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THE IMPACT OF EXPORT DIVERSIFICATION ON CO_2 EMISSIONS: EVIDENCE FROM POLAND

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ABSTRACT

The study aims to analyze the impact of export diversification on CO_2 emissions over the period of 1990––2015 in Poland by ARDL bounds test approach. For the export diversification, three variables were used: export product diversification, export margin and import margin. A cointegration relationship was determined for all models in the study. Export product diversification and import margin long-run coefficients were found to be statistically significant and positive. This means that export diversification increases environmental degradation. GDP and economic complexity are additional factors that negatively impact the environment. In contrast, urbanization reduces CO_2 emissions. Based on the empirical results, this paper recommends innovative solutions and regulations for eco-friendly industrial manufacturing. European Union environmental policies should be strictly adopted by the member countries in order to reduce emissions.

Key words: export diversification, CO_2 emissions, ARDL bounds test, Poland

Jel codes: Q43, F14, O11

INTRODUCTION

The world is facing the problem of environmental degradation. With the growth of population, the impact of humans on the environment has expanded. Depending on the increase in production and consumption, there has been a rise in energy consumption and emissions. Climate change and global warming are problems the world faces today. After the 1970s, the usage of fossil energy stimulated an increase of emissions [Shahzad et al. 2020, Wang et al. 2020, Can et al. 2021]. One of the major factors of global warming is CO_2 emissions, of which an extensive amount has been released into the atmosphere by fossil energy consumption [Friedl and Getzner 2003]. In the modern age, countries are facing a new global challenge against environmental conditions [Mania 2019]. The International Panel Conference on Climate Change (IPCC) report pointed out that increases in emissions through human activities impact global warming [Stocker et al. 2013]. The emissions of all European Union countries are monitored within the scope of the EU Climate Monitoring Mechanism. For the EU, reducing energy consumption and waste is an increasingly important goal [Regulation No 525/2013].

The impact of trade on pollution can be explained by three effects theories: scale effect, composition effect and technique effect [Liu et al. 2019]. The relationship between income levels and pollution emissions can be explained by scale effect. Exports and imports increase with the rise in production, with higher production requiring higher energy consumption. Also,

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a linkage between the size of an economy and pollution can be explained by the scale effect. Developed countries adopt high level technologies compared to developing countries and transform manufacturing using less emissions [Can et al. 2021, Shahbaz et al. 2015]. The Technique effect explains the emission intensity transformation process. In many countries, the process of production development begins from the agricultural sector which later expands onto the industrial sector. Changes of production techniques of sectors and shares in GDP impact pollution emissions with product diversification and energy consumption. The composition effect measures the transformation of industrial composition [Can et al. 2021].

An increasing number of studies in the literature on trade openness and the environment have determined the potential relationships between trade and pollution [Cole 2004, Copeland and Taylor 2005, Shahbaz et al. 2015, Ertugrul et al. 2016, Aydin and Turan 2020]. The effect of trade on pollution is also studied by using export diversification variables [Liu et al. 2019, Bashir et al. 2020, Shahzad et al. 2020, Can et al. 2021]. The export diversification of an economy determines a country's ability to be competitive in the global market. Empirical studies illustrate that diversification helps to reduce economic volatility [Giri et al. 2019, Berthélemy and Chauvin 2000]. In the literature, the impact of export diversification on CO_2 emissions is examined through diversification of export products and the export market [Cadot 2013, Liu et al. 2019].

In 1990, Poland transformed its economic model to the market-led system. After 1990, Polish GDP per capita exploded and Poland became one of the fastest growing economies among European Union countries [Gorynia and Wolniak 2002]. According to World Bank Data, Poland's CO_2 emissions during the 1990–2015 study period were above the European Union average, except for the 2000–2006 period. Considering data on average CO_2 emissions for the period 1990–2015, Poland was the ninth largest emitter of carbon dioxide in the European Union, after Estonia, the Czech Republic, Finland, Belgium, Germany, the Netherlands, Denmark, and Ireland. With the growth rates it has achieved in recent years, Poland will play an important role in Europe's policies to reduce emissions. Considering the above-discussed situation, this research aims to analyze the impact of export diversification on CO_2 emissions in Poland, which is a rising economy of the European Union.

LITERATURE REVIEW

In previous research, the relationship between international trade and carbon emissions has been examined using different variables. One of these variables is trade openness. Between 1971–2011 Ertugrul et al. [2016] used ARDL bounds test and Granger causality techniques to examine the relationship between CO_2 and trade openness in 10 developing countries with the highest rate of carbon dioxide emission. Trade openness has been found to be one of the main determinants of carbon emissions. From 1996 to 2016, Aydin and Turan [2020] examined the impact of trade openness on the ecological footprint in BRIC countries using panel data methods.

The econometric test results showed that trade openness has had a negative impact on environmental conditions in South Africa but a positive impact in China and India. In Brazil over the period of 1975––2016, Hdom and Fuinhas [2020] investigated the impact of trade openness on CO_2 emissions with the help of cointegration methods. Their study demonstrates the increase of trade openness on CO_2 emissions. Dauda et al. [2021] examined the trade openness and various variable impacts on CO_2 emissions in nine African countries for the period of 1999–2016 using panel data methods. According to the empirical results of the study, trade openness decreased CO_2 emissions in Kenya and Algeria. On the other hand, it had a negative impact on carbon dioxide release in Mozambique and South Africa. Over the period 1980–2019 in India, Shahbaz, Sharma, Sinha, and Jiao [2021] analyzed the impact of trade openness on CO_2 emissions with the help of NARDL bounds test. According to the long-run coefficients estimation, trade openness had a direct impact on carbon dioxide release. The positive fluctuations in the volume of trade openness decreased CO_2 emissions in India. In contrast, the negative fluctuations in the volume of trade openness increased CO_2 emissions.

In other studies, few scholars test the impact of export diversification on environmental conditions.

Between 2000–2014, Liu et al. [2019] investigated the relation between international trade and carbon emissions in 125 countries using the regression analyses. It was discovered that the trade diversification, presented by export market diversification and export product diversification, helps CO_2 emissions reduction. Liu, Kim, Liang, and Kwon [2018] examined the impact of export market diversification and export product diversification on environmental conditions. In their research, the ecological footprint was used as a proxy variable for environmental degradation. The Johansen cointegration test was also used to investigate the impact of export diversification on environmental conditions for the period of 1990–2013 in three East Asian countries (South Korea, Japan and China). The results of the study showed that in South Korea and Japan, EKC hypothesis is valid. However, in China, diversification of export increases the ecological footprint.

Mania [2019] analyzed the effect of export diversification on CO_2 emissions for developing and developed countries for the period 1995–2013 using panel data methods. Export diversification turned out to have a positive impact on CO_2 emissions. Shahzad et al. [2020] investigated the impact of export product diversification, extensive margin, and intensive margins on the CO_2 emissions for developing and developed countries for the period 1971–2014, using the panel data method. This study demonstrates that product diversification, extensive margin, and intensive margins stimulate the reduction of carbon levels.

Bashir et al. [2020] examined the impact of export diversification on energy and carbon intensity for the 29 OECD countries between 1990 and 2015 with the help of Pedroni cointegration and panel regression approaches. The authors discovered that export diversification, extensive margin and intensive margins have negative impacts on energy and carbon intensity.

Wang et al. [2020] analyzed the impact of export diversification on carbon emissions for the period of 1990–2017 in G-7 countries using panel data approaches. According to the CS-ARDL results, export diversification increased carbon emissions. Sharma, Sinha, and Kautish [2021] examined the impact of export diversification on carbon dioxide emissions in the BRICS nations for the period of 1990–2018 with the help of second-generation econometric approaches (CS-ARDL). In the study, the relationship between export diversification and carbon emissions was determined. The research also demonstrates the deficiency of export diversification, leading to the growth of carbon emissions in the BRIC nations.

Can et al. [2021] analyzed the impact of trade on energy use and the environment in ten newly industrialized countries using panel data methods between 1970–2014. The study reveals the impact of export products on the increase of the CO_2 emissions. Panel causality test results demonstrated the causality between export diversification and CO_2 emissions, as well as between intensive margin and CO_2 emissions. Some studies, such as Apergis, Can, Gozgor and Lau [2018], used export product concentration as a dependent variable. In their study, the authors examined the impact of export product concentration on environmental conditions in 19 developed countries between 1962–2010. The results of the study showed that export product concentration leads to environmental degradation.

MODEL AND DATA

Dietz and Rosa [1997] developed the IPAT model to analyze the effects of population, affluence and technology on CO_2 emissions. Can et al. [2021] extended the IPAT model by adding export diversification, export margin and import margin. The models used in the study are as below:

Model-1:

$$lnCO_{2_t} = \beta_0 + \beta_1 lnEDI_t + \beta_2 lnGDP_t + \beta_3 lnEL_t + \\ + \beta_4 lnURB_t + \varepsilon_t$$

Model-2:

$$lnCO_{2_t} = \beta_0 + \beta_1 lnEM_t + \beta_2 lnGDP_t + \beta_3 lnEL_t + \\ + \beta_4 lnURB_t + \varepsilon_t$$

Model-3:

$$lnCO_{2_t} = \beta_0 + \beta_1 lnIM_t + \beta_2 lnGDP_t + \beta_3 lnEL_t + \\ + \beta_4 lnURB_t + \varepsilon_t$$

Here, CO_2, *EDI*, *EM*, *IM*, *GDP*, *EL* and *URB* refer to carbon dioxide emission, export product diversification, export margin, import margin, gross domestic product, economic complexity and urbanization variables respectively, with the reference to the period of 1990–2015 in Poland. In all models, CO_2 emissions are used as a dependent variable and the data is obtained from the World Bank [WorldBank 2020]. *GDP* and *URB* variables are the other variables which are obtained from the World Bank [WorldBank 2020].

In our models, we used three different export diversification variables, such as *EDI*, *IM* and *EM*, with the export diversification data being obtained from the International Monetary Fund [IMF 2021]. We transformed the Theil indices using the method of Can et al. [2021]; Dennis and Shepherd [2011]; Gozgor and Can [2017]. The technological level variable refers to economic complexity data, and is obtained from the Observatory of Economic Complexity database [OEC 2021].

ECONOMETRIC METHODOLOGY

In order to investigate the long run relationship between CO_2 emissions, export diversification, urbanization, gross domestic product per capita and economic complexity, we apply the ARDL bounds test to cointegration developed by Pesaran, Shin, and Smith [2001]. In the models which have a small sample size, ARDL bounds test results are consistent and efficient. Additionally, it allows to investigate cointegration relationships among variables and stationarity at various levels.

The version of the unlimited error correction model modified to our study is presented below.

$$\Delta \mathrm{CO2}_t = \alpha_0 + \rho \mathrm{CO2}_{t-1} + \theta_1 EDI_{t-1} + \theta_2 GDP_{t-1} +$$

$$+ \theta_3 URB_{t-1} + \theta_4 EL_{t-1} + \sum_{i=1} \beta_1 \mathrm{CO2}_{t-1} + \sum_{i=1}^{q} \beta_2 EDI_{t-1} +$$

$$+ \sum_{i=1}^{q} \beta_3 GDP_{t-1} + \sum_{i=1}^{q} \beta_4 URB_{t-1} + \sum_{i=1}^{q} \beta_5 EL_{t-1} + \varepsilon_t$$

Optimal lag of the ARDL model that was used in our study was chosen according to the Schwarz information criterion. The null hypothesis formed for the existence of a cointegration relation can be expressed as: H0: $\delta 1 = \delta 2 = \delta 3 = \delta 4 = \delta 5 = 0$ and is tested against the alternative hypothesis H1: $\delta 1 \neq \delta 2 \neq \delta 3 \neq \delta 4 \neq \delta 5 \neq 0$. The computed F-statistic values are compared with the upper critical bound and lower critical bound at the table in Pesaran et al. [2001]. If the calculated F-statistic value is greater than upper critical bound in the table, a cointegration relationship exists among variables. If the calculated F-statistic value is lower than lower critical value, then there is no long-run relationship among variables. The next step is the determination of the ARDL model by the Schwarz criteria. After the determination of the cointegration relationship among variables, long-run coefficients of the variables are estimated by the ARDL model. Robustness of the ARDL models is checked using diagnostic and stability tests, which are presented in Table 1 and Figure 1.

Table 1. Diagnostic tests

Diagnostic Test	Statistics		
	Model-1	Model-2	Model-3
A: Serial Correlation	0.23	0.09	0.24
B: Functional Form	0.18	0.72	0.15
C: Normality	0.66	0.41	0.90
D: Heteroscedasticity	0.17	0.52	0.48

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

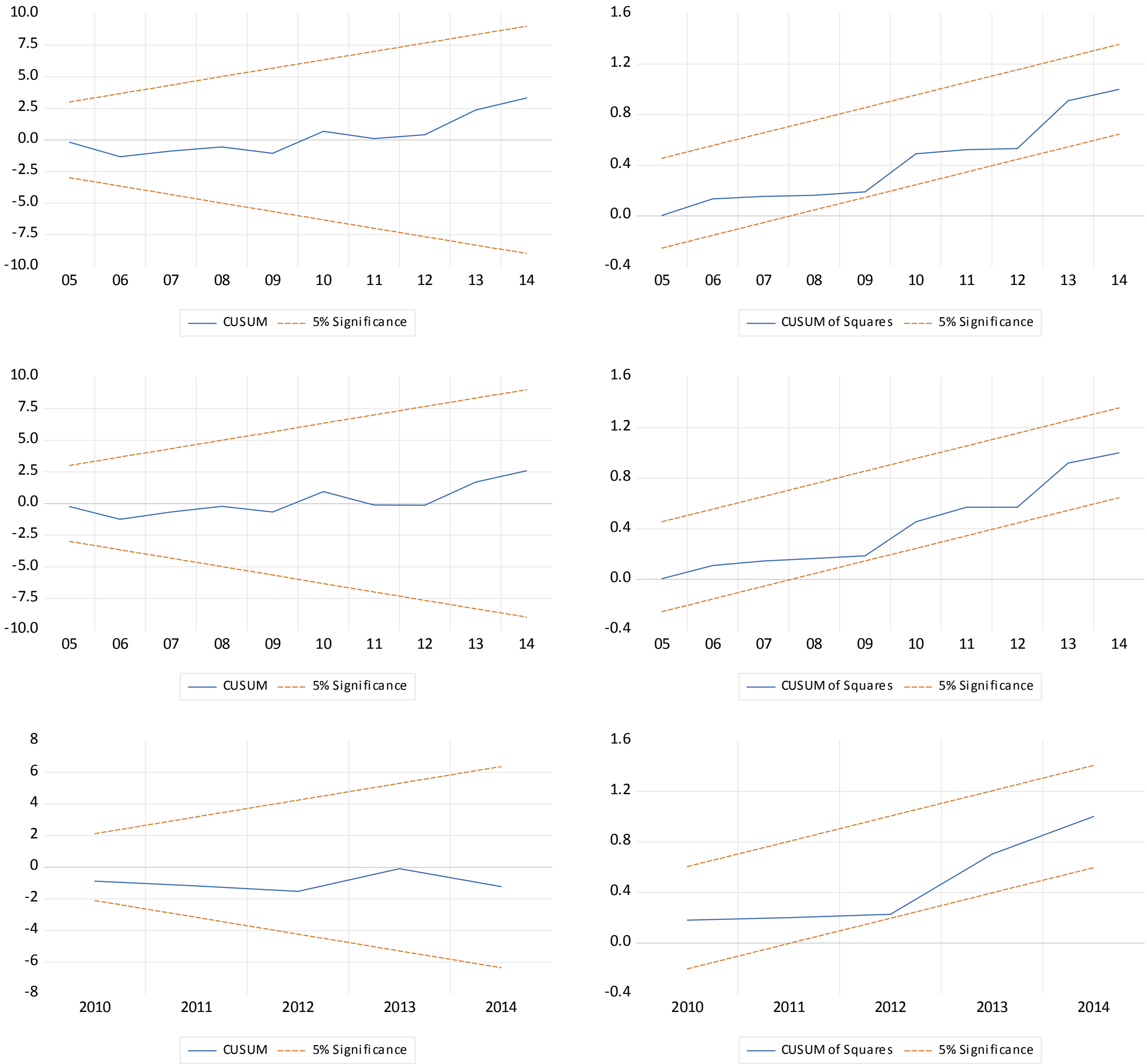

Fig. 1. Cusum and Cusumsq figures

Source: Author's own estimation.

EMPIRICAL RESULTS

Unit Root test

In the study, ADF and PP unit root tests are applied to analyze the stationarity of variables. The stationarity analysis shows that variables are stationary at various levels, but none of them are stationary at the second level. Results from Unit Root tests are presented in Table 2.

ARDL Bounds Tests Results

After the unit root tests, long-term relationships between variables were analyzed using ARDL bounds tests. The stationarity level of variables should not be level 2 for either of these tests. Results from ARDL bounds tests are given in Table 3.

Table 2. Unit root tests results

PP								
At Level								
		LNCO_2	*LNEDI*	*LNEL*	*LNEM*	*LNGDP*	*LNIM*	*LNURB*
With Constant	t-Statistic	–1.128	–3.191	–1.267	–1.761	0.170	–2.587	1.049
	Prob.	0.687	0.033	0.627	0.390	0.965	0.109	0.996
		no	**	no	no	no	no	no
With Constant and Trend	t-Statistic	–1.808	–3.240	–1.330	–1.700	–3.733	-2.639	-0.359
	Prob.	0.669	0.101	0.855	0.720	0.039	0.268	0.983
		No	No	No	No	**	No	No
At First Difference								
		Δ*LN*CO_2	Δ*LNEDI*	Δ*LNEL*	Δ*LNEM*	Δ*LNGDP*	Δ*LNIM*	Δ*LNURB*
With Constant	t-Statistic	–3.926	–7.538	–3.112	–5.195	–6.594	–5.740	–0.736
	Prob.	0.007	0.000	0.040	0.000	0.000	0.000	0.818
		***	***	**	***	***	***	No
With Constant and Trend	t-Statistic	–3.835	–7.322	–3.127	–5.094	–6.977	–5.608	–2.041
	Prob.	0.033	0.000	0.124	0.002	0.000	0.001	0.549
		**	***	No	***	***	***	No
ADF								
At Level								
		LNCO_2	*LNEDI*	*LNEL*	*LNEM*	*LNGDP*	*LNIM*	*LNURB*
With Constant	t-Statistic	–1.128	–3.194	–1.141	–1.761	0.254	–2.560	–0.977
	Prob.	0.687	0.033	0.682	0.390	0.970	0.115	0.744
		no	**	no	no	no	no	no
With Constant and Trend	t-Statistic	–1.670	–3.230	–0.916	–1.700	–1.949	–2.455	–1.570
	Prob.	0.733	0.102	0.938	0.720	0.597	0.345	0.773
		no	no	no	no	no	no	no
At First Difference								
		Δ*LN*CO_2	Δ*LNEDI*	Δ*LNEL*	Δ*LNEM*	Δ*LNGDP*	Δ*LNIM*	Δ*LNURB*
With Constant	t-Statistic	–3.926	–6.760	–3.230	–5.196	–6.594	–5.610	–0.736
	Prob.	0.007	0.000	0.031	0.000	0.000	0.000	0.818
		***	***	**	***	***	***	No
With Constant and Trend	t-Statistic	–3.826	–6.572	–5.378	–5.080	–6.701	–5.469	–1.921
	Prob.	0.034	0.000	0.001	0.002	0.000	0.001	0.611
		**	***	***	***	***	***	no

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

Source: Author's own estimation.

Table 3. ARDL Bounds Tests Results

Model	F statistic	Selected Model	Significance Level (%)	I(0)	I(I)	Cusum	Cusumsq	Conclusion
			10	3.430	4.624	stable	stable	
Model-1	9.235	ARDL (4, 0, 0, 1, 0)	5	4.154	5.540	stable	stable	cointegration
			1	5.856	7.578	stable	stable	
			10	3.430	4.624	stable	stable	
Model-2	10.974	ARDL (4, 2, 1, 1, 2)	5	4.154	5.540	stable	stable	cointegration
			1	5.856	7.578	stable	stable	
			10	3.430	4.624	stable	stable	
Model-3	12.252	ARDL (4, 0, 0, 1, 0)	5	4.154	5.540	stable	stable	cointegration
			1	5.856	7.578	stable	stable	

Source: Author's own estimation.

In Table 3, the Model-1 F-statistic value was found to be 9.235, the Model-2 F-statistic value was found to be 10.974, the Model-3 F-statistic value was found to be 12.252. These F-statistics values are greater than the upper limit of 7.578 at 1% significance level. According to the results of ARDL bounds tests, the calculated F-statistics values were found to be greater than I(I) and the null hypotheses were rejected. Thus, it was determined that there is a cointegration relationship among the variables for all models.

Long-run Analysis

In Table 4, the long-term coefficients are presented, which were calculated based on the estimations of ARDL models.

According to the long-run coefficients results in Table 4, it was concluded that export product diversification variable and import margin variable coefficients in Model-1, and in Model-3 were significant and positive. This means that increases in export product diversification and import margin increase CO_2 emissions. A 1% increase in both export product diversification and import margin causes an increase of 0.194% and 0.190% in the CO_2 emissions, respectively. The study demonstrates that if EL expands by 1%, CO_2 emissions will increase by 0.104, 0.243 and 0.124% for the Model-1, Model-2 and Model-3, respectively. According to the results for urbanization, it is obvious that if urbanization rises by 1%, CO_2 emission will decrease approximately 12% for all models. A 1% increase in GDP causes the rise by approximately 0.485% for Model-1, 0.068% for Model-2 and for Model-3 0.464% of CO_2 emissions.

Table 4. Long-term Estimation Results of ARDL

Model-1				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEDI	0.194**	0.078	2.508	0.031
LNGDP	0.485***	0.151	3.204	0.009
LNEL	0.104*	0.055	1.892	0.088
LNURB	–11.803***	1.007	–11.715	0.000
Model-2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEM	0.063	0.124	0.510	0.632
LNGDP	0.068	0.235	0.291	0.783
LNEL	0.243*	0.094	2.561	0.051
LNURB	–12.194**	3.763	–3.240	0.023
Model-3				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIM	0.190***	0.051	3.714	0.004
LNGDP	0.464***	0.124	3.747	0.004
LNEL	0.124**	0.045	2.753	0.020
LNURB	–12.827***	0.849	–15.100	0.000

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

Source: Author's own estimation.

Short-run Analysis

In Table 5, short-term relationship estimations are presented using the ARDL method based on the error correction model.

Table 5. Results of Error Correction Model based on ARDL

Model-1				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	162.091	20.161	8.040	0.000
@TREND	–0.113	0.014	–8.024	0.000
D(*LN*CO_2(-1))	1.304	0.189	6.892	0.000
D(*LN*CO_2(-2))	0.739	0.155	4.774	0.001
D(*LN*CO_2(-3))	0.582	0.141	4.114	0.002
D(*LNEL*)	0.085	0.076	1.111	0.292
CointEq(-1)***	–2.821	0.351	–8.040	0.000
Model-2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	159.677	16.057	9.944	0.000
@TREND	–0.063	0.006	–11.258	0.000
D(*LN*CO_2(-1))	0.584	0.125	4.687	0.005
D(*LN*CO_2(-2))	0.799	0.139	5.728	0.002
D(*LN*CO_2(-3))	0.564	0.125	4.534	0.006
D(*LNEM*)	–0.192	0.042	–4.526	0.006
D(*LNEM*(-1))	–0.319	0.069	–4.601	0.006
D(*LNGDP*)	1.698	0.324	5.237	0.003
D(*LNEL*)	0.321	0.069	4.657	0.006
D(*LNURB*)	–22.683	5.745	–3.948	0.011
D(*LNURB*(-1))	–9.983	7.253	–1.376	0.227
CointEq(-1)***	–2.556	0.257	–9.939	0.000
Model-3				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	190.359	20.555	9.261	0.000
@TREND	–0.125	0.013	–9.245	0.000
D(*LN*CO_2(-1))	1.376	0.172	8.011	0.000
D(*LN*CO_2(-2))	0.735	0.136	5.410	0.000
D(*LN*CO_2(-3))	0.631	0.128	4.944	0.001
D(*LNEL*)	0.135	0.069	1.961	0.078
CointEq(-1)***	–3.078	0.332	-9.261	0.000

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

Source: Author's own estimation.

The error correction terms of all models which are presented in Table 5 are statistically significant and negative signs. The estimated coefficients of ECT indicate that changes in CO_2 emissions are corrected by nearly 35, 39 and 32% for Model-1, Model-2 and Model-3, respectively.

CONCLUSION

The study tested the effect of export product diversification, extensive margin, and intensive margin on CO_2 emissions in Poland. The relationship between the export diversification and CO_2 emissions was examined with the help of annual data for the period of 1990–2015. In the study, the stationary level of variables was examined using ADF and PP tests. According to the unit root tests results, the ARDL bounds test is chosen for the long-run analysis among variables. In all models of the study, the cointegration relationship among variables using ARDL bounds test approaches was determined.

After Poland's accession to the European Union, the growth performance of the Polish economy increased. The Polish economy is among the emerging economies of the European Union. Poland's economic growth performance adversely affects Poland's environmental conditions due to its carbon emissions. The Polish government should implement the EU policies which, according to the Regulation on the Governance of the Energy Union, clearly focus on decreasing CO_2 emissions. Previous studies have shown that humans are a major factor responsible for environmental degradation. The human impact on environmental degradation can be corrected by education. Eco-friendly entrepreneurship should be encouraged by the government. The solution to many problems of this century is education. Eco-friendly citizens will have a higher level of awareness regarding environmental issues. Raising eco-friendly citizens can save the future of the world through education.

The empirical findings have indicated that export product diversification, import margin, income, urbanization, and economic complexity have an impact on CO_2 emissions. Furthermore, the results of the study are parallel with the studies of Wang et al. [2020] and Maria [2019], which found that export diversification increases CO_2 emissions. This means that the findings of the study support previous environmental economics research which found a negative impact of export diversification on environmental conditions. In conclusion, policymakers need to consider export diversification within economic growth plans that are based on exporting, in order to reduce its impact on the environment.

Future studies should consider the fact that this study has some limitations. First of all, the study focuses mainly on the economy of Poland. Thus, the results of the study cannot be generalized. Secondly, CO_2 emissions were used as the environment variable. Thus, results can show only the impact of export diversification on CO_2 emissions. Future studies can use other dependent variables instead of CO_2 emissions. Finally, the impact of trade on the environment is analysed using export diversification variables. Future studies should consider other independent variables instead of diversification indices, such us export quality.

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WPŁYW DYWERSYFIKACJI EKSPORTU NA EMISJĘ CO_2: DANE Z POLSKI

STRESZCZENIE

Celem opracowania jest charakterystyka wpływu dywersyfikacji eksportu na emisję CO_2 w latach 1990–2015 w Polsce przy zastosowaniu modelu ARDL. Do dywersyfikacji eksportu wykorzystano trzy zmienne: dywersyfikację produktów eksportowych, marżę eksportową i marżę importową. Dla wszystkich modeli w badaniu określono zależność kointegracji. Stwierdzono, że długookresowe współczynniki dywersyfikacji produktów eksportowych i marży importowej są statystycznie istotne i dodatnie. Oznacza to, że dywersyfikacja eksportu zwiększa degradację środowiska. Złożoność gospodarcza i PKB to dodatkowe czynniki, które negatywnie wpływają na środowisko, a urbanizacja zmniejsza emisję CO_2. Na podstawie wyników empirycznych w niniejszym opracowaniu rekomendowane są innowacyjne rozwiązania i przepisy dotyczące ekologicznej produkcji przemysłowej. Polityka środowiskowa Unii Europejskiej powinna być ściśle przyjęta przez kraje członkowskie w celu ograniczenia emisji.

Słowa kluczowe: dywersyfikacja eksportu, emisje CO_2, model ARDL, Polska