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The Impact of Decarbonization Tax on Economic Growth - Evidence for Western Balkan Countries

Enis Abdurrahmani[1], Nurten Deva[2*]

[1] Management, Business and Economics, University for Business and Technology, Prishtinë 10000, Kosovo
[2] Faculty of Geosciences, University "Isa Boletini" Mitrovicë, Mitrovica 40000, Kosovo

Corresponding Author Email: nurten.deva@umib.net

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ABSTRACT

Decarbonization and carbon tax have become increasingly relevant in recent years, due to the economic implications in industry, and especially in the energy sector. Naturally, the implementation of decarbonization policies in Western Balkans countries is a necessity for mitigating the environmental crisis in the region. This study examines the impact of carbon tax on economic growth in Western Balkan countries including Croatia. Our research is a quantitative empirical study based on regression model. Panel data on empirical study is based on 91 years of observation of Western Balkan countries, each of these countries has a 13-year observation. Data includes two sets of variables and examines the panel data obtained from World Bank Open Data over the period 2010-2022. The results indicate a significant impact of CO_2 emission tax on economic growth in Western Balkan countries. The result shows that CO_2 emission tax and economic growth are negatively correlated with each other. The results indicate a significant impact of CO_2 emission tax on economic growth in Western Balkan countries. A percentage CO_2 emission tax, causes a 2.52 decrease in economic growth under ceteris paribus average. CO_2 emission tax, FDI, GDP growth and unemployment rate indicate an inelastic relationship. The highest negative impact is shown in the state of Kosova, followed by Serbia and Bosnia and Herzegovina. The high negative impact on these countries is due to their high reliance on coal in energy production.

1. INTRODUCTION

Climate change is challenging our society by threatening not only the livelihood of humans but also the environment and the global economy [1]. Universally, carbon dioxide emission is considered to be the main driver of global warming [2]. The carbon tax is being used by many countries as the main tool of economic policy to reduce global warming and climate change. The application of the carbon tax as a powerful measure has been shown to be effective in reducing the intensity of carbon emissions as well as the economic compensation of its negative effect [3]. Carbon emission tax is levied mainly on coal, natural gas and oil products and any carbon-based products in proportion to carbon emission [4]. The Western Balkans countries are characterized by a competitive and diverse economy as well they share serious environmental problems, high intensity of carbon emissions, weak energy efficiency, serious reliance on coal and lack of wastewater treatment. Their economies are still in transition and consist of specialized sectors in low and medium technology production of goods and intensive sectors of textiles, agriculture and service [5]. Wind and solar energy sources currently make up only 22% of the region's total energy supply. The energy sector, mining, heavy industry and agriculture are considered the biggest environmental polluters in Western Balkans countries. Annual carbon dioxide emissions from energy and heat from fossil fuels in these countries for 2015-2020 is around 57 million tons [6]. European countries (except Ukraine and Switzerland) already practice the carbon tax. Although the tax is different in these countries, its main goal is to tax fuels with carbon content. Western Balkan countries, although late in this process, cannot avoid this tax, they must quickly follow the steps of these countries. The main technical obstacle to the full implementation of the carbon tax in the western Balkan countries is considered their energy markets. Despite progress in this direction, a single energy market has not yet been achieved. Although the economies of six Western Balkan countries are facing economic transition, they aspire soon to become part of the European Union. These countries, as signatories of the Sofia Summit and part of the energy community, have committed to decarbonization of the industry by 2050. The carbon tax is considered as an opportunity to mitigate the negative climate effects as well as a high economic role to boost public revenues in these countries. All Western Balkan countries have taken the first tangible steps to apply carbon dioxide taxation, with the aim of decarbonizing the economy and avoiding the carbon tax on imports that is planned to be imposed by the European Union from 2026. Since the 80s in these countries, there has been no

investment in increasing energy capacities, as such energy production is reliant on coal and high-cost energy imports.

Recently these countries have initiated important investment initiatives in photovoltaic and renewable energy. Kosova as a newly established state, after successful investments in solar panels with a capacity of about 100 MW, is continuing with the first wind auction with a capacity of 150 MW [7]. Albania concretizes the photovoltaic project with a capacity of 300 MW. Croatia has announced a round of 450 MW renewable energy capacity. Montenegro has initiated the photovoltaic park project with a capacity of 47 MW. Bosnia and Herzegovina has finalized the works of a solar power plant with a capacity of 36 MW. North Macedonia promoted investment in the construction of solar power plants with a capacity of 50 MW. Serbia has initiated the auctions of wind and solar energy with the generating capacity of about 450 MW.

The decarbonization of the Western Balkan energy companies is challenging even despite their ambitious goals for 2050, but they are flexible in mapping the path, because the development of technologies cannot be predicted with certainty. Certainly, the main challenge of these countries is the decarbonization of energy production. Coal resources as a reliance for energy production in these countries vary from 41% to 95%. From these countries, Kosovo's energy production is highly relied on coal resources up to (95%), followed by Serbia (67%), Bosnia and Herzegovina (65%), North Macedonia (51%) and Montenegro (41%), while Albania's energy production is mainly relied on hydropower plants and imports [8] (Figure 1).

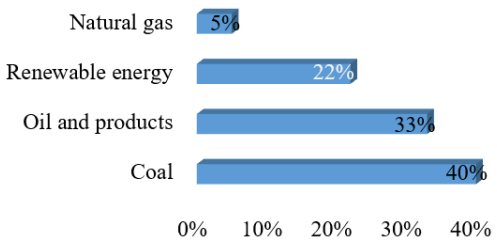

Figure 1. Energy structure in WBC [9]

Considering the commitment of Western Balkan countries to decarbonize the energy sector and reduce greenhouse gas emissions, the implementation of a carbon tax could play a pivotal role in promoting the transition to cleaner energy sources and reducing emissions. The imposition of a carbon tax is likely to have economic implications, particularly in the energy sector. Energy produced in thermal power plants that predominantly use coal will be significantly impacted due to its high carbon intensity. The tax would increase the cost of emitting gases, rendering the power produced by these plants less competitive compared to cleaner alternatives. This, in turn, could encourage investment and innovation in renewable energy sources and energy efficiency technologies.

For Western Balkan countries, adopting measures such as the implementation of a domestic carbon tax or integration into the EU Emissions Trading System (ETS) could align their efforts with EU standards and facilitate future integration into the European energy market. Therefore, given the critical role of clean energy sources in sustainable economic development and the need to decarbonize the energy sector by 2050, the main objectives of our study are:

1) To determine the state and relationship between carbon tax implementation and economic growth in Western Balkan countries, including Croatia, over the period 2010-2022.

2) To investigate the effects of carbon tax on macroeconomic variables (GDP growth, FDI, and unemployment rate) in six Western Balkan countries, including Croatia, from 2010 to 2022.

As this study is among the few that examine the relationship between carbon tax and economic growth within the context of Western Balkan countries, it aims to fill this gap. The study also serves as an initial point for policy discussion to minimize the negative impacts of the carbon tax. The research approach is based on an econometric model utilizing panel data and regression analysis for the period 2010-2022, organized as follows: The first part of the study presents the background of the carbon tax and its application in Western Balkan countries. The second part reviews relevant literature on the impact of carbon tax in various countries. The third part introduces the applied methodology and the database used. The fourth part presents the results of the empirical analysis. The fifth part discusses the conclusions drawn from the study.

2. LITERATURE REVIEW

Theoretical and empirical practice of carbon tax policy has been analyzed through many quantitative methods and research techniques. The carbon tax is not a fiscal innovation, it is already a reality in both developed and most developing countries. Carbon tax definition has been defined in many studies by several authors. The main definitions determine the carbon tax as; tax levying with an effective main role in limiting and reducing carbon-based emission fuels [10-12]. Generally, theoretical and empirical literature of carbon tax role is explored in many aspects and empirical methods and techniques. The literature review mainly is based on studies that have explored the role and impact of carbon tax on macroeconomic measurements and environmental changes in different countries. Literature output highlights the impact of the carbon tax on macroeconomic rates, cost of debt and climate change. The literature findings have a positive role in our study since they identify the impact of the carbon tax in macroeconomic terms and environmental change. Last decade, many studies confirmed the effective role of the carbon tax in reducing global warming and environmental damage [13-15]. Also, some studies revealed a significant impact of carbon tax on economic growth and cost of debt [16-18]. Most of these studies argued the positive and negative effects of carbon tax on macroeconomic rates and climate change. So, carbon taxation influence can be considered as positive or negative depending on the economic sector where it's applied. Kumbhakar et al. [19] highlighted the effective role of carbon tax on manufacturers' economic and environmental performance. The authors' approach combined production model and stochastic frontier to assess the carbon tax effects on economic and environmental efficiency. Their findings revealed that a 1% rise in the carbon tax increases production efficiency to 0.5%. Similarly, Metcalf and Stock [20] spotted the effective role of carbon tax in various European countries. They found the positive modest impact of carbon tax on employment and GDP growth. A study done by Creech [21] using a Linear Regression Model investigates the effect of carbon tax on emissions and GDP in eleven countries.

This study found the effective role of the carbon tax in six countries and positive effects in other nine countries in terms of emission reduction without influence on their GDP.

Ahmadi et al. [22] conducted the investigation on how carbon tax influences the emissions in British Columbia production sector. The study revealed as a response to the policy, production increased by 1.8%, while the intensity of emissions fell to 6%. So, they argue that lowering corporate income taxes encourages factories to invest in more energy-efficient technologies that increase their productivity. Metcalf and Stock [23] used a dataset on carbon tax rates to investigate the macroeconomic impacts of carbon tax on GDP and employment growth rates. The study found no evidence of any strong impact of a negative effect of carbon tax on employment or GDP. The authors concluded that there no support for the prospect that carbon taxes are employment and economic growth-killers. Mortha et al. [24] used a regression-based model for Japan to examine the impact of carbon tax on reducing CO_2, Sulphur dioxide (SO_2), carbon monoxide (CO) and nitrogen oxide (NOX). They find the positive effective role of the carbon tax in cutting non-CO_2 greenhouse gases and pollutants in different economic sectors. Kamil et al. [25] used inter-regional input-output model to examine the impact of carbon price on revenue output in six regions in Indonesia. Study results showed that the application of carbon price of 2.1 USD/ton will affect additional revenue of about 241 billion Rupiah at the national level. Moreover, many studies with different ideas found a positive effect of carbon emission tax on the cost of debt of companies in many countries [26-29].

However, many studies with similar ideas found a negative role of carbon tax. Zhao [30], by using an advanced model on a set of carbon tax policy parameters on assessing the influence of carbon tax on the competitiveness of the energy sector by using panel data of 21 OECD countries, revealed the significant negative role of carbon tax on the competitiveness on energy intensive sector. Wei et al. [31] investigated the micro and macro impacts of carbon tax in China's economy. Micro effects are shown in three approaches; producers, consumers and investors. Study shows the adversely impact of levying tax on business by increasing the production cost, affecting supply and demand and return on investment. And finally concludes that levying tax may reduce the rate of China's economic growth to some size. Wang et al. [32] explored the risk that using the carbon tax as revenue generator could create a perverse incentive for carbon emissions in order to ensure the continuous flow of carbon tax revenue. Using DICE model their study provides that this risk is not sustainable in the short term, but there is the fact that this perverse incentive can be created over time. Furthermore, Ayu [33] argued the negative impact of carbon tax on policy application on the value of change in private and government household demand, GDP, and GDP Quantity Index in Indonesia by using computable general equilibrium model. Kapfhammer [34] investigated the economic result of carbon taxes at the macroeconomic and sectoral levels in Nordic countries. By running the independent OLS projections this study revealed that carbon tax is an effective tool for reducing carbon emissions, but with consequences in the dimming of macroeconomic indicators, and in particular the fall of GDP. Similarly, Chua and She [35] examined how carbon tax effects impact the macroeconomy. By using the DSGE model, they conclude that carbon tax aversion effects may stabilize aggregate prices but at the same time exacerbate the loss of production. A study with a close idea was done by Frankowski et al. [36]. This study analyzed macroeconomic impact of carbon tax by using MEMO model in two cases, Greece and Poland, on three main indicators; GDP, unemployment rate and value added and employment. The results of the study confirmed the significant effects of the carbon tax on GDP and unemployment in the Polish industrial economy, while in Greece, such a tax shows a deterrent effect in the short term but with boosting incentive motive for decarbonization in the long term. Yiadoma et al. [37] found the unmitigated role of carbon tax on FDI in African countries. By using the DSGE model, the study revealed that the negative relationship between FDI and carbon taxes can deteriorate if the additional carbon tax is levied at higher levels compared to their counterpart countries. Furthermore, empirical results show that the tightening the carbon tax price affects a significant increase in energy prices [1]. Moreover, this may influence a stable decrease in carbon emissions. Moessner [38] quantitatively determined the effect of carbon price on inflation for 35 OECD economies from 1995 to 2020. The study findings reveal that every rise in prices of ETS by \$10/ton of CO_2 equivalents boost the energy CPI inflation by 0.8% (pp), also headline inflation by 0.08pp, and every rise in carbon taxes by \$10/ton of CO_2 equivalents increases food CPI inflation by 0.1 (pp), without significant impacts on energy CPI inflation.

Available literature sources regarding carbon tax effect in Western Balkan countries are limited, skimpy and sporadic. The study done by Madžar [39], investigated the correlation between environmental taxes and pollution in North Macedonia and Serbia. The study revealed a stronger negative correlation in North Macedonia, in contrast to Serbia, indicating that Serbia should pay more attention to these issues if it wants to converge towards EU environmental standards. Similarly, Đorić [40] highlighted the effective role of balancing social, economic development and environmental protection. According to him, the Green Agenda for the Western Balkans follows the same direction as the European Green Agenda and covers five key areas of intervention: decarbonization, circular economy, pollution reduction, sustainable agriculture and biodiversity.

Limited literature sources and empirical data on the role and effect of the carbon tax in the Western Balkan countries reflect the need to enrich the literature in this area. Based on the literature summary we can conclude that there is a lot of opposition in empirical findings based on the different countries with different empirical methods. Our study is in harmony with many of these studies concerning the prominent role of the carbon tax on the decarbonization of economic sectors and macroeconomic effect. However, the macroeconomic role of carbon taxes is still uncertain in many countries. So, this study contributes to the literature, through the exploration of the role and impact of the carbon tax in economic growth for a range of Western Balkan countries.

3. METHODOLOGY

This study aims to analyze the decarbonization tax impact on economic growth in Western Balkan countries. So, as we know economic growth can be defined as an increase in the real GDP of an economy over a year.

Economic growth can be measured by looking at the percentage change in real GDP. In this case, economic growth for these countries is calculated by using this formula [41]:

$$EG = \frac{\text{Real GDP (yr. 2)} - \text{Real GDP (yr. 1)}}{\text{Real GDP (yr. 1)}} \times 100\% \quad (1)$$

For this purpose, linear regression model is used because of its visible structure and simple estimation, to analyze relationship of decarbonization tax on economic growth in Western Balkan countries. Original regression model function can be expressed as follows:

$$Y = \beta 0 + \beta 1 + \alpha + \varepsilon \quad (2)$$

where, Y is dependent variable, while β0 and β1 are independent variables. In this regression model our purpose is to analyze the relationship between input and output. The regression is built by the following model:

$$\text{Ln } (GDP_{it}) = \text{Ln } \beta_0 + \text{Ln } (\beta_1) + \text{Ln } (\alpha) + \varepsilon_i \quad (3)$$

where, ε_i is stochastic component. Where β_0, β_1, express real output, while respectively α express elasticity and εi residual standard error. In order to find out whether $LnGDP_{it}$, β_1, has significant differences between them, it is necessary to adjust them through testing hypothesis. If β_0, plus β_1 is larger than 1, then we have a significant impact on decarbonization tax. Through linear regression model we will estimate β_0 and β_1. So, we have transformed the model to on more basic math natural log.

$$\text{In } (Q) = \text{In } (A) + \beta_0 * \text{In } (L) + \beta_1 * \text{In}(k) \quad (4)$$

$$\text{In } (Q) = Y \quad (5)$$

$$\text{In } (A) = \beta_0 \quad (6)$$

$$\text{In } (L) = \beta_1 \quad (7)$$

From this is log-linear (double-lay) or constant model if we have:

If $(\beta_0 + \beta_1) = 1$, we have constant return scale.

If $(\beta_0 + \beta_1) > 1$, we have increasing returns to scale.

If $(\beta_0 + \beta_1) < 1$, we have decreasing returns to scale.

Panel data of our empirical study is based on 91 years observation of six Western Balkan countries (Kosova, Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, and Serbia), including and Croatia, each of these countries has 13-year observation. Table 1 ilustrates the variables type. Data includes two set of variables and examines the panel data obtained from World Bank Open Data over the period 2010-2022.

Table 1. Variable description

Variable		
Independent Variable	**Unit**	**Source**
Decarbonization tax	% annual	WB
Dependent Variable		
Gross domestic production		
Foreign direct investment	Annual net inflows (% of GDP)	WB
Unemployment $_{rate}$	% annual	WB

4. EMPIRICAL ANALYSIS AND RESULTS

This study introduces the first comprehensive analyses of the economic growth impact of decarbonation tax of Western Balkan countries. The aim of this study is to estimate CO_2 emission tax on economic growth in Western Balkan countries. The sample includes 6 Western Balkan countries (Kosova, Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, and Serbia) including and Croatia. Some of these countries has not imposed carbon emission tax yet on economy sectors, instead of that we have used the environmental tax. Our data included two set of variables and examines the panel data obtained from EU Eurostat database [42] on real GDP and carbon tax from the World Bank Open Data [43] and covers the period from 2010 to 2022. The study aims to test the validity of the next hypothesis;

H_0: $\beta = 0$ (this states that slope is 0, and there is no relationship variables).

H_1: $\beta \neq 0$ (this infer that is significant relationship between variables).

Before diving into the linear regression data analysis, it is checked for the regression requirements and assumptions. First of all, there is a linear relationship between dependent and independent variables. Error component is normally distributed. There is no multicollinearity and no instability of regression coefficients. The variance of residuals is constant and there is no heteroskedasticity across the predicted values. Since none of these assumptions are violated then the forecasts, confidence range and scientific understandings yielded by a regression model are efficient. The data analysis is done by using the STATA package software.

Table 2 illustrates Anova results. The results show that there is observation done for 13 years of data and there are tests for the probability F-test, probability t-test, coefficients t-test and R-squared test. The value of F-test is 49.81, and P value for F is 0.0000. This indicates that our model parameters are statistically significant at 10% confidence level. So, we are going to say that we are 99% confident that we can reject the H0 and the H0 hypothesis is that R-square equals zero. So, we reject that and conclude that the alternative hypothesis H1 does not equal zero. This means that our regression model has explanatory power. The next thing to consider is the R-square. The R-square take value between 0 and 1, and is known as the coefficient of determination. The closer to one the better the model. Our R-square is 0.8191, so we can say that 81.91% of the variation in economic growth is explained by CO_2 emission tax.

The summary of correlation analysis for the sample countries of the relevant variables is presented in Table 3. Correlation analysis is useful to describe the strength and direction of linear relationships between variables. Based on the matrix coefficients, there is a low negative correlation between CO_2 emission tax and real GDP (-0.295). While there is a very low positive correlation between CO_2 emission tax and FDI (% GDP) (0.0621). Similarly, there is a low positive correlation between CO_2 emission tax and unemployment (0.3907). Naturally, there is a low negative correlation between GDP (%), FDI (%) (-0.1176) and unemployment (-0.8039). The increase in FDI presumably positively stimulates the increase of GDP growth. While the increase in CO_2 emission tax decreases the real GDP (%).

Table 2. Anova results

Anova Results								
Source	**SS**	**DF**	**MS**	**F (1,11)**	**Prob > F**	**R-square**	**Adj R-square**	**Root MSE**
Model	0.047298152	1	0.047298152	49.81	0	0.8191	0.8027	0.03082
Residual	0.01044557	11	0.000949597					
Total	0.57743722	12	0.004811977					

Table 3. Correlation analysis

	Decarbonization Tax (CO_2)	**Real GDP (%)**	**FDI (% GDP)**	**Unemployment $_{rate}$ (% Annual)**
Decarbonization tax (CO_2)	1.0000			
Real GDP (%)	-0.2951	1.0000		
FDI (% GDP)	0.0621	-0.1176	1.0000	
Unemployment $_{rate}$ (% annual)	0.3907	-0.8039	-0.0110	1.0000

Table 4. Linear regression results

Regression Results						
Real GDP (%)	**Coef.**	**Std. Err.**	**t**	**P> |t|**	**95% Conf.**	**Interval**
Decarbonization tax (CO_2)	-2.527274	0.3580964	-7.06	0.000	-3.315439	-1.739109
FDI (% GDP)	-.0090138	.0135911	-0.66	0.524	-.0397591	.0217315
Unemployment $_{rate}$ (% annual)	-.0138211	.0035536	-3.89	0.004	-.0218599	-.0057824
Constant	5.354761	1.00263	5.34	0.000	3.086654	7.622868

Table 4 provides linear regression results. In our regression results what we are going to be specifically interested in is our probability values for our t-test. In our case, we see that both our probability t-values, the log of CO_2 emission tax and constant are 0.000. The regression results with our P values of t-test, indicate that it's possible to reject the H0 hypothesis in two cases. This means that CO_2 emission tax has a significant effect on economic growth in Western Balkan countries. So, we can conclude that we are confident at 99% level that CO_2 emission tax has a significant effect on economic growth. Having interpreted t-test, we now can move on to the actual coefficients. The intercept coefficient for CO_2 emission tax is negative -2.527274 and the constant coefficient is 5.354761, so these essentially show the nature of the relationship between our variables. This indicates that when CO_2 emission tax is zero the log of the economic growth is 5.3547

The intercept coefficient is negative number (-2.52727) this shows that CO_2 emission tax and economic growth are negatively correlated with each other. Hence, it is concluded that a one unit increase in CO_2 emission tax, causes a (-2.52727) decrease in economic growth. Further, a percentage rise CO_2 emission tax is related to (-0.09013) decrease in FDI in the short run, at the 5% significance under ceteris paribus average. A percentage increase in CO_2 emission tax is correlated with (-0.01382) drop-in unemployment rate. On the other hand, the results indicate a positive effect of CO_2 emission tax on unemployment rate with p-value of 0.004. So, results found the inversely relationship between CO_2 emission tax and unemployment. This relationship can reduce the unemployment rate and the possibility of job thriving. Finally, based on the results obtained it's confirmed that CO_2 emission tax, FDI, GDP growth and unemployment indicate an inelastic relationship. As we see the effect of CO_2 emission tax on economic growth in Western Balkan countries is significant. CO_2 emission tax intercept coefficients in all Western Balkan countries are negatively. It infers that CO_2 emission tax intercept economic growth in Western Balkan countries. However, the CO_2 emission tax impact on economic growth is evenly apparently. The highest impact is in state of Kosova, Serbia and Bosnia and Herzegovina. Respectively their intercept coefficients are shown in Table 4.

Table 5 illustrates CO_2 emission tax impact by Wester Balkan countries on economic growth. The highest impact is in state of Kosova (-0.89), Serbia (-0.84) and Bosnia and Herzegovina (-0.77). Respectively their intercept coefficients manifest the level that GDP will move if CO_2 emission tax rise by 1%. This high negative impact on these countries is due to their high reliance on coal.

Table 5. Regression results by countries

Countries	**βi**	**Yi**
Kosova	-0.98 (-2.02)	-0.89 (2.69***)
Albania	-0.71 (-1.71)	-0.38 (1.99**)
Bosnia and Herzegovina	-0.91 (-1.95)	-0.77 (2.45***)
Montenegro	-0.69 (-1.68)	-0.33 (1.76**)
Croatia	-0.62 (-1.34)	-0.29 (1.55**)
North Macedonia	-0.73 (-1.76)	-0.41 (2.01*)
Serbia	-0.94 (-1.98)	-0.84 (2.74***)
Adj $R^2 = 0.8191$	F = 49.81	Intercept = -2.527274

*Statistical significance at the 1%, **Statistical significance at the 5%, ***Statistical significance at the 10% level

5. CONCLUSION

This study has analyzed CO_2 emission tax on economic growth in Western Balkan countries including Croatia. The study is based on panel data obtained from the EU Eurostat database on real GDP and carbon tax from the World Bank Open Data. The findings revealed that the impact of CO_2 emission tax on economic growth is negative in all Western Balkan countries. Considering that in these countries over 55% of energy production are based on coal products, the CO_2 emission tax has a direct impact on the production cost in the energy sector as well as in other industrial sectors. The Western Balkans countries as newly established countries from the last wars in the region continue to be challenged with major economic, social and environmental problems. Poor competitiveness, unemployment, high de-industrialization,

limited economic growth, social problems, inequality and poverty are the main challenges that continue to face the region. Additionally, the region continues to share environmental fragility as a result of the high reliance on coal energy production and high industrial and mining pollution. Most of these countries are in the early stages of developing their energy sector through alternative and renewable energy sources. Such investments in alternative energy sources seem to change quickly the current shape of energy development in the Western Balkan countries.

Due to the high negative impact of the CO_2 emission tax in Western Balkan countries, governments must coordinate the implementation strategy of this tax in order to minimize its negative effects on the energy sector and other industrial sectors. Always assuming that these countries are developing countries and their economies must be protected from the economies of the developed countries. It's very important the governments to consider carbon tax with particular importance. To minimize its negative effects on economy, by supporting the sectors that are affected by this tax, making policies and strategies to subsidize or ease the burden. The countries of the region can achieve these benefits by modernizing their energy sector through FDI or EU assistance. Energy modernization would strengthen the security of supply due to the age of power plants and the lack of renewable resources, and would potentially reduce electricity prices. All this will be an initiative that will contribute to joint regional efforts to fight climate change as a global threat. At the same time, Western Balkan countries should promote and increase investments in green energy as well as draw up strategies to end their reliance on coal for energy production. More incentive methods should be practiced to encourage investments in cleaner technologies to achieve CO_2 reduction. On the other hand, these countries should also work on raising human engineering resources in order to improve the quality of management in energy sector and other industrial sectors in harmony with environmental policies for a clean carbon economy. Apart from the fact that the primary task of the carbon tax is reduction of CO_2 emissions, a secondary benefit is to increase revenues. Distribution of carbon tax revenues in renewable energy sectors investment would ease the burden tax in the future. This can be done by establishing a green fund with the allocation of funds mainly for the decarbonization of the industry.

The aspirations of the Western Balkans countries to join the EU should increase their efforts to align with the climate and environmental policies of the EU. In this regard, Western Balkans countries have two benefits, firstly, the great opportunity to modernize their energy sector through EU grants and assistance, and secondly, the progress of the green agenda in these countries can avoid barriers to expansion, and also encouraging integration at the regional level. Also, the Carbon Border Adjustment Mechanism (CBAM) can play an important role in the decarbonization of the Western Balkan countries. Setting a carbon price on the exports of these countries to the EU should take into account that the macroeconomic impacts on these countries remain minimal and, what is important, the impacts on carbon tax revenues should be used productively. The main barrier in the implementation of the carbon price in the Western Balkan countries is the lack of an integrated regional energy market. It is necessary to achieve a fully integrated energy market in order for these countries to have access to alternative and diversified energy at a lower cost.

Another technical barrier is also their monopolistic energy markets, which dominate this sector and make it impossible to develop the alternative energy sector. In order to overcome these barriers, it is imperative that the carbon price be as effective as possible, and all instruments opposing the carbon price will have to be gradually removed. This should also include favorable policies for subsidizing fossil fuels as well as reforming electricity tariffs. I consider that coordinated regional cooperation should be achieved between Western Balkans countries on the carbon price, this can help to limit the carbon leakage, and the joint development of alternative energy capacities, as well as the sharing of experiences and knowledge on the policies of favorable environmental. All this would lead the Western Balkans countries towards further integration in the EU, as well as enable the easy implementation of decarbonization in their countries.

REFERENCES

[1] Känzig, D.R. (2021). The economic consequences of putting a price on carbon. SRN Electronic Journal. http://doi.org/10.2139/ssrn.3786030

[2] Tu, Z., Liu, B., Jin, D., Wei, W., Kong, J. (2022). The effect of carbon emission taxes on environmental and economic systems. International Journal of Environmental Research and Public Health, 19(6): 3706. https://doi.org/10.3390/ijerph19063706

[3] Zhang, J., Zhang, Y. (2020). Examining the economic and environmental effects of emissions policies in China: A Bayesian DSGE model. Journal of Cleaner Production, 266: 122026. https://doi.org/10.1016/j.jclepro.2020.122026

[4] World Bank. (2022). State and trends of carbon pricing 2022. World Bank, Washington, DC. https://documents1.worldbank.org/curated/en/099045006072224607/pdf/P1780300092e910590acb201757ecd54322.pdf.

[5] Ceko, E., Cakrani, E. (2023). Environmental tax reform in Western Balkan countries. Taking on Climate Change Through Green Taxation, 5(1): 101-153. https://doi.org/10.4018/978-1-6684-8592-7.ch005

[6] Allert, V., Larina, M., Gläser, A. (2023). Impacts of the EU Carbon Border Adjustment Mechanism on the Western Balkans and Ukraine: Policy options for governments. https://www.germanwatch.org/sites/default/files/germanwatch_impacts_of_the_cbam_on_the_western_balkans_and_ukraine_2023_0.pdf.

[7] Abdurrahmani, E., Doğan, Z. (2021). Creative accounting and its influence on corporate performance and financial reporting: A case study of Kosovo. Problems and Perspectives in Management, 19(4): 385-394. https://doi.org/10.21511/ppm.19(4).2021.31

[8] Ruiz, P., Medarac, H., Somers, J., Mandras, G. (2021). Recent Trends in Coal and Peat Regions in the Western Balkans and Ukraine. Publications Office of the European Union.

[9] Frey, B. (2024). The energy transition in the Western Balkans: The status quo, major challenges and how to overcome them (No. 76). Policy Notes and Reports.

[10] Sumner, J., Bird, L., Dobos, H. (2011). Carbon taxes: A review of experience and policy design considerations. Climate Policy, 11(2): 922-943.

https://doi.org/10.3763/cpol.2010.0093
[11] Poterba, J.M. (1991). Tax policy to combat global warming: On designing a carbon tax. Working Paper 3649. https://doi.org/10.3386/w3649
[12] Rausch, S., Reilly, J. (2012). Carbon tax revenue and the budget deficit: A win-win-win solution? MIT Joint Program on the Science and Policy of Global Change.
[13] Floros, N., Vlachou, A. (2005). Energy demand and energy-related CO2 emissions in Greek manufacturing: Assessing the impact of a carbon tax. Energy Economics, 27(3): 387-413. https://doi.org/10.1016/j.eneco.2004.12.006
[14] Al Shammre, A.S., Benhamed, A., Ben-Salha, O., Jaidi, Z. (2023). Do environmental taxes affect carbon dioxide emissions in OECD countries? Evidence from the dynamic panel threshold model. Systems, 11(6): 307. https://doi.org/10.3390/systems11060307
[15] Wesseh Jr, P.K., Lin, B., Atsagli, P. (2017). Carbon taxes, industrial production, welfare and the environment. Energy, 123: 305-313. https://doi.org/10.1016/j.energy.2017.01.139
[16] Conefrey, T., Fitz Gerald, J.D., Valeri, L.M., Tol, R.S. (2013). The impact of a carbon tax on economic growth and carbon dioxide emissions in Ireland. Journal of Environmental Planning and Management, 56(7): 934-952. https://doi.org/10.1080/09640568.2012.709467
[17] Özşahin-Koç, F., Deran, A. (2024). The impact of carbon emissions on corporate cost of debt (COD): A research on borsa istanbul (BIST) sustainability index. Sosyoekonomi, 32(60): 33-50. https://doi.org/10.17233/sosyoekonomi.2024.02.02
[18] Zhixin, Z., Ya, L. (2011). The impact of carbon tax on economic growth in China. Energy Procedia, 5: 1757-1761. https://doi.org/10.1016/j.egypro.2011.03.299
[19] Kumbhakar, S.C., Badunenko, O., Willox, M. (2022). Do carbon taxes affect economic and environmental efficiency? The case of British Columbia's manufacturing plants. Energy Economics, 115: 106359. https://doi.org/10.1016/j.eneco.2022.106359
[20] Metcalf, G.E., Stock, J.H. (2023). The macroeconomic impact of Europe's carbon taxes. American Economic Journal: Macroeconomics, 15(3): 265-286. https://doi.org/10.1257/mac.20210052
[21] Creech, J. (2023). The impact of a carbon tax on emissions. Bachelor Thesis, University of Arkansas.
[22] Ahmadi, Y., Yamazaki, A., Kabore, P. (2022). How do carbon taxes affect emissions? Plant-level evidence from manufacturing. Environmental and Resource Economics, 82(2): 285-325. https://doi.org/10.1007/s10640-022-00678-x
[23] Metcalf, G.E., Stock, J.H. (2020). Measuring the macroeconomic impact of carbon taxes. AEA Papers and Proceedings, 110: 101-106. https://doi.org/10.1257/pandp.20201081
[24] Mortha, A., Taghizadeh-Hesary, F., Vo, X.V. (2021). The impact of a carbon tax implementation on non-CO2 gas emissions: The case of Japan. Australasian Journal of Environmental Management, 28(4): 355-372. https://doi.org/10.1080/14486563.2021.1991498
[25] Kamil, A.S., Setyaningrum, L., Lesmana, A.C., Putri, M.S., Negara, S., Susiati, H., Anggoro, Y.D. (2023). Regional impact analysis of carbon tax implementation on Indonesia's coal power plant with interregional input-output method. International Journal of Energy Economics and Policy, 13(3): 149-157. https://doi.org/10.32479/ijeep.14115
[26] Jung, J., Herbohn, K., Clarkson, P. (2018). Carbon risk, carbon risk awareness and the cost of debt financing. Journal of Business Ethics, 150: 1151-1171. https://doi.org/10.1007/s10551-016-3207-6
[27] Kozak, S. (2021). Will the reduction of CO2 emissions lower the cost of debt financing? The case of EU countries. Energies, 14(24): 8361. https://doi.org/10.3390/en14248361
[28] Palea, V., Drogo, F. (2020). Carbon emissions and the cost of debt in the eurozone: The role of public policies, climate-related disclosure and corporate governance. Business Strategy and the Environment, 29(8): 2953-2972. https://doi.org/10.1002/bse.2550
[29] Pizzutilo, F., Mariani, M., Caragnano, A., Zito, M. (2020). Dealing with carbon risk and the cost of debt: Evidence from the European market. International Journal of Financial Studies, 8(4): 61. https://doi.org/10.3390/ijfs8040061
[30] Zhao, Y.H. (2011). The study of effect of carbon tax on the international competitiveness of energy-intensive industries: An empirical analysis of OECD 21 countries, 1992-2008. Energy Procedia, 5: 1291-1302. https://doi.org/10.1016/j.egypro.2011.03.225
[31] Wei, Z., Li, W., Wang, T. (2011). The impacts and countermeasures of levying carbon tax in China under low-carbon economy. Energy Procedia, 5: 1968-1973. https://doi.org/10.1016/j.egypro.2011.03.338
[32] Wang, R., Moreno-Cruz, J., Caldeira, K. (2017). Will the use of a carbon tax for revenue generation produce an incentive to continue carbon emissions? Environmental Research Letters, 12(6): 064001. https://doi.org/10.1088/1748-9326/aa6e8a
[33] Ayu, P. (2018). The impact of carbon tax application on the economy and environment of Indonesia. European Journal of Economics and Business Studies, 4(1): 110-120. https://doi.org/10.2478/ejes-2018-0011
[34] Kapfhammer, F. (2023). The economic consequences of effective carbon taxes. CAMP Working Paper Series.
[35] Chua, Y.H., She, L. (2023). Carbon tax aversion and macroeconomic effects. SSRN. https://doi.org/10.2139/ssrn.4645208
[36] Frankowski, J., Sokołowski, J., Michas, S., Mazurkiewicz, J., Kleanthis, N., Antosiewicz, M. (2024). Assessing macroeconomic effects of a carbon tax as a tipping intervention in economies undergoing coal phase-out: The cases of Poland and Greece. In Positive Tipping Points Towards Sustainability: Understanding the Conditions and Strategies for Fast Decarbonization in Regions, pp. 301-323. https://doi.org/10.1007/978-3-031-50762-5
[37] Yiadom, E.B., Mensah, L., Bokpin, G.A., Mawutor, J.K. (2024). Carbon tax adoption and foreign direct investment: Evidence from Africa. Cogent Economics & Finance, 12(1): 2312783. https://doi.org/10.1080/23322039.2024.2312783
[38] Moessner, R. (2022). Effects of carbon pricing on inflation. CESifo Working Paper No. 9563.
[39] Madžar, L. (2023). Green taxation in the western Balkan countries. Journal of Accounting and Management, 13(2): 107-116.
[40] Đorić, Ž. (2021). Zelena ekonomija i održivi razvoj u zemljama zapadnog balkana. Ekonomske Ideje i Praksa,

2021(41): 67-91.
[41] Limam, Y.R., Miller, S.M. (2004). Explaining economic growth: Factor accumulation, total factor productivity growth, and production efficiency improvement. Economics Working Papers, 200420.
[42] EU Statistical Office. (2023). Dataset. https://ec.europa.eu/eurostat/data/database.
[43] World Bank Open Data. (2023). Dataset. https://databank.worldbank.org/home.aspx.