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Assessing the Role of Economic, Financial, and Institutional Dynamics on CO2 Emissions: Comparative Analysis of OECD and Western Balkan Regions

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Abstract. The main purpose of this research is assessing dynamics of economic, financial, and institutional developments on CO2 emissions for the period of twelve years, namely from 2010 to 2022, applying a comparative approach between 38 OECD and 5 Western Balkan countries. Further, the topic was chosen considering the role of environment and the degradation may cause economic, financial, and institutional developments. To specify this impact/correlation, secondary data was extracted from reliable sources. Additionally, the methodological approach in this study employs standard regression techniques adapted for panel data, including OLS, fixed effects (FE), random effects (RE), and Hausman–Taylor model instrumental variables IV. The analysis includes especially the Western Balkans and the OECD countries as well as their comparative aspect, and findings indicate the significant roles of inflation, business freedom, and notably, political stability in influencing CO2 emissions have been highlighted.

The study's contribution to literature is significant in two main ways. Firstly, it addresses a research gap by introducing a unique dataset and methodology for a specific time. Secondly, the importance of comparing the OECD countries with 5 Western Balkan countries is highlighted, providing valuable insights into differing economic, social, and environmental dynamics. This comparative approach of the study offers a practical framework that policymakers can use to develop effective strategies.

Keywords: Economic; Financial and Institutional Developments; Environment

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1. Introduction

One of the main fields of research in modern environmental economics is the interaction between environmental degradation, institutional quality, financial development, and economic growth. Environmental quality is a major concern in all countries of the world, and research into the relationships between these factors is becoming increasingly interesting. The world is currently facing a serious problem of global warming, due to a significant increase in carbon dioxide (CO2) emissions, and the main objective of global climate change initiatives is to reduce global CO2 emissions. Environmental degradation has been recognized as one of the world's key challenges that may have a negative impact on human health; as a result, researchers and politicians have given attention to the topic in recent years (Amin et al., 2022).

The study examined the relationships between these variables by comparing 5 Western Balkan countries with member states of the OECD. These sectors provide a foundation for understanding the complex connections that influence the environment due to their different institutional, financial, and economic development.

The study examined whether these factors separate economic growth from environmental degradation in OECD countries with high incomes, financial and institutional development. This analysis is essential to understand whether advanced economies are turning to sustainable growth models based on environmental protection. The OECD countries with their different mature economies provide a suitable analysis field for this concept. It is known that the OECD countries are at the forefront of industrial progress, which often has a significant impact on the environment. In recent years, however, many countries have grown up on the transition to sustainability. Industrialization, technological innovation, and globalization have contributed significantly to the economic growth of the OECD countries, mainly high-income countries. However, economic growth often results in environmental degradation. Industrial activities and high consumption patterns in the OECD countries have caused significant environmental damage such as air and water pollution, the loss of biodiversity and greenhouse gas emissions to have a major impact on global climate change. These countries face the challenge of balancing economic growth with the need to help protect and preserve the environment, which leads to an increased focus on sustainable development, green technologies, and eco-friendly legislation. In addition, in the OECD countries, the quality of institutions is often high. These countries often have established, transparent and effective institutions, such as a legislative framework, a regulatory body, and an environmental procedure enforcement body. This high level of quality of institutions facilitates the adoption of comprehensive environmental policies, international agreements, and investments in sustainable technologies. Despite these advantages, environmental degradation remains a problem due to industrialization, high consumption habits and past pollution traces. The challenges facing the OECD countries are how to use their institutional strengths to develop and implement policies that address current environmental issues such as climate change, loss of biodiversity and pollution, while maintaining economic growth. Financial development is characterized by

sophisticated financial markets, many financial products and services, and strong regulatory frameworks. Despite these advantages, environmental degradation is still a problem due to industrialization, high consumption habits, and past pollution legacy. The challenges facing the OECD countries are to use institutional strengths to develop and implement effective policies that address current environmental problems such as climate change, loss of biodiversity, and pollution, while maintaining economic growth.

On the other hand, Western Balkan countries have a different scenario than the OECD countries in terms of transition economies, developing financial systems, and institutional quality development. Although these countries experienced economic growth, they often faced different challenges than the OECD countries. Their growth is driven by efforts to integrate into the European Union and the world market, accompanied by major reforms in various areas. However, environmental degradation in the Western Balkans is also of major concern and is often caused by a lack of environmental regulation, reduced technological progress, and inadequate environmental management infrastructure. In addition, the Western Balkan countries are often confronted with challenges related to weaker institutional quality. The impact of these countries' environmental degradation is often increased by the lack of institutional weaknesses and resources for investing in sustainable technologies and practices. The Western Balkans are also working on harmonizing its policies and institutions with the European Union's standards, particularly in the environmental sector. The Western Balkans, which are generally considered transitional economies, have a lower financial sector. This low level of financial development can hinder economic growth and environmental and sustainable development funding. These countries may face challenges in attracting green investment due to higher risks and lower returns. However, in many Western Balkan countries aspiring to become members of the European Union, the transitional process towards aligning with EU standards provides opportunities for financial sector reform and development, including sustainability and environmental considerations in financial decision-making. Recently research, covering the relationship between economic growth and financial development, has progressed, and it is showed that carbon emissions tend to be higher in countries with high levels of financial development due to increased consumption from expanding production lines, which leads to environmental degradation (Shahbaz et al., 2016).

We decided to include the countries of the Western Balkans in our analysis to identify the economic, financial, and institutional dynamics affecting CO2 emissions that are particularly different due to the complex transition of the region from centrally planned economies to market-oriented systems. Economically, many of these countries have been confronted with high unemployment, low investment levels, and slow economic growth, which in turn affect their energy consumption patterns and dependence on older, more polluting technologies. Financially, the Western Balkans are facing several challenges, including limited access to international capital markets, undeveloped local financial sectors, and the strong dependence on foreign direct investment, which is often focused on energy-intensive industries. These financial constraints impede the adoption of cleaner technologies and can maintain a higher level of CO2 emissions. At the institutional level,

although progress has been made towards EU integration, inconsistencies in regulatory frameworks across the region may lead to unbalanced enforcement of environmental standards and policies. The varied speed and commitment to EU environmental protection regulations also play a crucial role in determining how these countries manage their environmental footprints. Understanding these nuanced processes in the Western Balkans sheds light on regional differences in CO2 emissions management, as well as the crucial role that economic development, financial stability, and institutional robustness play in influencing environmental results. This comparative research not only sheds light on the specific issues confronting the Western Balkans, but also provides broader insights into how similar regions might take their way to sustainable development.

The goal of this paper is to analyze the complex relationships between environmental degradation, institutional quality, financial development, and economic growth by comparing five Western Balkan countries to the OECD countries. Additionally, the study aims to contribute to the policy discussion on sustainable development by providing insights into how regions can balance economic and financial growth with environmental protection.

The hypotheses that we raised in this research paper are: H1: Economic growth does not impact CO2 emission, and H2: Institutional and financial development impact CO2 emission. Based on the results obtained, hypotheses are tested.

The comparative analysis between the OECD and Western Balkan countries aims to provide the various impacts of economic and financial development on environmental degradation across different stages of economic and institutional quality. The main objective of the study is to contribute to the political discussion on sustainable development by providing information on how different regions can balance economic and financial growth with environmental protection. It is expected that the findings will be particularly relevant to policymakers and stakeholders from the OECD and the Western Balkans and provide evidence-based guidance on the formulation of sustainable and growth-oriented economic and environmental strategies.

The decision to include economic, financial, and institutional dynamics in our research of CO2 emissions derived from an interest to fully understand the different effects on the degradation of the environment. Each of these elements provides a distinctive perspective through which we can investigate the sources of CO2 emissions, allowing us to gain a more comprehensive understanding of the relationships that influence environmental effects. By investigating these variables together, we hope to gain a better, more complete understanding of how different developmental trajectories affect the environment. We realize the complexity this brings to our study and value your insights, which encourages greater consideration on how we might effectively communicate the crucial correlations our research intends to find.

2. Literature review

The degradation of the environment has recently been the focus of much attention worldwide. There are growing concerns about the impact of economic, financial, and institutional development on environmental degradation. This literature study focuses on the Western

Balkan countries and OECD countries to investigate the relationship between these factors and environmental degradation. The research examined provides a comprehensive understanding of the impact of these developments on the environment.

Pavlovic et al., (2021) studied the impact of foreign direct investments (FDI) and economic growth in the Balkans on environmental degradation, they found a link between FDI and economic growth with environmental degradation, supporting the pollution haven hypothesis. Also, (Lasisi et al., 2020) identified key factors endangering environmental sustainability in the OECD countries, including income growth, increased international tourism, and the environmental impact of the labor force. Additionally, (Ozcan, et al., 2020) found that energy consumption patterns and economic growth contribute to enhancing countries' environmental performance levels in the OECD countries. Further, (Lorente et al., 2018) discussed that economic growth and renewable energy consumption have a positive impact on CO2 emissions. Similarly, the study (Onofrei et al., 2022) establishes a stable, long-term link between economic growth and CO2 emissions across EU nations, demonstrating that economic expansion consistently drives an increase in emissions. Regarding the other factors such as money supply on inflation, (Ujkani & Gara, 2023) found a positive relationship, indicating that increases in the money supply are associated with higher inflation rates. Also, (Bilalli, Beka, & Gara, 2023) revealed that inflation positively impacts economic growth. Additionally, their analysis revealed a positive correlation between stock market value trades and economic growth, suggesting that stock market performance is a significant contributor to economic development (Gara, et al., 2024). Another study shows how financial development indicators affect environmental degradation, finding a slow adjustment impacting global pollution in the OECD countries (Halkos & Polemis, 2017). Moreover, (Bayar et al., 2020) revealed that both financial development and primary energy consumption have a positive correlation with increases in CO2 emissions. Continuing, (Phong Le & Ozturk, 2020) demonstrate that globalization, financial development, and energy consumption increase CO2 emissions.

Siljak & Nagy (2019) highlighted the regressive effects of the global financial and economic crisis emphasizing a correlation between economic development and environmental and social outcomes. This suggests that financial and economic development can influence environmental degradation, although the role of institutional developments in this context is critical. In the context of the OECD and Western Balkan countries, there are, nevertheless, insufficient research findings regarding the influence of institutional advancements on the degradation of the environment. This indicates a significant knowledge gap that requires further investigation. Complementing this perspective (Feruni, et al., 2020) highlighted the destructive impact of corruption on economic development, with more severe consequences in the Western Balkans compared to EU countries and suggests that institutional quality plays a critical role in sustainable development. Furthermore, (Batol, et al., 2020) found that that institutional quality, economic growth, foreign direct investment, gross primary enrolment, and industrial growth significantly increase CO2 emissions, while financial development, population growth, trade openness, urban population growth, and R&D expenditures reduce CO2. Moreover, (Chousa et al., 2017) reveal that economic development decreases environ-

mental degradation with higher levels of economic growth, also the results show that financial development is an essential factor to decrease the CO2 per capita emissions. Further, (Abid, 2017) notes a continuously increasing relationship between CO2 emissions and GDP in both MEA and EU regions. The key policy insight is that sustainable economic growth, coupled with reduced carbon dioxide emissions, requires effective regulation and enhancement of domestic institutional roles and efficiency. Along the same line, (Khan, 2021) concluded that renewable energy sources are beneficial for the environment, as nonrenewable energy consumption is linked to increased carbon emissions, financial development has a positive impact on reducing carbon emissions, while foreign direct investment (FDI) tends to increase emissions and technological progress is shown to positively influence environmental quality, and several institutional quality variables are significant concerning carbon emission. Also, (Adams, 2018) indicates that economic growth and urbanization are key contributors to environmental degradation, the study highlights that financial development becomes significantly impactful when political regimes are considered, establishing a strong positive correlation between environmental degradation and economic growth. In a study conducted, financial development was linked to decreased CO2 emissions in more developed areas, while it led to increased emissions in less developed regions (Xiong, et al., 2017). This phenomenon highlights the dual impact of financial development on environmental degradation, which has increasingly become a subject of both empirical and theoretical research. Also, a study (Shahnazi & Shabani, 2021) discovered that the relationship between economic freedom and CO2 emissions is U-shaped, meaning that at different levels of economic freedom, CO2 emissions first decrease and then increase.

Ahmad (2022) indicates that institution quality reduces the negative ecological impacts of financial development, the causality analysis suggested that any policy related to financial development, human capital, and institutional quality will affect EF. Another study (Kozarević et al., 2017) reviewed the development of the banking system in the Western Balkans, focusing on aspects such as ownership structure and investment returns, this study is relevant for understanding how the financial system's development may influence environmental degradation in these countries. Further exploring the relationship between economic development and environmental impact (Maneejuk et al., 2020) their findings on the impact of financial development, industrial sector, and urbanization on CO2 emissions provide insights into the role of institutional factors in environmental degradation. Similarly, (Fatima et al., 2022) conclude that in thre OECD countries, globalization and high institutional quality contribute to reducing CO2 emissions, while economic growth is linked to increased environmental degradation. Further, (Usman et al., 2022) show that environmental damage is mitigated by advancements in financial sectors and the use of renewable energy, while factors like globalization, economic expansion, and reliance on nonrenewable energy sources heighten ecological harm. Overall, these studies highlight the complex interplay between the development of the economy, finance and institutions, and the environmental degradation of the OECD and the Western Balkans. They emphasize the importance of balanced growth, including environmentally sustainable growth, particularly in areas experiencing major economic transitions.

3. Methodology

The impact of economic, institutional, and financial development on environmental degradation is evaluated by panel data analysis covering five countries of the Western Balkans and 38 of the OECD between 2010 and 2022. The methodology uses various panel data techniques, such as pooled ordinary least squares (OLS), fixed effects (FE), random effects (RE) and Hausman–Taylor instrumental variables' IV model. The Hausman test identifies the most accurate model is Hausman–Taylor model. The use of appropriate estimation techniques is required to ensure that the coefficient is accurately, effectively, and objectively estimated. Furthermore, a methodological approach is used to compare different countries. The result of the Hausman test showed that the IV Hausman–Taylor instrument is more consistent and efficient than fixed effects and random effects to investigate environmental degradation in 38 OECD countries and 5 Western Balkans countires. The time of the research is long-term which includes a total of 559 observations; respectively, the analysis is carried out for 43 countries (38 OECD countries and 5 Western Balkan countries) in the 12-year period (2010–2022). The reason for using the Hausman–Taylor model, unlike most of the conducted research, also solves the problem of endogeneity, since it is considered that economic, financial, and institutional variables can be highly correlated with each other.

The Hausman–Taylor model is defined as follows:

$$Y_{it} = c + \beta_1 y_{it-1} + \beta_2 GDP_{it} + \beta_3 FDI_{it} + \beta_4 INF_{it} + \beta_5 \mathrm{BFI}_{it} + \beta_6 IFI_{it} + \beta_7 EFI_{it} + \beta_8 FFI_{it} + \beta_9 IIQ_{it} + \beta_{10} GEI_{it} + \beta_{11} CCI_{it} + \beta_{12} RLI_{it} + \beta_{13} PSI_{it} + u_{it} \quad (1)$$

where y_{it} is the dependable variable, which in this case is CO2 per capita, i = 1….43 (countries), t = 2010…2022 (years); c is constant; the explanatory variables include: y_{it}−1, which is the first lagged of the dependent variable, *GDP* (Growth Domestic Product); *FDI* (Foreign Direct Investment); *INF* (Inflation); *BFI* (Business freedom index); *IFI* (Investment freedom index)); *EFI* (Economic freedom, overall index); *FFI* (Financial freedom index); *IIQ* (Index of institutional quality); *GEI* (Government effectiveness index); *CCI* (Control of corruption Index); *RLI* (Rule of law index); *PSI* (Political stability index) and u_{it} is error term.

Table 1. Definition. of variables

Type	Variable	Abbreviations	Unit
Dependent variable	Emission of Carbon Dioxide	CO2	ppm
Economic Variables	Foreign Direct Investment	FDI	%
	Growth Domestic Product	GDP	%
	Inflation	INF	%
Financial Variables	Business freedom index	BFI	0-100
	Investment freedom index	IFI	0-100
	Economic freedom index	EFI	0-100
	Financial freedom index	FFI	0-100

Type	Variable	Abbreviations	Unit
Institutional Variables	Index of institutional quality	IIQ	0-100
	Government effectiveness index	GEI	(-2.5 weak; 2.5 strong)
	Control of corruption	CCI	(-2.5 weak; 2.5 strong)
	Rule of law index	RLI	(-2.5 weak; 2.5 strong)
	Political stability index	PSI	(-2.5 weak; 2.5 strong)

3.1. Data

Our study utilizes a comprehensive panel dataset derived from two primary sources: the World Bank database (WBD) and the Global Economy database. This dataset encompasses a period spanning from 2010 to 2022 and includes a diverse range of countries, specifically five from the Western Balkans – Albania, North Macedonia, Bosnia and Herzegovina, Montenegro, and Serbia – and thirty-eight member countries of the Organization for Economic Co-operation and Development (OECD). The OECD countries in our dataset include a wide array of economies from various parts of the world, such as Colombia, Turkey, Mexico, Costa Rica, Chile, Poland, Hungary, Greece, Latvia, Slovak Republic, Lithuania, Portugal, Czechia, Estonia, Slovenia, Spain, South Korea, Italy, Japan, France, the United Kingdom, New Zealand, Germany, Israel, Belgium, Canada, Austria, Finland, the Netherlands, Australia, Sweden, Denmark, Iceland, the United States, Norway, Switzerland, Ireland, and Luxembourg. In our study, we carefully chose a set of financial variables to provide a comprehensive analysis of how various financial aspects influence the environment, focusing particularly on CO2 emissions. These indicators allow us to explore the interactions and influences of these financial aspects on CO2 emissions extensively. Our methodology employs these variables to not only measure direct financial impacts but also to understand the broader economic activities that contribute to environmental degradation. Through this detailed analysis, we seek to provide practical insight to improve the understanding of the sustainability of financial development and environmental health.

3.2. Descriptive statistics

The data provided in Table 2 encompasses various economic and environmental indicators reflecting a country's performance and characteristics. The mean value of carbon dioxide (CO2) emissions stands at 6.91 ppm (parts per million). This value represents the average level of CO2 emissions in the examined context. Considering the global concern over climate change and the need to mitigate greenhouse gas emissions, this figure may suggest the environmental impact of the region under consideration.

The Gross Domestic Product (GDP) growth rate is recorded at 2.31%. GDP growth is a fundamental indicator of economic health, reflecting the rate at which a country's economy is expanding. A positive GDP growth rate indicates economic prosperity and development within the region. However, it's important to assess this growth in conjunction with other factors to understand its sustainability and inclusivity.

Foreign Direct Investment (FDI) is reported at 3.8%. FDI represents investment made by a company or individual in one country in business interests in another country. A higher FDI value signifies confidence from foreign investors in the region's economic prospects. This can lead to job creation, technology transfer, and overall economic growth.

The Inflation rate (INF) is at 2.68%. Inflation reflects the rate at which the general level of prices for goods and services is rising, and it's an essential indicator for economic stability. A moderate and stable inflation rate is generally desirable as it ensures that the purchasing power of a currency remains relatively constant over time.

Furthermore, the indices related to economic freedom, such as the Business Freedom Index (BFI), Investment Freedom Index (IFI), and Economic Freedom Index (EFI), indicate the degree to which individuals are free to participate in the economy. Higher values in these indices suggest a favorable business environment, characterized by minimal government intervention, protection of property rights, and ease of doing business.

Additionally, the indices related to institutional quality and governance, including the Government Effectiveness Index (GEI), Control of Corruption Index (CCI), and Rule of Law Index (RLI), shed light on the effectiveness of governance structures and the rule of law within the region. Higher values in these indices suggest stronger institutions, better governance, and a more conducive environment for economic activities.

Table 2. Descriptive statistics for all sampled countries

Variable	Obs	Mean	Std. Dev.	Min	Max
CO2	559	6.91	3.72	1.31	21.75
GDP	559	2.31	3.29	-15.30	24.37
FDI	559	3.80	22.79	-391.43	234.46
INF	559	2.68	4.25	-1.73	72.30
BFI	516	78.66	10.61	46.00	100.00
IFI	516	77.14	9.59	50.00	95.00
EFI	516	70.65	6.40	53.00	84.00
FFI	516	68.37	11.15	40.00	90.00
IIQ	516	70.62	6.40	53.2	84.40
GEI	516	1.04	.69	-1.04	2.23
CCI	516	.97	.91	-1.00	2.40
RLI	516	1.02	.78	-.80	2.12
PLI	516	.535	.68	-2.01	1.64

Source: Author's calculation

The data provided in Table 3 compares various economic and environmental indicators between the Western Balkans region and OECD countries.

In terms of CO2 emissions, the Western Balkans region has a lower mean value of 4.37 ppm compared to the OECD countries' mean of 7.25 ppm. This indicates that, on average, the Western Balkans emit less carbon dioxide per capita compared to the OECD

countries. However, it's essential to note that both regions need to continue efforts to reduce emissions to mitigate climate change.

Regarding economic indicators, both regions exhibit similar mean values for GDP growth and inflation. However, the Western Balkans have a higher mean value for Foreign Direct Investment (FDI) compared to the OECD countries. This suggests that despite potential challenges, such as political instability or institutional weaknesses, the Western Balkans have been successful in attracting foreign investment, which could contribute to economic development and growth in the region. When considering indices related to economic freedom, the Western Balkans generally exhibit lower mean values compared to the OECD countries. This indicates that the business and investment environments in the Western Balkans may have more constraints or regulations compared to the OECD countries, potentially impacting entrepreneurial activities and economic competitiveness. Furthermore, analyzing indices related to institutional quality and governance reveals notable differences between the Western Balkans and OECD countries. The Western Balkans generally have lower mean values for indices such as the Government Effectiveness Index (GEI), Control of Corruption Index (CCI), and Rule of Law Index (RLI) compared to the OECD countries. This suggests that the quality of governance and institutional frameworks in the Western Balkans may be weaker, which could hinder economic development and investor confidence.

Table 3. Comparison of results in 5WB countries and OECD countries

Variable	5 Western Balkans			OECD		
	Obs.	Mean	Std.Dev	Obs.	Mean	Std.Dev
CO2	65	4.37	1.82	494	7.24	3.78
GDP	65	2.38	3.58	494	2.30	3.26
FDI	65	6.47	3.92	494	3.45	24.17
INF	65	2.76	3.50	494	2.67	4.34
BFI	60	67.73	10.16	456	80.10	9.81
IFI	60	66.41	6.04	456	78.55	9.07
EFI	60	63.60	3.92	456	71.58	6.07
FFI	60	58.00	7.54	456	69.73	10.8
IIQ	60	63.50	3.87	456	71.55	6.08
GEI	60	-0.13	0.3	456	1.19	0.57
CCI	60	-0.343	0.204	456	1.147	0.826
RLI	60	-0.212	0.139	456	1.192	0.675
PLI	60	-0.07	0.339	456	0.614	0.676

Source: Author's calculation

4. Empirical findings and discussion

This section outlines the research findings. Table 4 shows the regression results executed with the Hausman–Taylor Instrumental Variable IV method. This model is suitable and deals with the endogeneity problem.

In the OECD countries, the coefficients indicate the relationship between various independent variables and CO2 emissions. A coefficient of 0.01 for GDP suggests that for every one-unit increase in Gross Domestic Product (GDP), there is a 0.01 increase in CO2 emissions, although this relationship is not statistically significant with a p-value of 0.538. Similarly, a coefficient of 0.04 for FDI (Foreign Direct Investment) indicates that for every one-unit increase in FDI, there is a 0.04 increase in CO2 emissions, but again, this relationship is not statistically significant with a p-value of 0.362.

In 5 Western Balkans countries, the coefficients reveal similar relationships between independent variables and CO2 emissions. A coefficient of 0.01 for GDP and 0.04 for FDI imply comparable relationships as in the OECD countries, suggesting that economic growth and foreign investment contribute to higher CO2 emissions. Additionally, a coefficient of 0.1 for INF (Inflation) and 0.12 for BFI (Business Freedom Index) indicates significant positive relationships, suggesting that higher inflation and greater business freedom are associated with increased CO2 emissions.

However, there are notable differences between the two groups regarding certain variables. For instance, while the coefficient for IFI (Investment Freedom Index) is -0.02 for the OECD countries, indicating a negative relationship (i.e., higher investment freedom is associated with lower CO2 emissions), the coefficient is -0.01 for the Western Balkans countries, albeit not statistically significant. Similarly, the coefficient for PLI (Political Stability Index) is remarkably different between the two groups, with -0.52 for the OECD countries and a significantly larger coefficient of -10.49 for the Western Balkans countries, both indicating negative relationships between political stability and CO2 emissions, although only the latter is statistically significant.

Table 4. Results of the Hausman–Taylor model for Western Balkan countries and OECD countries

Variable	5 Western Balkans			OECD		
	Coef	Std. Err	P-value	Coef	Std. Err	P-value
Tvexogenous						
GDP	0.01	0.01	0.389	0.01	0.01	0.538
FDI	0.02	0.02	0.310	0.04	0.01	0.362
INF	0.10***	0.02	0.000	0.12***	0.03	0.000
BFI	0.06***	0.09	0.000	0.08***	0.01	0.000
IFI	-0.01	0.09	0.262	-0.02	0.01	0.406
EFI	-0.01	0.14	0.894	-0.05	0.15	0.893
FFI	0.04***	0.01	0.002	0.04***	0.01	0.009
IIQ	-0.09	0.14	0.503	-0.11	0.16	0.476
GEI	0.03	0.40	0.993	0.17	0.46	0.719
CCI	-0.12	0.35	0.722	-0.11	0.42	0.791
RLI	-0.33	0.48	0.489	-0.21	0.56	0.701
PLI	-0.49**	0.24	0.046	-0.52	0.31*	0.099

Variable	5 Western Balkans			OECD		
	Coef	Std. Err	P-value	Coef	Std. Err	P-value
TVendogenous						
CO2_lag	0.11***	0.02	0.000	0.16	0.02***	0.000
TIexogenous						
ID	0.11***	0.04	0.010	0.12**	0.05	0.036
_cons	4.06**	1.89	0.032	4.26*	2.40	0.077
sigma_u	2.85		sigma_u	3.07		
sigma_e	0.84		sigma_e	0.88		
rho	0.91		rho	0.92		

Source: Author's calculation
Notes: * p<0.1, ** p<0.05, *** p<0.01

5. Discussion

H1: Economic growth does not impact CO2 emissions – based on the coefficients provided for GDP in both the OECD and Western Balkan countries (0.01), as well as their associated p-values (0.538 and 0.389, respectively), we cannot reject the null hypothesis for either group. This finding implies that there is no statistically significant link between economic growth (measured by GDP) and CO2 emissions within the contexts of both OECD and Western Balkans. Therefore, the data support our first hypothesis, confirming that economic growth does not influence CO2 emissions in these regions.

H2: Institutional and financial development impact CO2 emissions – to evaluate this hypothesis, we need to consider the coefficients associated with various indices related to institutional and financial development (BFI, IFI, EFI, FFI, IIQ, GEI, CCI, RLI, and PLI) and their relationships with CO2 emissions.

Among these indices, the coefficients for BFI, FFI, and PLI are statistically significant in both the OECD and Western Balkans countries. Specifically, in the Western Balkans, the coefficient for BFI is 0.06 (p-value = 0), for FFI is 0.04 (p-value = 0.002), and for PLI is -10.49 (p-value = 0.046). Similarly, in the OECD countries, the coefficient for BFI is 0.08 (p-value = 0), for FFI is 0.04 (p-value = 0.009), and for PLI is -0.52 (p-valu = 0.099).

Based on these findings, it appears that higher levels of business and financial freedom and political stability, as measured by BFI, FFI and PLI, are associated with an increase in CO2 emissions in both regions, contrasting with the original hypothesis that institutional and financial development would reduce environmental degradation. As a result, the second hypothesis is rejected, pointing to a complex relationship in which specific aspects of development could lead to environmental degradation.

The careful examination of the influence of economic growth, institutional, financial development, and environmental degradation produces complex and interesting findings. The null hypothesis on the relationship between GDP and CO2 emissions could not be

rejected for either the OECD or Western Balkan countries, indicating that there is no statistically significant correlation between economic growth and environmental degradation. This result appears in the broader academic landscape, where authors such as (Pavlovic et al., 2021; Halkos & Polemis 2017) investigated the nuanced interplay between economic activities and environmental outcomes, highlighting factors such as foreign direct investment and the multifaceted effects of financial development on pollution levels. Furthermore, investigation into the second hypothesis revealed substantial connections between various indicators of institutional and financial development – specifically, BFI, FFI, and PLI – and CO2 emissions. This finding, which shows that higher levels of economic and financial freedom, as well as political stability, are linked to increased environmental degradation, is consistent with the findings of (Batool, et al.,2020; Chousa, et al., 2017). These writers emphasize the importance of financial liberalization and institutional quality on environmental health, implying a complex relationship in which certain parts of development may unintentionally increase environmental difficulties.

This analysis not only highlights the complex dynamics within developed and transitional regions, but also emphasizes the need for a precise environmental policy adapted to different economic, financial and institutional contexts. This aligns with findings of Pavlovic et al. (2021), who noted a similar complex relationship between foreign direct investment and environmental degradation. Additionally, Shahnazi & Shabani (2021) found a U-shaped relationship between economic freedom and CO2 emissions, which complements our findings that not all economic growth is beneficial to the environment. Other authors like Halkos & Polemis (2017) and Batool et al. (2020) have also emphasized the multifaceted effects of financial and institutional development on pollution levels, suggesting that while some aspects of development may reduce emissions, others may increase them. Our research contributes to this nuanced understanding by providing empirical evidence from both the OECD and Western Balkan countries, highlighting the need for region-specific policies to manage the balance between economic development and environmental sustainability.

Firstly, economic development is often seen as a double-edged sword in terms of environmental sustainability. On the other hand, higher levels of economic development can provide the necessary resources and incentives for investing in cleaner technologies, environmental protection measures, and the development of a regulatory framework that supports sustainable practices.

Secondly, the role of institutions cannot be overstated in mediating the relationship between economic development and environmental sustainability. Effective institutions, characterized by strong governance, clear regulatory frameworks, and the enforcement of environmental laws, are crucial for directing economic growth toward sustainable outcomes.

Thirdly, financial development emerges as a critical enabler of environmental sustainability. A well-developed financial sector can mobilize the necessary capital for investments in sustainable infrastructure, clean energy projects, and green technologies.

6. Conclusion

This paper aimed to empirically assess how economic, financial, and institutional developments have influenced environmental degradation over thirteen years spanning from 2010 to 2022. This analysis was carried out using a comparative approach, which involved studying 38 OECD countries and 5 Western Balkan nations. This diverse selection of countries allowed for a rich analysis, considering the varied economic structures, levels of financial development, and institutional frameworks across these two distinct regions. The use of advanced econometric techniques allowed for a nuanced understanding of the dynamic relationships between economic, financial, and institutional developments and environmental degradation, contributing valuable insights into the global discourse on sustainable development. Through this research, the paper aspired to contribute to a deeper understanding of how integrated policy frameworks, involving economic, financial, and institutional reforms, can be leveraged to achieve environmental sustainability goals, providing a roadmap for countries striving to balance economic development with ecological preservation.

The article enhances our understanding of the relationship between economic growth and CO2 emissions by exploring this dynamic in different regional contexts, by comparing the OECD countries with the Western Balkan countries. Although the basic idea that economic growth leads to higher emissions is well known, the value of the study lies in its study of how these emissions can be influenced by the wider economic, financial, and institutional environments of different regions.

This comparative analysis helps to uncover whether more developed or transitioning economies manage the balance between growth and environmental impact more effectively. By employing empirical econometric models, the study not only confirms established theories but also provides detailed insights into the potential mechanisms through which regions can achieve sustainable development. This comprehensive approach offers crucial insights for policymakers and offers a solid foundation for crafting strategies aimed at mitigating environmental impact while fostering economic growth. The first contribution addresses the need to fill a gap in the existing literature for the specific countries under study. This means that the study has identified a knowledge gap in the research landscape and has taken steps to address it. The second contribution is related to the practical application of the study's findings. It suggests that the study can serve as a framework for policymakers. In this context, the study's results and analysis may offer recommendations or insights that can inform policy decisions in the countries under investigation. Policymakers can use the study's findings as a basis for developing or adjusting policies, strategies, or interventions that are relevant to the issues examined in the research. To reduce the impact of economic and financial development on environmental degradation in the OECD and Western Balkan countries, a specific policy framework is required and recommendation policy. This should include stricter emission regulations, financial incentives for green projects, and incorporating environmental sustainability into political objectives. As well as supporting green technology development, governments should also

participate in global environmental initiatives. Public education initiatives and frequent environmental impact analyses are essential to involving society and maintaining policy effectiveness. In combination, these activities provide a method to connect development with environmental sustainability, addressing the complex dynamics of economic growth, financial development, and environmental protection.

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