higher the contribution to environmental protection. Based on empirical implications, this study adds to the literature for the first time the application and investigation of the Environmental Kuznets Hypothesis using panel techniques such as the Fixed Effect, the Random Effect, and the Hausman Taylor test. Even though the study has its limitations, it can serve as a basis for further research. This study does not include other macroeconomic and environmental indicators in the analysis, such as GDP, Energy consumption, fossil fuel, air pollution, green investments, green finance, etc. Thus, as a result, the basis for this study was the Environmental Kuznets Curve hypothesis. The second important limitation is the data; the data for CO_2 for three Western Balkan countries was unavailable. For further study, it is recommended to include other countries.

6. Conclusions

The European Green Agenda for the Western Balkans represents a development strategy towards a circular economy, a green economy and environmental protection. Many laws and legal regulations have been foreseen for the implementation of the agenda, which should be given importance to achieve the overall European strategic objectives for a green Europe. Taking into account that the countries of the Western Balkans are all on their way towards European integration. However, at different stages, the implementation of the European Green Agenda should be taken into account with the aim of sustainable growth and environmental protection. This also paves the way towards membership in the European Union.

The Environmental Kuznets Curve EKC hypothesis implies that in the first stages of economic growth, carbon dioxide increases, but then, after countries reach a certain level of development and economic growth, carbon dioxide falls, which implies an inverted curve for the Environmental Kuznets hypothesis. Our findings from the empirical study reject the Kuznets hypothesis. Thus, this study concludes that countries with specific economic and environmental development conditions, such as Western Balkan countries, struggle to sustain economic growth. It is worth emphasizing that this study is applied for the first time in an empirical analysis for six Western Balkan countries. The unique feature of this study is that it adds to the theory, further emphasizing that the Kuznets hypothesis is not universal and, therefore, does not apply equally to all countries in the world. Here, it is worth emphasizing that countries with different stages of economic development face difficulties in pursuing environmental policies, as they are *too poor to go green*.

Developing countries are still facing challenges from their transition to free market economies, despite their tendency to grow economically, and are not yet ready to deal with climate change and protect their environment. Their electricity infrastructure is outdated, they are heavily dependent on fossil fuels, and their tendency to grow economically will affect the increase in CO_2 unless the Western Balkan countries define clear strategies for sustainable economic growth and development, integrating international green economy practices, green agenda regulations, and measures to overcome the risks of eco-environmentalism and climate change. Without a doubt, these countries towards economic growth and transition to a green economy need to implement many reforms foreseen in the European Green Agenda for the Western Balkan countries and a national development strategy is needed for the respective countries where they will focus on an additional segment such as the green economy. The suggestions, measures and policies outlined in the Green Agenda are essential for sustainable economic growth in the case of the Western Balkan countries. On the contrary, economic growth will be accompanied by an increase in carbon dioxide as long as green economy practices are not taken into action by the authorities of the Western Balkan countries, which are also the main findings of this study.

Under the EU Green Agenda strategy, the study verifies a U-shaped EKC, thus the environment degradation-economic growth correlation in Western Balkans. However, it underscores that economic growth does not necessarily have to accompany environmental advancement, particularly where institutional and legal capacity is still low or in its developmental stages. Findings support the need for incorporating binding environmental policies into development plans, and regional governments actively enforcing and implementing the EU Green Agenda rules. Assumed limitations include homogeneity among Western Balkan states, not accounting fully for institutional and governance factors, and covering only a limited range of countries and years.

Disclosure statement

Authors declare there are no competing financial, professional, or personal interests from other parties.

Authors contribution

BZ, XHI, NA and JV conceived the study and were responsible for the design and development of the data analysis. XHI, BZ and NA were responsible for data collection and analysis. BZ and NA and JV were responsible for data interpretation. BZ, XHI and NA and JV wrote the first draft of the article. JV reviewed and improved the first draft; she has a supervisory role.

References

Acheampong, A. O. (2018). Economic growth, CO_2 emissions and energy consumption: What causes what and where? *Energy Economics*, *74*, 677–692. https://doi.org/10.1016/j.eneco.2018.07.022

Achuo, E., & Ojong, N. (2024). Foreign direct investment, economic growth and environmental quality in Africa: Revisiting the pollution haven and environmental Kuznets curve hypotheses. *Journal of Economic Studies, 52*(4). https://doi.org/10.1108/JES-02-2024-0065

Almeida, D. V., Kolinjivadi, V., Ferrando, T., Roy, B., Herrera, H., Gonçalves, M. V., & Van Hecken, G. (2023). The "greening" of empire: The European Green Deal as the EU first agenda. *Political Geography*, *105*, Article 102925. https://doi.org/10.1016/j.polgeo.2023.102925

Ansari, S. (2023, June 19). The Kuznets curve. *Economics Online*. https://www.economicsonline.co.uk/definitions/the-kuznets-curve.html

Ansuategi, A., Barbier, E., & Perrings, C. (1998). The environmental Kuznets curve. In *Theory and implementation of economic models for sustainable development* (pp. 139–164). Springer. https://doi.org/10.1007/978-94-017-3511-7_7

Antonakakis, N., Chatziantoniou, I., & Filis, G. (2017). Energy consumption, CO_2 emissions, and economic growth: An ethical dilemma. *Renewable and Sustainable Energy Reviews*, *68*, 808–824. https://doi.org/10.1016/j.rser.2016.09.105

Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy, 100*(2), 223–251. https://doi.org/10.1086/261816

Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed.). MIT Press. https://mitpress.mit.edu/9780262025539/economic-growth/?utm_source

Beka, A., Bilalli, A., & Gara, A. (2024). Assessing the role of economic, financial, and institutional dynamics on CO_2 emissions: Comparative analysis of OECD and Western Balkan regions. *Ekonomika*, *103*(3), 6–21. https://doi.org/10.15388/Ekon.2024.103.3.1

Bilalli, B. (2025). The impact of economic growth and human development on Carbon emissions (case of Western Balkans countries). *Knowledge – International Journal, 69*(1), 175–180. https://ojs.ikm.mk/index.php/kij/article/view/7218

Borhan, H., Ahmed, E. M., & Hitam, M. (2012). The impact of CO_2 on economic growth in ASEAN 8. *Procedia-Social and Behavioral Sciences*, *35*, 389–397. https://doi.org/10.1016/j.sbspro.2012.02.103

Boubellouta, B., & Kusch-Brandt, S. (2020). Testing the environmental Kuznets Curve hypothesis for E-waste in the EU28+ 2 countries. *Journal of Cleaner Production*, *277*, Article 123371. https://doi.org/10.1016/j.jclepro.2020.123371

Bouznit, M., & Pablo-Romero, M. D. P. (2016). CO2 emission and economic growth in Algeria. *Energy Policy*, *96*, 93–104. https://doi.org/10.1016/j.enpol.2016.05.036

Chen, P. Y., Chen, S. T., Hsu, C. S., & Chen, C. C. (2016). Modeling the global relationships among economic growth, energy consumption and CO_2 emissions. *Renewable and Sustainable Energy Reviews*, *65*, 420–431. https://doi.org/10.1016/j.rser.2016.06.074

Choi, E., Heshmati, A., & Cho, Y. (2010). *An empirical study of the relationships between CO_2 emissions, economic growth and openness* (IZA Discussion Papers No. 5304). Econstor. https://doi.org/10.2139/ssrn.1708750

Chowdhury, R. R., & Moran, E. F. (2012). Turning the curve: A critical review of Kuznets approaches. *Applied Geography*, *32*(1), 3–11. https://doi.org/10.1016/j.apgeog.2010.07.004

Chowdhury, R. R., & Moran, E. F. (2012). Turning the curve: A critical review of Kuznets approaches. *Applied Geography, 32*(1), 3–11. https://doi.org/10.1016/j.apgeog.2010.07.004

Churchill, S. A., Inekwe, J., Ivanovski, K., & Smyth, R. (2018). The environmental Kuznets curve in the OECD: 1870–2014. *Energy Economics*, *75*, 389–399. https://doi.org/10.1016/j.eneco.2018.09.004

Cole, M. A., Rayner, A. J., & Bates, J. M. (1997). The environmental Kuznets curve: An empirical analysis. *Environment and Development Economics, 2*(4), 401–416. https://doi.org/10.1017/S1355770X97000211

Cutcu, I., Altiner, A., & Bozkurt, E. (2025). The impact of economic policy uncertainty and geopolitical risk on environmental quality: An analysis of the environmental Kuznets Curve hypothesis with the novel QRPD approach. *Sustainability*, *17*(1), Article 269. https://doi.org/10.3390/su17010269

Debus, M., & Tosun, J. (2021). The manifestation of the green agenda: A comparative analysis of parliamentary debates. *Environmental Politics*, *30*(6), 918–937. https://doi.org/10.1080/09644016.2020.1864130

Dinda, S. (2004). Environmental Kuznets curve hypothesis: A survey. *Ecological Economics*, *49*(4), 431–455. https://doi.org/10.1016/j.ecolecon.2004.02.011

Dinda, S. (2005). A theoretical basis for the environmental Kuznets curve. *Ecological Economics*, *53*(3), 403–413. https://doi.org/10.1016/j.ecolecon.2004.10.007

Đurić, S., & Lalatović, B. (2023). The role of the European environment agency in light of green agenda priorities for the Western Balkans with a special focus on Montenegro-recovery and European Future. *EU and Comparative Law Issues and Challenges Series (ECLIC)*, *7*, 116–148. https://doi.org/10.25234/eclic/27445

European Commission. (2019, December 11). *The European Green Deal* (COM/2019/640 final). Brussels. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52019DC0640

European Commission. (2020a). *Guidelines for the implementation of the Green Agenda for the Western Balkans: Commission staff working document (SWD(2020) 223 final)*. Publications Office of the European Union. https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-10/green_agenda_for_the_western_balkans_en.pdf

European Commission. (2020b, October 6). *Questions and answers: Economic and Investment Plan for the Western Balkans*. https://ec.europa.eu/commission/presscorner/detail/cs/qanda_20_1819

European Commission. (2020c). *Western Balkans: An Economic and Investment Plan to support the economic recovery and convergence*. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1811

European Commission. (2024). *Circular economy action plan.* https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

European Commission. (2025, January 17). *Carbon border adjustment mechanism.* https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

European Parliament. (2022, May). *The Economic and Investment Plan for the Western Balkans: Assessing the possible economic, social and environmental impact of the proposed Flagship projects*. https://www.europarl.europa.eu/legislative-train/package-western-balkans-policy-a-new-momentum/file-western-balkans-economic-and-investment-plan

Fetai, B., Sadiku, L., & Berisha, N. (2017). Environmental policy and economic growth: Evidence from Southeast Europe. *Journal of Sustainable Development, 10*(5), 93–101.

Fukuda, T. (2024). ARDL and VECM investigation of the Environmental Kuznets Curve hypothesis in Egypt, India, Mexico, Pakistan, Thailand, and Turkey: Financial development, globalization, and government expenditure implications for sustainable development. *Energy Technologies and Environment, 2*(2), Article 13. https://doi.org/10.58567/ete02020003

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics*, *110*(2), 353–377. https://doi.org/10.2307/2118443

Gogoi, N., & Hussain, F. (2024). Application of the environmental Kuznets curve hypothesis in the Indian core industries: Towards a greener economy. *Review of Development Economics, 28*(4), 1718–1740. https://doi.org/10.1111/rode.13119

Guo, X., & Shahbaz, M. (2024). The existence of environmental Kuznets curve: Critical look and future implications for environmental management. *Journal of Environmental Management*, *351*, Article 119648. https://doi.org/10.1016/j.jenvman.2023.119648

Horobet, A., Belascu, L., Radulescu, M., Balsalobre-Lorente, D., Botoroga, C. A., & Negreanu, C. C. (2024). Exploring the Nexus between Greenhouse emissions, environmental degradation and Green Energy in Europe: A critique of the Environmental Kuznets Curve. *Energies, 17*(20), Article 5109. https://doi.org/10.3390/en17205109

Ibraimi, X., Ziberi, B. F., Ahmad, N., & Vveinhardt, J. (2025). Foreign direct investment legislation and economic growth in Western Balkan countries: A panel analysis. *Technological and Economic Development of Economy*, *31*(3), 842–862. https://doi.org/10.3846/tede.2025.23132

Jóźwik, B., Gavryshkiv, A., Kyophilavong, P., & Gruszecki, L. (2021). Revisiting the environmental Kuznets Curve Hypothesis: A case of Central Europe. *Energies, 14*(12), Article 3415. https://doi.org/10.3390/en14123415

Khan, U., Khan, A. M., Alam, M. S., & Houaneb, A. (2025). Toward sustainability: Understanding the impact of economic growth, urbanization, energy use, and resource management on carbon emissions. *International Journal of Energy Economics and Policy*, *15*(2), 637–646. https://doi.org/10.32479/ijeep.18846

Leal, P. H., & Marques, A. C. (2022). The evolution of the environmental Kuznets curve hypothesis assessment: A literature review under a critical analysis perspective. *Heliyon*, *8*(11), Article e11521. https://doi.org/10.1016/j.heliyon.2022.e11521

Mardani, A., Streimikiene, D., Cavallaro, F., Loganathan, N., & Khoshnoudi, M. (2019). Carbon dioxide (CO2) emissions and economic growth: A systematic review of two decades of research from 1995 to 2017. *Science of The Total Environment*, *649*, 31–49. https://doi.org/10.1016/j.scitotenv.2018.08.229

Mata, J. P. V., Bautista, M. G. G., Granda, L. E. S., & Moreano, E. G. Z. (2024). Evaluating the Environmental Kuznets Curve: The role of renewable energy, economic growth, urban density and trade openness on CO_2 emissions. An analysis for high-income countries using the CS-ARDL model. *International Journal of Energy Economics and Policy*, *14*(6), 580–596. https://doi.org/10.32479/ijeep.16740

Mitić, P., Hanić, A., Kojić, M., & Schlüter, S. (2022, June). Environment and economy interactions in the Western Balkans: Current situation and prospects. In T. Tufek-Mamišević, M. Arslanagić-Kalajdžić, & N. Ademović, *Interdisciplinary Advances in Sustainable Development. ICSD 2022. Lecture Notes in the Networks and Systems* (Vol. 529, pp. 3–21). Springer. https://doi.org/10.1007/978-3-031-17767-5_1

Mitić, P., Kostić, A., Petrović, E., & Cvetanovic, S. (2020). The relationship between CO_2 emissions, industry, services and gross fixed capital formation in the Balkan countries. *Engineering*

Economics, *31*(4), 425–436.
https://doi.org/10.5755/j01.ee.31.4.24833

Muratoğlu, Y., Songur, M., Uğurlu, E., & Şanlı, D. (2024). Testing the environmental Kuznets Curve hypothesis at the sector level: Evidence from PNARDL for OECD countries. *Frontiers in Energy Research*, *12*, Article 1452906.
https://doi.org/10.3389/fenrg.2024.1452906

Naqvi, R. A., Almohsen, B., & Sohail, A. (2025). Modeling the environmental Kuznets Curve: A stochastic approach using economic and climate data. *Journal of Environmental Management*, *373*, Article 123108.
https://doi.org/10.1016/j.jenvman.2024.123108

Panayotou, T. (1997). Demystifying the environmental Kuznets curve: Turning a black box into a policy tool. *Environment and Development Economics*, *2*(4), 465–484.
https://doi.org/10.1017/S1355770X97000259

Pavlović, A., Njegovan, M., Ivanišević, A., Radišić, M., Takači, A., Lošonc, A., & Kot, S. (2021). The impact of foreign direct investments and economic growth on environmental degradation: The case of the Balkans. *Energies*, *14*(3), Article 566.
https://doi.org/10.3390/en14030566

Pejović, B., Karadžić, V., Dragašević, Z., & Backović, T. (2021). Economic growth, energy consumption and CO_2 emissions in the countries of the European Union and the Western Balkans. *Energy Reports*, *7*, 2775–2783.
https://doi.org/10.1016/j.egyr.2021.05.011

Petrushevska, D., & Trpkova-Nestorovska, M. (2023). *Investigating the interplay of economy and environment in the Western Balkan and neighboring countries using VECM approach*. ResearchGate. https://doi.org/10.47063/EBTSF.2023.0011

Popescu, G. H., Poliak, M., Ćurčić, N., Göktuğ Kaya, M., Dumitrescu, C. O., & Saremi, M. (2024). Dynamics of industrialization, energy transition, population, and ecological footprint: energy, sustainability, and environment in Balkan countries. *Economics, Management, and Financial Markets*, *19*(3), 76–92.
https://doi.org/10.22381/emfm19320244

Qamruzzaman, M., Almulhim, A. A., & Aljughaiman, A. A. (2025). Nexus between uncertainty, innovation, and environmental sustainability in BRICS: An analysis under the environmental Kuznets Curve (EKC) framework. *Frontiers in Environmental Science*, *13*, Article 1570150.
https://doi.org/10.3389/fenvs.2025.1570150

Regional Cooperation Council. (2020, November 10). *Sofia Declaration on the Green Agenda for the Western Balkans*. https://www.rcc.int/docs/546/sofia-declaration-on-the-green-agenda-for-the-western-balkans-rn

Sabato, S., Mandelli, M., & Jessoula, M. (2022). Towards an EU eco-social agenda? From Europe 2020 to the European Green Deal. In *Towards sustainable Welfare States in Europe* (pp. 199–219). Edward Elgar Publishing.
https://doi.org/10.4337/9781839104633.00021

Sarkodie, S. A., & Strezov, V. (2019). A review on environmental Kuznets curve hypothesis using bibliometric and meta-analysis. *Science of The Total Environment, 649*, 128–145.
https://doi.org/10.1016/j.scitotenv.2018.08.276

Shahbaz, M., & Sinha, A. (2019). Environmental Kuznets curve for CO_2 emissions: A literature survey. *Journal of Economic Studies*, *46*(1), 106–168. https://doi.org/10.1108/JES-09-2017-0249

Shahbaz, M., Ozturk, I., Afza, T., & Ali, A. (2013). Revisiting the environmental Kuznets Curve in a global economy. *Renewable and Sustainable Energy Reviews*, *25*, 494–502.
https://doi.org/10.1016/j.rser.2013.05.021

Shahzad, I., & Rahman, S. U. (2025). Nexus of Green finance environment in G-7 countries: A fresh insight from EKC using GHG emissions and ecological footprint. *The Critical Review of Social Sciences Studies*, *3*(1), 1004–1034.
https://doi.org/10.59075/pprrqj24

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65–94.
https://doi.org/10.2307/1884513

Stern, D. I. (2004). Environmental Kuznets Curve. In C. J. Cleveland (Ed.), *Encyclopedia of energy* (pp. 517–525). Elsevier.
https://doi.org/10.1016/B0-12-176480-X/00454-X

Stern, D. I. (2017). The environmental Kuznets curve after 25 years. *Journal of Bioeconomics*, *19*, 7–28.
https://doi.org/10.1007/s10818-017-9243-1

Tchapchet-Tchouto, J. E., Duthil, G., Meyet Tchouapi, R. P., Kelly, A. M., & Ketu, I. (2024). The Environmental Kuznets Curve under Norden "Green Deal" and Action plans in Nordic European countries. *Journal of the Knowledge Economy*, *15*, 16969–17002. https://doi.org/10.1007/s13132-024-01744-z

Tutak, M., Brodny, J., & Bindzár, P. (2021). Assessing the level of energy and climate sustainability in the European Union countries in the context of the European green deal strategy and agenda 2030. *Energies*, *14*(6), Article 1767.
https://doi.org/10.3390/en14061767

United Nations Economic Commission for Europe. (2025). *The Aarhus Convention and the EU*. https://unece.org/environment-policy/public-participation/aarhus-convention/text

Van Alstine, J., & Neumayer, E. (2008). The environmental Kuznets curve. In *Handbook on trade and the environment*. Edward Elgar Publishing. https://doi.org/10.4337/9781848446045.00011

Verbič, M., Satrovic, E., & Muslija, A. (2021). Environmental Kuznets curve in Southeastern Europe: The role of urbanization and energy consumption. *Environmental Science and Pollution Research*, *28*, 57807–57817.
https://doi.org/10.1007/s11356-021-14732-6

Wang, Q., Ren, F., & Li, R. (2024). Exploring the impact of geopolitics on the environmental Kuznets curve research. *Sustainable Development*, *32*(3), 1700–1722.
https://doi.org/10.1002/sd.2743

Wang, S., Zafar, M. W., Vasbieva, D. G., & Yurtkuran, S. (2024). Economic growth, nuclear energy, renewable energy, and environmental quality: Investigating the environmental Kuznets curve and load capacity curve hypothesis. *Gondwana Research*, *129*, 490–504. https://doi.org/10.1016/j.gr.2023.06.009

World Bank. (2025). *World Development Indicators* [Database]. The World Bank. https://databank.worldbank.org/source/world-development-indicators

Yessymkhanova, Z., Azretbergenova, G. Ž., & Saparova, A. (2024). Testing the environmental Kuznets Curve Hypothesis in BRIC countries. *International Journal of Energy Economics and Policy*, *14*(1), 371–376. https://doi.org/10.32479/ijeep.15111

Zhigolli, G., & Fetai, B. (2024). The relationship between CO2 emissions and GDP per capita, energy consumption, industrial production in the case of Western Balkan countries. *Ekonomska misao i praksa*, *33*(2), 539–553.
https://doi.org/10.17818/EMIP/2024/2.10

Ziberi, B., & Alili, M. Z. (2022). Economic growth in the Western Balkans: A panel analysis. *The South East European Journal of Economics and Business*, *16*(2), 68–81.
https://doi.org/10.2478/jeb-2021-0015

Appendix

Econometric results

Table A1. Pooled OLS results

Variable	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval] Lower	[95% Conf. Interval] Upper
gdppercapitaconstant2015us	–0.00125	0.000297	–4.22	0	–0.0018342	–0.0006707
gdppercap2	1.47E-07	4.24E-08	3.47	0.001	6.39E-08	0.00000023
_cons	3.445833	0.479019	7.19	0	2.506973	4.384693

Table A2. Fixed effect regression results

Variable	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval] Lower	[95% Conf. Interval] Upper
gdppercapitaconstant2015us	–0.00113	0.000247	–4.59	0	–0.001625	–0.0006435
gdppercap2	1.15E-07	3.51E-08	3.29	0.001	4.56E-08	0.000000185
_cons	3.482632	0.404046	8.62	0	2.680388	4.284875

Note: F test that all u_i = 0: F(2, 94) = 25.75 Prob > F = 0.0000.

Table A3. Random effect regression results

Variable	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval] Lower	[95% Conf. Interval] Upper
gdppercapitaconstant2015us	–0.00125	0.000297	–4.22	0	–0.0018342	–0.0006707
gdppercap2	1.47E-07	4.24E-08	3.47	0.001	6.39E-08	0.00000023
_cons	3.445833	0.479019	7.19	0	2.506973	4.384693

Table A4. Hausman test results

Variable	(b) re	(B) fe	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
gdppercapitaconstant2015us	–0.00125	–0.0012525	0	0
gdppercap2	1.47e-07	1.47e-07	0	0

Note: b = consistent under Ho and Ha; obtained from xtreg; B = inconsistent under Ha, efficient under Ho; obtained from xtreg. Test: Ho: difference in coefficients not systematic.

chi2(0) = (b-B)'[(V_b-V_B)^(–1)](b-B) = 0.00
Prob > chi2 = (V_b-V_B is not positive definite)

Table A5. Panel data

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
1990	Kosovo	1		
1991	Kosovo	1		
1992	Kosovo	1		
1993	Kosovo	1		
1994	Kosovo	1		
1995	Kosovo	1		
1996	Kosovo	1		
1997	Kosovo	1		
1998	Kosovo	1		
1999	Kosovo	1		
2000	Kosovo	1		
2001	Kosovo	1		
2002	Kosovo	1		
2003	Kosovo	1		
2004	Kosovo	1		
2005	Kosovo	1		
2006	Kosovo	1		
2007	Kosovo	1		
2008	Kosovo	1		2543.6
2009	Kosovo	1		2680.9
2010	Kosovo	1		2822.6
2011	Kosovo	1		2995.6
2012	Kosovo	1		3021.4
2013	Kosovo	1		3163.5
2014	Kosovo	1		3279.0
2015	Kosovo	1		3520.6
2016	Kosovo	1		3739.2
2017	Kosovo	1		3890.2
2018	Kosovo	1		4009.1
2019	Kosovo	1		4219.1
2020	Kosovo	1		3990.9
2021	Kosovo	1		4429.9
2022	Kosovo	1		4666.4
2023	Kosovo	1		4888.6
1990	North Macedonia	2	1.5	3534.3
1991	North Macedonia	2	1.4	3328.6
1992	North Macedonia	2	1.4	3146.0
1993	North Macedonia	2	1.5	2948.3

Continued Table A5

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
1994	North Macedonia	2	1.5	2917.1
1995	North Macedonia	2	1.5	2876.1
1996	North Macedonia	2	1.8	2889.9
1997	North Macedonia	2	1.6	2954.5
1998	North Macedonia	2	1.7	3038.1
1999	North Macedonia	2	1.5	3154.8
2000	North Macedonia	2	1.4	3283.4
2001	North Macedonia	2	1.4	3169.3
2002	North Macedonia	2	1.3	3240.1
2003	North Macedonia	2	1.4	3307.9
2004	North Macedonia	2	1.3	3473.8
2005	North Macedonia	2	1.3	3657.6
2006	North Macedonia	2	1.3	3866.7
2007	North Macedonia	2	1.3	4140.6
2008	North Macedonia	2	1.2	4392.6
2009	North Macedonia	2	1.1	4405.2
2010	North Macedonia	2	1.0	4582.4
2011	North Macedonia	2	1.1	4711.1
2012	North Macedonia	2	1.1	4708.1
2013	North Macedonia	2	0.9	4863.7
2014	North Macedonia	2	0.9	5053.8
2015	North Macedonia	2	0.8	5262.7
2016	North Macedonia	2	0.7	5429.9
2017	North Macedonia	2	0.8	5510.8
2018	North Macedonia	2	0.7	5698.4
2019	North Macedonia	2	0.8	5961.6

Continued Table A5

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
2020	North Macedonia	2	0.7	5743.7
2021	North Macedonia	2	0.7	6064.9
2022	North Macedonia	2	0.7	6250.6
2023	North Macedonia	2		6393.8
1990	Albania	3	1.3	1606.3
1991	Albania	3	1.2	1163.5
1992	Albania	3	0.7	1086.4
1993	Albania	3	0.6	1197.6
1994	Albania	3	0.6	1305.0
1995	Albania	3	0.4	1488.0
1996	Albania	3	0.4	1633.6
1997	Albania	3	0.3	1464.3
1998	Albania	3	0.4	1603.6
1999	Albania	3	0.5	1821.9
2000	Albania	3	0.5	1960.9
2001	Albania	3	0.5	2143.5
2002	Albania	3	0.6	2247.5
2003	Albania	3	0.6	2380.6
2004	Albania	3	0.6	2522.4
2005	Albania	3	0.5	2675.5
2006	Albania	3	0.5	2851.4
2007	Albania	3	0.5	3044.9
2008	Albania	3	0.4	3298.5
2009	Albania	3	0.4	3432.2
2010	Albania	3	0.4	3577.1
2011	Albania	3	0.5	3678.0
2012	Albania	3	0.4	3736.3
2013	Albania	3	0.4	3780.7
2014	Albania	3	0.5	3855.8
2015	Albania	3	0.4	3952.8
2016	Albania	3	0.4	4090.4
2017	Albania	3	0.4	4249.8
2018	Albania	3	0.4	4431.6
2019	Albania	3	0.4	4542.3
2020	Albania	3	0.3	4417.0
2021	Albania	3	0.3	4858.1
2022	Albania	3	0.3	5154.8
2023	Albania	3		5419.6
1990	Montenegro	4		

Continued Table A5

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
1991	Montenegro	4		
1992	Montenegro	4		
1993	Montenegro	4		
1994	Montenegro	4		
1995	Montenegro	4		
1996	Montenegro	4		
1997	Montenegro	4		4488.8
1998	Montenegro	4		4723.1
1999	Montenegro	4		4290.9
2000	Montenegro	4		4431.6
2001	Montenegro	4		4462.3
2002	Montenegro	4		4529.1
2003	Montenegro	4		4623.1
2004	Montenegro	4		4819.1
2005	Montenegro	4		5013.2
2006	Montenegro	4		5435.9
2007	Montenegro	4		5798.1
2008	Montenegro	4		6205.8
2009	Montenegro	4		5833.7
2010	Montenegro	4		5982.2
2011	Montenegro	4		6168.8
2012	Montenegro	4		5995.8
2013	Montenegro	4		6202.5
2014	Montenegro	4		6307.0
2015	Montenegro	4		6517.2
2016	Montenegro	4		6707.9
2017	Montenegro	4		7023.4
2018	Montenegro	4		7381.8
2019	Montenegro	4		7684.2
2020	Montenegro	4		6515.5
2021	Montenegro	4		7390.3
2022	Montenegro	4		7889.2
2023	Montenegro	4		8403.3
1990	Bosnia Hercegovina	5	7.0	791.2
1991	Bosnia Hercegovina	5	6.9	715.7
1992	Bosnia Hercegovina	5	5.4	705.0
1993	Bosnia Hercegovina	5	4.7	747.9
1994	Bosnia Hercegovina	5	1.0	871.1

Continued Table A5

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
1995	Bosnia Hercegovina	5	0.9	1012.9
1996	Bosnia Hercegovina	5	0.8	1497.6
1997	Bosnia Hercegovina	5	1.1	1973.5
1998	Bosnia Hercegovina	5	1.2	2261.4
1999	Bosnia Hercegovina	5	1.1	2452.1
2000	Bosnia Hercegovina	5	1.3	2566.6
2001	Bosnia Hercegovina	5	1.3	2616.4
2002	Bosnia Hercegovina	5	1.3	2742.3
2003	Bosnia Hercegovina	5	1.3	2854.8
2004	Bosnia Hercegovina	5	1.3	3062.9
2005	Bosnia Hercegovina	5	1.3	3216.9
2006	Bosnia Hercegovina	5	1.3	3418.8
2007	Bosnia Hercegovina	5	1.3	3663.9
2008	Bosnia Hercegovina	5	1.4	3927.9
2009	Bosnia Hercegovina	5	1.4	3876.4
2010	Bosnia Hercegovina	5	1.5	3980.0
2011	Bosnia Hercegovina	5	1.6	4093.1
2012	Bosnia Hercegovina	5	1.5	4138.7
2013	Bosnia Hercegovina	5	1.5	4305.5
2014	Bosnia Hercegovina	5	1.3	4411.4
2015	Bosnia Hercegovina	5	1.3	4662.3
2016	Bosnia Hercegovina	5	1.4	4876.5
2017	Bosnia Hercegovina	5	1.4	5099.8
2018	Bosnia Hercegovina	5	1.3	5360.2
2019	Bosnia Hercegovina	5	1.2	5583.3
2020	Bosnia Hercegovina	5	1.2	5490.8

End of Table A5

Year	Country	ID	Carbon intensity of GDP (kg CO_2e per constant 2015 US$ of GDP)	GDP per capita (constant 2015 US$)
2021	Bosnia Hercegovina	5	1.1	5995.4
2022	Bosnia Hercegovina	5	1.1	6327.1
2023	Bosnia Hercegovina	5		6507.0
1990	Serbia	6		
1991	Serbia	6		
1992	Serbia	6		
1993	Serbia	6		
1994	Serbia	6		
1995	Serbia	6		3012.5
1996	Serbia	6		3200.8
1997	Serbia	6		3497.6
1998	Serbia	6		3699.4
1999	Serbia	6		3329.5
2000	Serbia	6		3542.4
2001	Serbia	6		3789.0
2002	Serbia	6		4038.7
2003	Serbia	6		4233.8
2004	Serbia	6		4527.4
2005	Serbia	6		4809.1
2006	Serbia	6		5016.4
2007	Serbia	6		5431.3
2008	Serbia	6		5735.9
2009	Serbia	6		5578.0
2010	Serbia	6		5690.7
2011	Serbia	6		5737.0
2012	Serbia	6		5739.3
2013	Serbia	6		5793.3
2014	Serbia	6		5716.5
2015	Serbia	6		5820.3
2016	Serbia	6		6025.0
2017	Serbia	6		6200.3
2018	Serbia	6		6524.1
2019	Serbia	6		6870.8
2020	Serbia	6		6851.0
2021	Serbia	6		7465.7
2022	Serbia	6		7857.4
2023	Serbia	6		8210.6