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ACCOMPLISHING THE SUSTAINABLE DEVELOPMENT GOAL 13 – CLIMATE ACTION AND THE ROLE OF THE EUROPEAN UNION

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ABSTRACT

One of the key aspects of Sustainable Development Goals is the difference in awareness of various societies regarding the need to protect the environment and transform economies and societies, so they rely more on renewable energy sources. As an initiative, it should represent a commitment that should be in focus of the international agreements, especially the Paris Climate Treaty. Whilst the Sustainable Development Goals as a totality comprise serious implementation limits, the Paris Climate Treaty should be considered necessary to implement the Sustainable Development Goal 13: Climate Action. Implementing the Sustainable Development Goals would perhaps allow a holistic framework in combating climate change. Nevertheless, for the immediate future, there should be no delays in implementing a certain form of international effort to combat climate change. Therefore, the role of the European Union's climate policy was studied in this article, mainly its effectiveness in the reduction of emissions, as a crucial aspect of implementing one of the crucial Sustainable Development Goals, Goal 13, especially in the context of the Paris Climate Treaty and carbon taxes. The EU sees its vital interest in the fulfilment of the Sustainable Development Goal 13, and in successful action that would enable it to comply with the Paris Climate Treaty. The quantitative analysis in this article, based on an Autoregressive Distributed Lags approach, finds that the most effective way of reducing carbon dioxide emissions in the European Union would be to continue the shift towards more dependency on renewable sources of energy sources while maintaining current or slightly higher levels of taxation on energy consumption. The revenue should be directed towards subsidizing research and development of renewable energy sources.

KEYWORDS

sustainable development goals, Paris climate treaty, the European Union, environmental tax, renewable energy sources

CLASSIFICATION

JEL: Q28; E60; O13

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INTRODUCTION

With the signing of the Paris Climate Treaty (also known as the Paris Climate Agreement, the Paris Agreement or Accord; hereafter: the Paris Climate Treaty) and its ratification, the focus of the international debate once again slowly shifted back towards sustainable development.

Mitigating, as well as adapting to climate change [1] and its impacts, will require building on the momentum achieved by the Paris Climate Treaty on Climate Change, which entered into force on 4 November 2016 [2]. The Paris Climate Treaty's central aim is "to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two °C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1,5 °C" [1]. The goals set forth in Paris do not aim to ensure long-term sustainable development. As part of the Paris Climate Treaty, each country put forward a "nationally determined contribution" (NDC) towards the common goal of limiting global warming. This will likely shift the focus away from international mitigation policies, such as the Kyoto Protocol, to policies on national level [3].

Pacala and Socolow [4] warned that "mitigating climate change will require substantial abatement of greenhouse gas emissions from all core economic sectors", whilst Martin et al. [5] pointed out that "the choice of appropriate policy instruments for each of these sectors is essential for minimizing the overall economic costs of mitigation with given technologies (static efficiency), and for stimulating technological innovations that will further reduce mitigation costs in the future (dynamic efficiency)."

Europe's transition to a low carbon economy is "a work in progress, now hampered by internal stresses and foot-dragging by some laggard member states." China has also already managed to influence the international markets of renewable energy products, its production mainly responsible for the decrease of price of solar panels for about 80 percent in a short period[2].The European Union (hereafter: the EU) sees its vital interest in the fulfilment of the Sustainable Development Goal 13 (hereafter: the SDG 13), and in a successful action that would enable it to comply with the Paris Climate Treaty. The framework was adopted by EU leaders in October 2014. It builds on the 2020 climate and energy package. The framework contains a binding target to cut emissions in EU territory by at least 40 percent below 1990 levels by 2030. This will enable the EU to take cost-effective steps towards its long-term objective of cutting emissions by 80-95 percent by 2050 in the context of necessary reductions by developed countries as a group, as well as make a fair and ambitious contribution to the Paris Climate Treaty [6]. The article aims to empirically assess the relevance of several key variables from an econometric perspective to test the impact key variables in the discussion of the Paris Climate Treaty may have on CO_2 emissions. It primarily aims to review whether subsidizing renewable energy or implementing carbon taxing is more effective as a means of curbing CO_2 emissions as these are the two most common theoretical recommendations for this issue.

This article will primarily try to provide one of the possible answers on how the EU climate policy is to be further pursued in the context of the Paris Climate Treaty, by conducting an analysis of the selected literature on both qualitative and quantitative papers and studies concerning the SDG13, limiting the emissions, as well as the relationship between economic growth and carbon dioxide (hereafter: CO_2) emissions. After a short discussion, the article presents the quantitative approach used. The methodological section is followed by the presentation of results and discussion, while policy recommendations are provided in the conclusion.

LITERATURE REVIEW

In the literature review, we address relevant sources on carbon taxation and SDG13. Carbon taxes are "expected to stimulate the production of clean technology, hence they modify the price differential between the use of high-carbon and low-carbon technologies" – according to the "Porter Hypothesis". Additionally, carbon taxes "stimulate country's economic growth more than harming it, by stimulating technological innovation" [7]. Baranzini and Carattini [8], however, warn about are significant downsides to carbon taxation: "the difficulty of their implementation, administrative burdens, exemptions for many carbon emitting intensive industries[3] and potential damages that may be caused to the competitiveness of key industries". Despite these issues, already mentioned carbon taxation is perhaps the most direct path to decreasing harmful emissions. Davis and Kilian [9] use a range of econometric techniques to "assess the potential impact that a carbon tax could have in the United States, by estimating the impact of past variations in gasoline tax" [8], while Baranzini and Weber [10] find that in Switzerland "an increase in the existing mineral oil tax decreased gasoline demand by about 3.5 percent". Concurrently, the consumers are aware that the price increase is not a product of market forces. So, while still a highly debated issue, studies like the one from [3], who used the unit without carbon taxes implemented as studied unit and "synthetic Sweden" as control unit, proved that the carbon taxes can be efficient in reducing CO2 emissions, contrary to the earlier studies of carbon taxes implementation performed by Bohlin [11], Bruvoll and Larsen [12], as well as Lin and Li [13].

Different from the G7's development agenda, which still primarily focuses on aid–recipient relationships as "dynamically defined by the OECD through the Development Assistance Committee (DAC), the G20 may be better placed to facilitate the implementation of the SDGs" [14]. It may be complex to understand the link between the Paris Climate Treaty and the SDGs. While we agree that the SDGs as a whole have serious limitations in their implementation, the Paris Climate Treaty should be considered necessary to implement the SDG 13. Implementing the SDGs as a whole would perhaps allow a holistic framework in combating climate change, but for the immediate future, there can be no delay in implementing some form of international effort to combat climate change. This is further emphasized in the study of von Stechow et al. [15] in determining that there is an inescapable link between the Paris Climate Treaty and implementing the SDGs. These goals attempt to combat climate change, inequality, hunger, discrimination, conflict, and all other essential concerns of the modern world. These goals are described in detail in Le Blanc [16], who emphasizes that it is sometimes difficult to transform these 13 goals into exact policy proposals and that is why it is so significant that the Paris Climate Treaty – as a bare minimum of what could be achieved on climate change, should be implemented without delay and with the participation of all of the key global actors.

Donald and Way [17] point out: "Although the SDGs are not legally binding, in some contexts it may be possible to make claims within national judicial mechanisms to hold governments accountable for the 2030 Agenda commitments, particularly where commitments to goals and targets overlap with existing legal or constitutional guarantees", whilst Elder et al. [18] accentuate the real cost of SDGs' implementation, which is actually not too high: "About 2.5–3.8 percent of the world GDP, and 0.7–1.1 percent of global financial assets."

Figueres [19] points out that "even the basic approach to decreasing CO_2 and other greenhouse gas emissions, as required by the Paris Climate Treaty, would require a significant change." This is the reason why many have been sceptic of the SDGs and believe that these goals did not go far enough in ensuring the sustainability of our world.

Leismann et al. [20] emphasize the task that lies in front of Western societies, if they want to preserve the habitat, and "ensure basic access to resources for developing and emerging economies and for the future generations: Western industrial societies must reduce their absolute resource consumption by a factor of 10 by 2050" [20]. Germany, as the largest economy of the EU, must now become one of the leaders in the fight against excessive greenhouse gas emission. While the EU has limited hard power in order to implement such a goal, its soft power has never been as important as it is today. The soft and normative power of the EU, or “leading by example”, has now become one of the key elements in ensuring the sustainability of the global economy. Policy-makers of the world’s large powers are currently focused on numerous conflicts that prevent a stronger focus on sustainable development.

Moore [21], on the other hand points out: “China, the biggest emitter of greenhouse gases in the world, already agreed to cap its output by 2030 or earlier if possible. Previously, China had only ever pledged to reduce the rapid rate of growth in its emissions, but it has now also promised to increase its use of energy from zero-emission sources to 20 percent by 2030. The USA pledged to cut its emissions to 26-28 percent below 2005 levels by 2025.” Incremental transition from coal-dependent to low carbon economy has started everywhere – as Figueres [19] states: “Emissions from the USA decreased the most: by 3 percent last year, while the GDP grew by 1,6 percent. In China, CO2 emissions fell by 1 percent in 2016, and its economy expanded by 6,7 percent. In 2016, two-thirds of China’s 5,4 percent extra demand for electricity was supplied by carbon-free energy resources, mostly hydropower and wind”.

The environmental policy of the EU has progressed with time and positioning itself in such a manner may be vital to the long-term soft-power approach adopted by the EU. Therefore, the EU is “the only international actor that has been dedicated to sustainable development and has been continuously dedicated to such an effort in the past two decades” [22]. It is nevertheless interesting to take note of the fact that, despite the EU’s declarative international stance towards climate change, there have been long-standing inconsistencies in the domestic stance of its member-states [23]. Michaelowa’s concerns regarding the influence of interest groups remains significant to this day, but relevant steps have since been taken to ensure the further development of EU environmental policy [23].

The EU has certainly built on its original strategy to combat excessive greenhouse gas emissions that was originally built upon voluntary cuts by members of the corporate sector, subsidies for “producing electricity from renewable energy sources” and a proposal to implement a tax on energy products [24]. The EU has continuously built upon this original framework and has contributed to the first strategy with a second strategy launched in 2005, and it EU remains the most up-to-date relevant leader in dealing with the issues of climate change, acknowledging and covering topics such as carbon capture and geological storage [25]. It is for this reason that we conduct an empirical assessment of key traits that determine the EU’s emissions.

Altieri and Rojas [26] as well as Renfrew [27] point out: “It is visible that environmental costs are unequally distributed as the burdens of air and water pollution, degraded soils and defoliated lands to a large extent rest disproportionately on the poor”. Bakker [28] emphasizes that it is argued that “this will help preserve the environment because of the internalisation of externalities and private property rights by recognising environmental resources as economic goods”, while Goldman [29] states that this way of thinking has been known as “green neoliberalism”.

Han and Lee [30] conducted a generalized method of moments (GMM) analysis on a panel of 19 OECD countries that have ratified the Kyoto protocol. They have concluded “the effect of CO_2 emission on economic growth is declining at a statistically significant trend.”

Blanco et al. [31] conducted panel Granger causality tests on 18 Latin American countries and found empirical evidence of causality between FDI in pollution-intensive industries and CO_2 emission per capita.

Shaari et al. [32] made a Vector Error Correction Model (VECM) for Malaysia and emphasize that “increasing energy consumption in order to increase economic growth may also result in increased CO_2 emission”. The authors suggest that “a statistically significant relationship between CO_2 emission and several macroeconomic variables is present”.

Srinivasan [33] used several quantitative analysis methods, including a VECM, impulse response functions and cointegration tests on the available data for India and concluded that there is “a short-run relationship from CO_2 emission to economic growth.” He further concludes that there is also “a long-term relationship between GDP and energy consumption.”

Lutz and Meyer [34] suggest a positive effect could be expected from a rising environmental tax in Europe. This will be highly relevant in regards to the empirical framework of the article, which also examines the impact of ‘‘carbon taxing’’ on CO_2 emissions.

Martin et al. [5] analysed the Climate Change Levy (CCL) package - “the single most important climate change policy that the UK government has unilaterally imposed on the business sector so far (HM Government, 2006), which consists of “a carbon tax and a scheme of voluntary agreements available to plants in selected energy intensive industries.”

Muhyidin et al. [35] analysed the long-run relationship between environment degradation, economic growth, total energy consumption and industrial production index growth in Malaysia (1970 to 2012). The authors used Johansen and Julies Cointegration test and VECM Granger causality test to estimate time series data were. The empirical analysis suggested “a long-run cointegration relationship between all series, while the orientation towards renewable energy sources (higher investment to control CO_2 emission) should jeopardize economic growth”, the authors concluded.

In their study, Wagner et al. [36] conducted Ordinary Least Squares (OLS) regression, with the adequate number of lags, the coefficients, constant, and error term. The authors concluded that “a switch to renewable energy is needed as soon as possible.”

Obradović and Lojanica [37] analysed the “causal relations among economic growth, energy consumption and carbon-dioxide emissions in Greece and Bulgaria by multivariate analysis”. The authors took into consideration two more variables – gross fixed capital formation, and export as an indicator of trade openness (both countries are included into integration flows and represent open economies), and used the VECM model in order to determine long and short run causal relations among the variables.

Andersson [3] analysed the environmental efficiency of a specific measure, in reducing greenhouse gas emissions – carbon tax and a value-added tax (VAT) on transport fuels, by using the example of Sweden, one of the first countries in the world to implement a carbon tax in 1991. It was introduced at the level of US$30 per ton of CO_2 and then successively increased to today's rate of US$132, currently the highest carbon tax in the world [38]. The author uses the data for CO_2 emissions of the transport sector (as the biggest emitter) and empirically analyzes the reduction of CO_2 emissions using panel data and two separate identification strategies: a differences-in-differences (DiD) approach and the synthetic control method, giving however the advantage to the latter.

As can be seen from the conducted literature review, several papers find empirical evidence that a shift to renewable energy sources can endanger economic growth [35], while others [36, 37] emphasize the long-term economic drawbacks of dependency on renewable energy sources and the costs that are associated with such a dependency. Similar disagreements can be found in the afore-mentioned studies that discuss the effects of carbon tax introduction. However, it has to be emphasized that the short-term impact of switching to renewable energy sources may be negative, but it decreases the dependency on foreign sources of energy and stimulates economic growth in the long run.

DATA AND METHODOLOGY

The data used in analysis is covering a time span from 1995 to 2015, and was extracted from the Eurostat database in 2017. The data is aggregated at the level of the EU, because, as mentioned earlier – one of the primary goals of this article was to study the EU's climate policies mainly through reducing their emissions. This article prefers the methodology of individual time series analysis; hence the key reason is the understanding of the impact of various variables on the emission levels of the EU. All of the variables, with brief descriptions and the period for which they were available, are presented in Table 1.

Table 1. Variables considered. Source: the Eurostat database 2017.

Variable	Abbreviated	Measurement
Gross Domestic Product	GDP	Gross domestic product at market prices – Euros
Exports of goods and services	Export	Export of goods and services at current prices – Euros
Unemployment rate - annual average	Unemp	Percentage rate
Carbon Dioxide emission	CO_2	Carbon dioxide in tons
Implicit tax rate on energy	Tax	EUR per ton of oil equivalent
Gross inland consumption of coal	Coal	Gross inland consumption of coal in TJ
Energy dependency	EnergyDep	Percentage rate
Share of renewable energy in gross final energy consumption (as in ec.europa.eu)	ShareofRE	Percentage rate

Before performing any further analysis, we will conduct a stepwise regression to determine which variable has the highest significance for our dependent variable, CO_2 emissions. Log transformations will be used for several variables in order to avoid concerns regarding heteroscedasticity.

The next step in our empirical approach is conducting an Autoregressive Distributed Lags (ARDL) regression model, introduced in literature in Pesaran and Shin [39]. This approach can be used to estimate both the short-term dynamics, as well as the long-term coefficients for the independent variables. Upon determining which variables are most significant, we will use up to three variables in order to determine the impact on greenhouse gas emission. All of the variables considered can be seen in Table 1. The general equation that will be used for the ARDL model is as follows:

$$CO2_t = \alpha_0 + \sum_{i=1}^{p} \beta_i CO2_{t-i} + \sum_{j=0}^{q} \gamma_j X_{t-j} + \sum_{j=0}^{q} \delta_j Z_{t-j} + \sum_{j=0}^{q} \theta_j Q_{t-j} + \epsilon_t \quad (1)$$

where CO_2 is the dependent variable with the number of lags determined by the Akaike information criterion, and X, Z, and Q are the independent variables that will be determined through stepwise regression from the possible variables in Table 1. The tests were performed using the specified (p, q) optimum lag lengths determined by "proper model order selection criteria" [40]. A restricted constant and the error term are included in the equation. As the ARDL approach is only suitable if variables are "stationary or are stationary in their first difference", we used the stationarity test [41] to confirm that the model is properly specified. It is not relevant whether the variables are stationary or stationary in their first differences for the ARDL approach [39]. After ensuring that the models are adequate, the Bounds test [42] was used. If based upon the test results evidence of a long-term relationship is detected, the co-integrating equation and long-term coefficients would be analysed. The diagnostic tests employed are the Breusch and Pagan [43] heteroscedasticity test, the autocorrelation LM test [44, 45], as well as the stability of the parameters CUSUM test [46, 47].

RESULTS AND DISCUSSION

Based on the theoretical evidence present, it is clear that CO_2 emissions are determined by several key factors. Using an ARDL approach, we aim to assess the actual impact of these factors and provide policy recommendations based on these results. Currently, greenhouse gas emissions are strongly impacted by the largest economies of the world – the US and China. As was stated in the theoretical aspect of this article, China plans to become predominantly dependent on renewable energy sources in the near future. This is interesting in the context of Sadorsky's [48] analysis of the G7 countries that pointed out: "GDP per capita and CO_2 per capita are major drivers of increased per capita renewable energy consumption". This suggests that policy-makers of heavily polluted countries are aware of the issue and are moving towards more renewable energy sources. The problem is the link between economic growth and CO_2 emissions that is present in many developed economies. Such a link further serves many who believe that curbing CO_2 emissions swiftly may hamper economic growth and cause stronger unemployment [35]. The reality is that there is no true alternative to preventing the negative consequences of climate change by reducing the impact mankind has on the environment. As has also been noted by Wagner et al. [36], there is also a "cost to not switching to non-renewable energy sources." As the USA plans to opt out of the Paris Climate Treaty and China plans to take a step-by-step approach in curbing its CO_2 emission, it is increasingly relevant for the EU to maintain a strong role in preventing increased emission of greenhouse gases. The stepwise regression has provided that the variables that are most significant to CO_2 emissions are share of renewable energy in gross final energy consumption, the gross domestic product, and gross consumption of coal. Prior to conducting the empirical approach based on the ARDL analysis, unit root tests are used to assert that the variables are stationary in either their level or their first difference. The Augmented Dickey Fuller (ADF) test is used to determine these aspects.

Table 2. ADF stationarity test. Source: Authors' calculations and E-Views 9.5 output.

	LGDP	**LCOAL**	**LTAX**	**Renew**
In level	–3,176** (0,0369)	–0,8966 (0,7677)	–3,666** (0,0135)	0,8432 (0,9922)
In first difference	–5,337*** (0,0005)	–4,0673*** (0,0061)	–6,714*** (0,000)	–4,445*** (0,0028)

Note: values in the parentheses represent the *p*-value.
**statistically significant at 5 %
***statistically significant at 1%

Based on the results of the ADF test, it is possible to conclude that all the variables are stationary either in level or in their first difference. This allows us to estimate the ARDL model and view whether the variables have a statistically significant long-term relationship. The best fit model that minimized the Akaike information criterion, while also conforming to the stability criteria, was the model with one lag of the dependent variable and one lag of the independent variable (1, 1, 1, and 1). The details concerning the basic regression are included in Table 3.

The first results suggest that the specification of the model is adequate. The R-squared and adjusted R-squared display that the predictability value of the model is very high. This figure, taken into account with the F-statistic and the p-value of the F-statistic, ensures that the model is statistically significant at the 1 percent level. Most of the lags of both the dependent and the independent variables are not statistically significant. Several variables are statistically significant: GDP, renewable energy use, as well as taxation on energy. Interestingly, it would seem that the amount of coal consumed is not one of the key determinants of CO_2 emissions. It is possible to see evidence of a strong short-term impact of economic growth on the growth of

Table 3. ARDL model basic regression output. Source: authors' calculations and E-Views 9.5 output.

Variable	Coefficient	Standard error	t-statistic
LCO_2(-1)	0.079 (0.7306)	0.225	0.354
LGDP	0.448** (0.008)	0.136	3.298
LGDP(-1)	-0.053 (0.7053)	0.135	0.389
RENEW	-0.028** (0.009)	0.006	-4.634
RENEW(-1)	0.002 (0.8235)	0.0088	0.229
LCOAL	0.0389 (0.6229)	0.077	0.507
LCOAL(-1)	-0.004 (0.9581)	0.066	-0.054
LTAX	-0.395*** (0.0007)	0.081	-4.862
LTAX(-1)	0.234** (0.0014)	0.079	2.963
C	14.33** (0.0014)	3.287	4.359
R-squared	0.9921	Mean dependent variable	21.918
Adjusted R-squared	0.985	S.D. dependent variable	0.063
S.E. of regression	0.0077	Akaike information criterion	-6.591
Sum squared residuals	0.0006	Schwarz criterion	-6.092
Log likelihood	75.901	Hannan-Quinn criterion	-6.493
F-statistic	140.262	Durbin-Watson stat	1.792
Probab(F-statistic)	0.000		

Note: values in the parentheses represent the *p*-value.
**statistically significant at 5 %
***statistically significant at 1 %

greenhouse gas emission. Taxes and the use of renewable energy seem to have a negative impact on total CO_2 emissions. These findings will be taken into account when estimating the long-term coefficients if there is evidence that the variables have a statistically significant long-term relationship. This will be determined by the Bounds test [42], presented in Table 4, on the basis of which we found a long-term cointegration of the variables, even at the 1 percent level of statistical significance. This allows us to observe the impact of the long-term coefficients in Table 5.

Table 4. Bounds test for ARDL model. Source: authors' calculations and E-Views 9.5 output.

Bounds Test	***Null Hypothesis*: No levels relationship**			
Test statistic	Value	Significance, %	I(0)	I(1)
F-statistic	5,859	10	2,20	3,09
k	4	5	2,56	3,49
		2,5	2,88	3,87
		1	3,29	4,37

Table 5. Long-term coefficients and co-integrating equation. Source: authors' calculations and E-Views 9.5 output.

Variable	Coefficient	Standard error	t-statistic
LGDP	0.4289*** (0.0000)	0.047	9.033
RENEW	–0.028*** (0.0000)	0.0026	–10.844
LTAX	–0.175*** (0.0015)	0.0404	–4.322
LCOAL	0.0383 (0.5397)	0.0605	0.635
C	15.568*** (0.0000)	1.136	13.704

Note: values in the parentheses represent the *p*-value.
***statistically significant at 1 %

As can be seen in Table 5, all of the coefficients with the exception of coal consumption have long-term statistically significant impact. Prior to conducting a more detailed analysis, the stability of the model is confirmed with the CUSUM test that can be seen in Figure 1.

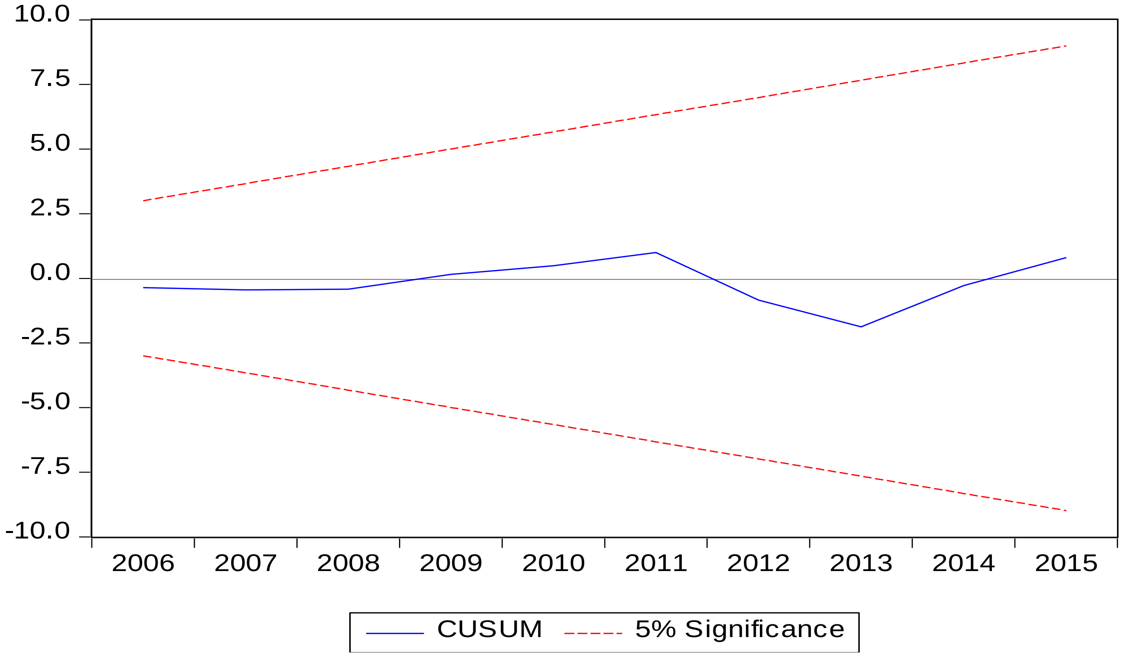

Figure 1. CUSUM test for ARDL model. Source: authors' calculations and E-Views 9.5 output.

Aside from the CUSUM test in Figure 1, Table 6 clearly presents that the ARDL model does not suffer from errors regarding heteroscedasticity, autocorrelation and that the distribution of the residuals is within acceptable parameters.

It is clear that the increase of GDP within the EU is still associated with the increased CO_2 emission. This can be explained through increased industrial investments in times of economic

Table 6. The key indicators of used ARDL model specification. Source: Authors' calculations and E-Views 9.5 output.

Indicator	Statistic value	P-value
Serial Correlation LM Test Statistic	1.973	0.2314
Breusch-Pagan-Godfrey F –statistic	0.5296	0.8234
Jarque-Bera	1.629	0.443

prosperity. It would seem that coal consumption does not significantly increase the amount of CO_2 emission within the EU, which is somewhat logical; hence the member-states of the EU are decreasing their dependency on coal on a yearly basis. Environmental taxes seem to have a stronger impact on decreasing the amount of CO_2 emission that investment in renewable energy sources, although both variables are statistically significant at the 1 percent level. Implementing similar environmental taxation and driving the revenue towards investing into renewable energies subsidies may be a significant way of how to effectively decrease the amount of the CO_2 emission. This conforms to the finding of Wagner et al. [36], and emphasizes the need to focus on more renewable energy sources. While coal is not a significant determinant of the increased CO_2 emission in the EU, the case may be completely different in some large emerging economies, such as China for example. However, the idea that leading by example is sufficient is not palpable in the complex geopolitical reality of the 21st century and the complex issues faced by China in implementing its new energy policy [49]. With numerous conflicts and competing interests, there needs to be a clear leader in combating excessive emission of greenhouse gases. The EU, although troubled by Brexit, migration and economic crises, and internal disputes amongst its member-states, remains the most dedicated international actor in combating climate change since 1980 [50].

CONCLUSION

The main goal of shift to low carbon economy is decoupling greenhouse gas emissions from GDP and other economic variables. The SDGs remain a key determinant in creating a more sustainable economic approach on a global level and significant progress has been made in their crafting in comparison to the MDGs. However, the Paris Climate Treaty and the SDGs lack a true leader that will implement the needed policy changes, as well as lead by the power of their example. Aside from these problems on a theoretical level, it is clear that many of the global economies are turning less to coal and more to renewable energy sources. This article finds that there is a connection between rising renewable energy use and decreasing levels of CO_2 emissions. The article finds that there is a constant connection between rising economic growth and CO_2 and while switching to renewable sources of energy may slightly decrease CO_2 emission, carbon taxing is a much more effective form of curbing CO_2 emissions.

The quantitative analysis implemented in this article, based on an ARDL approach, finds that the most effective way of reducing CO_2 emissions in the EU would be to continue the shift towards more dependency on renewable energy sources while maintaining current or slightly higher levels of taxation on energy consumption. This form of taxation remains crucial in preventing excessive levels of greenhouse gas emission and revenue should be directed towards subsidizing research and development of renewable energy sources. While we acknowledge the limitations of carbon taxation noted in Baranzini and Carattini [8], we believe that such a policy recommendation is crucial for the long-term sustainability of the planet. Based on these findings, this article finds that developed economies should implement carbon taxing in an effort to reduce CO_2 emissions. Most of the existing research, including that of Baranzini and Carattini [8], does not show that it significantly constrains economic growth, while this article demonstrates that it is highly effective in reducing CO_2 emissions. Ensuring that the Paris Climate Treaty is implemented is an absolute requirement for ensuring that the Goal 13 is implemented. The feasibility of implementing the remaining SDGs lies outside of the scope of this article, but the need to implement coordinated changes based on a coherent strategy should present a logical start to truly global cooperation on many relevant issues.

REMARKS

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