Investigation on the role of economic, social and political globalization on environment: Evidence from CEECs

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ABSTRACT

This study aims to investigate the impact of different dimensions of globalization (i.e. overall globalization index, economic globalization index, social globalization index and political globalization index) on environmental pollution by incorporating the real gross domestic product and energy consumption in Central and Eastern European Countries (CEECs). In doing so, the annual period from 1995 to 2015 is examined with second generation panel data methodologies to consider the possible cross-sectional dependence among observed countries. The findings show that increasing overall globalization, economic globalization and social globalization increases the carbon emissions while increasing political globalization reduces the environmental pollution. In addition, it is also found that Environmental Kuznets Curve (EKC) hypothesis is confirmed.

Keywords: Globalization, Carbon emissions, EKC hypothesis, CEECs

1. Introduction

Over the past decades, the excessive increase in environmental pollution has been seen as a result of production activities due to increased energy consumption and hence economic growth. Therefore, many countries have begun to explore alternative ways to reduce environmental pollution without harming their economic structures. Despite increasing the consumption of renewable energy is the most prominent option in this direction, the level of environmental pollution on a global scale has not been reduced to the desired levels. Based on this reason, investigating the determinants of carbon emissions is important both for selection the focus policies for the sustainable development targets and for measuring the success of the implemented policies.

In the studies investigating the factors affecting carbon emission, it seems that the effects of trade liberalization (Al-Mulali, 2012; Farhani et al. 2014; Ozturk and Acaravci, 2016; Bento and Moutinho, 2016; Ali et al. 2017), foreign direct investment (Mutafoglu, 2012; Tang, 2014; Shahbaz et al. 2015a; Solarin and Al-Mulali, 2018), financial development (Tamazian and Rao, 2008; Tamazian et al. 2009; Jalil and Feridun, 2011; Shahbaz et al. 2013; Paramati et al. 2017), tourism arrivals (De Vita et al. 2015; Dogan et al. 2017; Azam et al. 2018; Bella, 2018), tourism receipts (Paramati et al. 2016; Zaman et al. 2016), internet usage (Salahuddin et al. 2016; Ozcan and Apergis, 2018; Park et al. 2018), information and communication technology (Amri, 2018), international migration (Muradian, 2006; Squalli, 2009; Price and Feldmeyer, 2011) and international agreements such as Kyoto protocol and Paris Climate Agreement (Aichele and Felbermayr, 2015; Grunewald and Martinez-Zarzoso, 2015; Mert and Boluk, 2016) are examined. However, instead of investigating the effects of these factors separately, all these factors can be grouped under the heading of “globalization”. Namely, due to the fact that the concept of globalization is a multidimensional concept, factors such as trade liberalization, capital flows, and financialization process are confirmed as sub-indicators of economic globalization, while the tourism, internet usage and international migration are sub-factors of social globalization. Similarly, international agreements aimed at increasing environmental quality can be evaluated under the heading of political globalization. Based on these reasons, it is important to evaluate the effects of globalization with all dimensions on the environment.

Based on above discussions, this study aims to investigate the impact of different dimensions of globalization (i.e. economic, social and political globalization) on carbon emissions in Central and Eastern European Countries (CEECs) for the period from 1995 to 2015. The reason for the election of this country group is that the effects of globalization on the environment may be determined more accurately for the observed period in these countries which started the globalization process with the end of the Cold War and started to feel the effects of globalization later than the rest of the world. Besides the effects of globalization, it is also aimed to examine the effects of economic growth and energy consumption on environmental pollution in mentioned countries

The possible contributions of this study to the existing literature by threefold: i) this is the first study to investigate the effect of different dimensions of globalization on environment in Central and Eastern European Countries. ii) the impact of economic growth and energy consumption on environment is also examined thus the validity of Environmental Kuznets Curve (EKC) hypothesis is also evaluated. iii) this study employs the second-generation panel data methodologies to take into account the cross-sectional dependence among observed countries.

The rest of paper is organised as following: second section reviews the existing literature. Third section gives information about methodological framework and data collection. Fourth section reports empirical results and their discussion. Finally, conclusion and policy implications are drawn in fifth section.

2. Literature review

In recent years, studies on the environmental impact of many variables that can be considered as indicators of globalization have increased while there are few studies that take into account the effects of globalization indices on the environment. Based on this reason, we categorized the literature part to two section. In the first section, we summarize the literature on the nexus between indicators of globalization and environmental pollution. In second part, we review the studies that utilized with globalization index to observe the impact of globalization on environment.

The studies that examined the impact of some globalization indicators on carbon emissions are summarized in Table 1. As a seen from table, in case of economic globalization, carbon emission increasing effect of trade openness is found by Al-Mulali (2012) for 12 Middle East countries, Al-Mulali and Ting (2014) for 189 countries, Ali et al. (2017) for Malaysia, Bento and Moutinho (2016) for Italy, Farhani et al. (2014) for Tunisia, Kasman and Duman (2015) for European Union countries and Amri (2018) for Tunisia. However, Ohlan (2015) concluded that trade openness has no statistically significant effect on carbon emissions for India. In case of foreign direct investment (FDI, hereafter) which is the other economic globalization indicator, carbon emission reducing effect of FDI is confirmed by Bakirtas and Cetin (2017) for MIKTA countries, Li et al. (2015) for China and Shahbaz et al. (2015) for 99 countries. On the other hand, Behera and Dash (2017), Sapkota and Bastola (2017), Solarin et al. (2017) and Sun et al. (2017) argued that increasing FDI increases carbon emissions. Furthermore, Ali et al. (2017) and Park et al. (2018) found that financial development reduces carbon emissions while environmental pollution increasing effect of financial development is argued by Amri (2018).

In case of social globalization indicators, it can be seen from Table 1, there are also conflicting results. For instance, Ozcan and Apergis (2018) found that increasing internet usage reduces carbon emissions while Salahuddin et al. (2016) concluded that internet usage is harmful for environmental quality. Similar to the internet usage, environmental pollution increasing impact of information and communication technology is also confirmed by Park et al. (2018). Moreover, carbon emission increasing effect of tourism receipts or tourist arrivals is found by De Vita et al. (2015) for Turkey. Unlike this study, the evidence that increasing tourism reduces carbon emissions is concluded by Dogan et al. (2017) for OECD countries, Azam et al. (2018) for Malaysia, Singapore and Thailand. The positive impact of tourism on environmental quality is also confirmed by Dogan and Aslan (2017) and Katircioglu et al. (2018).

In case of political globalization, it seems some studies utilized with Kyoto protocol as a dummy variable to observe the political agreements on the environment. Grunewald and Martinez-Zarzoso (2015) found the carbon emissions reducing effect of Kyoto protocol for 170 countries. Similar to this study, Bozkurt and Okumus (2017) also supported the view that Kyoto protocol reduces carbon emissions for 33 countries.

[INSERT TABLE 1 HERE]

Unlike above studies, there are also some studies to directly use the globalization index to observe the impact globalization on environmental pollution. In second section of the literature, we review the previous studies which investigate the relationship between globalization index and carbon emissions. Shahbaz et al. (2013) explored the impact of real income, energy consumption and overall globalization index on carbon emissions using with ARDL bound test for the period from 1970 to 2010 in Turkey and the findings show that increasing globalization reduces carbon emissions. Leitao (2014) investigated the relationship between carbon emission, real income, energy consumption, renewable energy consumption and globalization for the period from 1970 to 2010 in Portugal using with VECM Granger causality method and concluded that globalization does not cause carbon emissions. Destek and Ozsoy (2015) probed the relationship between real GDP, energy consumption, urbanization, economic globalization and carbon emissions for the period from 1970 to 2010 in Turkey utilizing with ARDL bound test and asymmetric causality approach. The results of this study imply that economic globalization reduces carbon emissions. Shahbaz et al. (2016) searched the impact of real GDP, energy intensity and globalization on carbon emissions using with ARDL bound test for the period of 1971-2012 in 19 African countries and concluded that globalization reduces carbon emissions in Angola, Cameroon, Congo Republic, Kenya, Libya, Tunisia and Zambia while it increases the pollution in Ghana, Morocco, South Africa, Sudan and Tanzania. Shahbaz et al. (2017a) examined the nexus between globalization and carbon emissions for the period of 1970-2014 in 25 developed countries using with Common Correlated Effect-Mean Group (CCE-MG) estimator and found the evidence that globalization increases carbon emissions. Shahbaz et al. (2017b) explored the relationship between real income, energy consumption, globalization and carbon emissions for the period from 1970 to 2014 in Japan. The non-linear ARDL test results indicate that globalization increases environmental pollution.

Furthermore, similar to this study, some studies explored the effect of different dimensions of globalization on environmental pollution. For instance, Shahbaz et al. (2015b) examined the impact of overall globalization and economic, social and political globalization indices on carbon emissions by incorporating the energy consumption and real income using with ARDL bound test for the period from 1970 to 2012 in India. The results of this study show that economic globalization reduces carbon emissions while overall globalization, social globalization and political globalization increases the environmental pollution. Shahbaz et al. (2017c) investigated the impact of overall globalization index, economic, social and political globalization on carbon emissions for the period of 1970-2012 in China by ARDL bound test procedure. The findings of this study show that increasing in all globalization indices improves the environmental quality. Xu et al. (2018) examined the impact of overall, economic, social and political globalization indices on carbon emissions for the period from 1971 to 2016 in Saudi Arabia using with ARDL bound test and concluded that economic globalization contributes the carbon emissions while overall, social and political globalization have no statistically significant effect on carbon emissions.

To sum up, as a seen from previous studies, the effects of globalization on the environment have been examined either through a single indicator of globalization (trade openness, foreign direct investment etc.) or through globalization indices for one country. In addition, the studies which use the panel data methodology employs the first-generation panel methods that ignore the cross-sectional dependence among observed countries. To overcome these shortcomings in the literature, this study employs the second-generation panel data methods to investigate the impact of globalization with different dimensions on environment in selected Central and Eastern European Countries.

3. Empirical strategy

3.1. Model and data

This study explores the impact of different dimensions of globalization (economic, social and political globalization) on environmental pollution by incorporating real income and energy consumption. In doing so, following the studies of Shahbaz et al. (2017c) and Xu et al. (2018), the carbon emission is described as function of real GDP, energy consumption and globalization indices as follows:

$$lnCO_{it} = a_0 + a_1 lnGDP_{it} + a_2 lnEC_{it} + a_3 lnGLB_{it} + \varepsilon_t \quad (1)$$

where i, t and ε_t indicates cross-section, time period and residual term, respectively. In addition, lnCO is the log of carbon dioxide emissions and used as a proxy for environmental pollution, lnGDP is log of real GDP and indicates the economic growth, lnEC is the log of energy consumption as a proxy for energy usage, lnGLB is the log of globalization and this variable includes four dimensions as overall globalization index (GLO), economic globalization index (EG), social globalization (SG) and political globalization index (PG). The descriptive statistics and measurements units are presented in Table 2.

[INSERT TABLE 2 HERE]

Based on above empirical model, this study uses the annual data from 1995 to 2015 to observe the impact of globalization on carbon emissions in 12 Central and Eastern European Countries (Albania, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, Slovenia, Estonia, Latvia and Lithuania). The carbon emission is used as carbon emissions per capita in metric tons, the real income is used as gross domestic product per capita in 2010 constant US dollar. Carbon emissions per capita (CO) and real gross domestic product per capita (GDP) is retrieved from World Development Indicators of World Bank. Furthermore, the data of globalization indices is obtained from KOF Globalization Index database of Dreher (2006).

3.2. Methodology

Using the panel data methods which ignores the cross-sectional dependence among cross-sections may lead to invalid results. Therefore, after testing the validity of cross-sectional dependence, using second generation panel data methodologies which are called as "second generation panel data methods" is more suitable when there is cross-sectional dependence among observed cross-sections. Based on this, we first observe the existence of that assumption with LM test of Breusch and Pagan (1980), CDLM test of Pesaran (2004), CD test of Pesaran (2004) and LMadj test of Pesaran et al. (2008).

3.2.2. Panel unit root test

If the cross-sectional dependence exists among cross-sections, it should be used a panel unit root test that allows cross-section dependency. Pesaran (2007) suggests to augment ADF regressions of cross-sectional units through cross-sectional means of lagged values and first differences of each time series. The computation of the cross-sectional ADF (*CADF*) regression is as following:

$$\Delta y_{it} = a_i + \rho_i y_{it-1} + \beta_i \bar{y}_{t-1} + \sum_{j=0}^{k} \gamma_{ij} \Delta \bar{y}_{it-1} + \sum_{j=0}^{k} \delta_{ij} y_{it-1} + \varepsilon_{it} \quad (2)$$

where a_i, k and $\bar{y}_t$ are deterministic term, lag order and the cross-sectional mean of time *t*, respectively. Based on Eq. (2), *t*-statistics are retrieved from the computation of individual *ADF* statistics. Moreover, there are also some advantages to employ this method as follows: i) this test allows the cross-sectional dependence among observed countries, ii) using this methodology leads consistent results even for small sample size (Pesaran, 2007). Finally, the critical values of CIPS statistics which are given in Pesaran (2007) are compared with computed *CIPS* statistic that computed by the means of *CADF* statistic for each cross-sections as follows:

$$CIPS = \left(\frac{1}{N}\right) \sum_{i=1}^{N} t_i \, (N, T) \quad (3)$$

3.2.3. Panel cointegration test

3.2.3.1. Durbin-Hausman cointegration test

In order to examine the existence of long-run relationship across variables, we use panel cointegration methodologies. In case of the presence of cross-sectional dependence, we first utilize with Durbin-Hausman cointegration test developed by Westerlund (2008). One of the reasons for choosing this method is that this procedure does not depend on the integration order of the variables. In addition, this method allows for cross-sectional dependence modeled by a factor model in which the errors of Eq. (1) are obtained by idiosyncratic innovations and unobservable factors that are common across units of the panel (Auteri and Constantini, 2005). Therefore, the error terms in Eq. (1) are modeled as follows;

$$\varepsilon_{it} = \lambda_i' F_t + e_{it}, \quad (4)$$

$$F_{jt} = \rho_j F_{jt-1} + u_{jt}, \quad (5)$$

$$e_{it} = \phi_i e_{it-1} + v_{it}, \quad (6)$$

where F_t is a k-dimensional vector of common factors F_{jt} with $j = 1, \dots \dots \dots, k$ and λ_i is a vector of factor loadings. In testing procedure, it is ensured that F_t is stationary with assuming that $\rho_j < 1$ across all js. In this situation, the integration order of the composite regression error ε_{it} depends only on the integrate pattern of the idiosyncratic disturbance e_{it}. Thus, the null hypothesis which indicates no cointegration is equivalent to testing whether $\phi_i = 1$. The null hypothesis is tested with two tests as panel test and group mean test. The instrumental variable (IV) and OLS estimators can be used to attain the Durbin-Hausman tests. Therefore, panel test and group mean test can be formulated as follows;

$$DH_g = \sum_{i=1}^{N} \hat{s}_i (\varphi_{1i} - \varphi_{2i})^2 \sum_{t=2}^{T} \hat{e}_i^2 (t-1) \quad (7)$$

$$DH_p = \hat{s}_n (\varphi_1 - \varphi_2)^2 \sum_{i=1}^{N} \sum_{t=2}^{T} \hat{e}_{i(t-1)}^2 \quad (8)$$

where φ_{2i} is the OLS estimator of ϕ_i and φ_2 is its pooled counterpart. In addition, individual and pooled instrumental variable estimators of ϕ_i, indicated φ_{1i} and φ_1, respectively. For the panel test (DH_p) the null hypothesis $H_0: \phi_i = 1$ is tested against the alternative $H_1^P: \phi_i = \phi$ and

$\phi < 1$ for all i. In contrast, for the group mean test (DH_g), the null hypothesis is tested against the alternative $H_1^g: \phi_i < 1$ for at least some i. Therefore, we only observe the Durbin-Hausman panel test in the empirical analysis.

3.2.3.2. LM bootstrap panel cointegration test

We also employ the LM bootstrap panel cointegration test of Westerlund and Edgerton (2007) to provide robustness. The computation of LM bootstrap panel cointegration test which is based on the Lagrange multiplier test of McCoskey and Kao (1998) is as following:

$$LM_N^+ = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{t=1}^{T} w_i^{-2} s_{i,t}^2 \tag{9}$$

where $s_{i,t}^2$ and w_i^{-2} indicates the partial sums and long-run variances of the error terms. The null hypothesis of the test implies the existence of cointegration for all countries. The asymptotic critical values are used for the assumption of cross-sectional independence while the bootstrap critical values are used in case of cross-sectional dependence. Therefore, we consider the bootstrap critical values.

3.2.4. Panel long-run coefficient estimator

We also employ Augmented Mean Group (AMG) estimator of Eberhardt and Bond (2009); Bond and Eberhardt (2013) to determine the parameters of explanatory variables on environmental pollution. Using this method has some advantages as follows: i) this method allows the cross-sectional dependence among observed countries. ii) the test can be used in case of the non-stationary variables. To obtain the parameters from AMG estimation, first, the main panel model (Eq. 1) is estimated with first differenced form as follows;

$$\Delta CO_{it} = \gamma_1 \Delta GDP_{it} + \gamma_2 \Delta EC_{it} + \gamma_3 \Delta GL_{it} + \sum_{t=2}^{T} p_t(\Delta D_t) + u_{it} \tag{10}$$

where ΔD_t is first differenced *T-1* period dummies; p_t is the parameters of period dummies. After that estimation, obtained p_t parameters are converted to φ_t variable that implies common dynamic process as follows;

$$\Delta CO_{it} = \gamma_1 \Delta GDP_{it} + \gamma_2 \Delta EC_{it} + \gamma_3 \Delta GL_{it} + d_i(\varphi_t) + u_{it} \tag{11}$$

$$\Delta CO_{it} - \varphi_t = \gamma_1 \Delta GDP_{it} + \gamma_2 \Delta EC_{it} + \gamma_3 \Delta GL_{it} + u_{it} \tag{12}$$

Group-specific regression model is first adapted with φ_t and then the mean values of group-specific model parameters are computed. For instance, the parameter of real income (γ_1) can be computed as $\gamma_{1,AMG}$=1/N$\sum_{i=1}^{N} \gamma_{1,i}$.

3.2.5. Panel DH causality test

This study employs the heterogeneous panel causality test of Dumitrescu and Hurlin (2012) to detect the possible causal connections between variables. The test is simply explained as the modified version of Granger (1969) non-causality test. The advantage of using this methodology is that DH causality test leads to consistent results in case of both small samples and cross-sectional dependence. Dumitrescu and Hurlin (2012) developed two statistics such as $W_{N,T}^{HNC}$ and $Z_{N,T}^{HNC}$. The first statistic is the simple averages of Wald statistics for each cross-section. The second statistic is computed by estimated values of mean and variance of each Wald statistics. The computation of these statistics is mainly as following:

$$W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{i,t} \quad , \quad Z_{N,T}^{HNC} = \frac{\sqrt{N}\,[W_{N,T}^{Hnc} - \sum_{i=1}^{N} E(W_{i,t}]}{\sqrt{\sum_{i=1}^{N} Var(W_{i,t})}} \tag{13}$$

where $W_{i,t}$ is the Wald statistic for the each country.

In DH causality procedure, the null hypothesis means there is not a homogeneously causality in the panel.

4. Empirical findings

The first step of the empirical analysis is to examine the existence of cross-sectional dependence among observed countries. Based on the obtained results from cross-sectional dependence tests, the most suitable tests should be chosen. The results of cross-sectional dependence tests are shown in Table 3. According to the results, there is cross-section dependency among CEECs. This means that a shock of one of these countries may easily be transmitted to the other countries.

[INSERT TABLE 3 HERE]

Based on the findings from cross-sectional dependence tests, we should employ the second-generation panel unit root test which takes into account the cross-sectional dependence. The results of CIPS unit root test are illustrated in Table 4. The findings show that all variables have unit root in the level form. However, in first differences, the null hypothesis that indicates the unit root can strongly be rejected and all variables have become stationary.

[INSERT TABLE 4 HERE]

In the third step, we utilized with panel cointegration tests to examine the validity of long-run relationship between variables. The results of Durbin-Hausman panel cointegration test of Westerlund (2008) from Table 5 reports that the null hypothesis of no cointegration is rejected Durbin-Hausman panel statistic for Model I, Model II and Model III. However, the validity of cointegration is rejected by DH_p statistic for Model IV. Therefore, we also employ the panel bootstrap cointegration of Westerlund and Edgerton (2007) to provide robustness of findings. The results of Table 5 reveal that the null hypothesis of cointegration is accepted by LM statistic for all models. Overall, we concluded that the real GDP per capita, energy consumption, globalization indices and carbon emissions are cointegrated.

[INSERT TABLE 5 HERE]

In the fourth step of our empirical analysis, we used the Augmented Mean-Group (AMG) estimation method to examine the impacts of explanatory variables on carbon emissions and the results are shown in Table 6. The findings from all models, the coefficient of real GDP is positive and the coefficient of the square of the real GDP is negative. This finding means that there is inverted U-shaped relationship between real GDP and carbon emissions therefore the Environmental Kuznets Curve (EKC) hypothesis is valid for CEECs. This finding is consistent with the study that found the validity of EKC hypothesis for CEECs by Destek et al. (2016). In addition, a 1% increase in energy consumption increases carbon emissions by 1.034 - 1.156%. The increasing effect of energy consumption on carbon emissions is sourced from the fact that the production activities of observed countries are still depend on fossil-fuel energy sources. This finding is consistent with the studies of Shahbaz et al. (2015).

In case of globalization, the results from Model I shows that a 1% increase in overall globalization index increases carbon emissions by 0.312%. This finding supports the finding of Shahbaz et al. (2017a) and Shahbaz et al. (2017b). Similar to the overall globalization index, the findings for Model II shows that economic globalization increases carbon emissions. A 1% increase in economic globalization increases carbon emissions by 0.098%. This finding is consistent the evidence that Xu et al. (2018). In case of Model III, the findings reveal that the impact of social globalization on carbon emissions is statistically insignificant. This result is same with the findings of Xu et al. (2018) that reached the evidence that social globalization has statistically insignificant effect on carbon emissions. Moreover, we found that a 1% increase in political globalization reduces carbon emissions by 0.330%. This result is consistent with the findings of Shahbaz et al. (2017c).

[INSERT TABLE 6 HERE]

We also examine the country-specific coefficients of real income, the square of real income, energy consumption and globalization dimensions on carbon emissions using with AMG estimator. As a shown in Table 7, in case of the Model I, it seems the positive significant coefficient of real income and the negative significant coefficient of the square of the real income is valid for Albania, Poland, Romania and Estonia. Therefore, the EKC hypothesis is confirmed for these countries. Further, the positive impact of energy usage on carbon emissions is found for all countries, excluding Lithuania. In addition, increasing overall globalization index increases carbon emissions is obtained for Bulgaria, Croatia, Czech Republic, Poland, Romania and Estonia.

[INSERT TABLE 7 HERE]

Table 8 illustrates the estimation results for Model II. It is concluded from Table 8 that the EKC hypothesis which means the validity of positive (negative) coefficient of real income (the square of real income) is confirmed for Albania, Poland, Romania and Estonia. Similar to Model I, carbon emission increasing effect of energy consumption is found for all countries, excluding Lithuania. Moreover, we found that economic globalization increases carbon emissions in Bulgaria, Czech Republic, Poland and Romania. However, economic globalization reduces environmental pollution in Estonia.

[INSERT TABLE 8 HERE]

The country-specific estimation results from Model III is shown in Table 9. At a first glance, it seems that EKC hypothesis is validated for Albania, Poland, Romania, Estonia and Lithuania. Increasing energy consumption increases carbon emissions in all countries, excluding Czech Republic. Furthermore, social globalization increases environmental pollution in Czech Republic and Latvia while increasing social globalization reduces carbon emissions in Slovenia.

[INSERT TABLE 9 HERE]

As a shown in Table 10, the existence of EKC hypothesis is confirmed for Albania, Poland, Romania, Slovenia and Estonia. Furthermore, energy usage increases carbon emissions in all countries, excluding Lithuania. In case of political globalization, it is found that increasing political globalization reduces environmental pollution in Croatia, Czech Republic, Hungary, Romania, Slovenia, Estonia and Lithuania.

[INSERT TABLE 10 HERE]

Finally, we use panel causality test of Dumitrescu and Hurlin (2012) to observe the possible causal connections between variables and the results are reported in Table 11. According to the results, there is unidirectional causality from real GDP to carbon emissions, from overall globalization index to carbon emissions, from economic globalization to carbon emissions and from political globalization to carbon emissions. In addition, it is concluded that there is bidirectional causality between energy consumption and carbon emissions. On the other hand, there is not any causal linkage between social globalization and carbon emissions.

[INSERT TABLE 11 HERE]

5. Conclusions and policy implications

This study examined the relationship between different dimensions of globalization and environmental pollution by incorporating economic growth and energy consumption in carbon emission function for the period from 1995 to 2015 in 12 Central and Eastern European countries. In doing so, based on the validity of cross-sectional dependence, the integration process of variables is examined with CIPS unit root test of Pesaran (2007). The cointegration relationship between variables is investigated with Durbin-Hausman panel cointegration test of Westerlund (2008) and panel bootstrap cointegration test of Westerlund and Edgerton (2007). In addition, the impact of globalization indices on carbon emissions is observed with panel Augmented Mean Group estimation technique. Finally, the causal linkage between variables are searched with panel causality test of Dumitrescu and Hurlin (2012).

The findings from the study showed that there is cross-sectional dependence among CEECs and these countries are highly integrated. Based on this, we utilized with second generation panel data methodologies and the cointegration test results reveal that real income, energy consumption, globalization and carbon emissions are cointegrated. According to the findings from panel coefficient estimator, it is found that the coefficient of real income is positive and the coefficient of the square of the real income is negative. Thus, the EKC hypothesis is confirmed for observed country group. This finding means that the environmental pollution level will increase to a certain level with economic growth. After this level, economic growth will lead to decrease in carbon emissions. In addition, the environmental pollution increasing effect of energy consumption is also validated. In case of globalization, the results imply that economic globalization increases carbon emissions. The meaning of this finding is that increasing trade openness, foreign direct investment inflows and financialization process contributes to growing emission level in these countries. Furthermore, we found that social globalization does not have an impact on carbon emissions. However, the political globalization reduces environmental pollution. This means that international agreements which aims to reduce environmental pollution are successfully implemented in observed countries. Finally, it is concluded that increasing overall globalization increases carbon emissions.

We also examined the country-specific estimation results for observed countries. It is concluded from country-specific findings, the EKC hypothesis is confirmed for Albania, Poland, Romania and Estonia. In situation of energy usage, it is found that energy consumption increases carbon emissions in all countries, excluding Lithuania. In addition, the results reveal that increasing overall globalization increases environmental pollution in Bulgaria, Croatia, Czech Republic, Poland, Romania and Estonia. Moreover, economic globalization increases carbon emissions in Bulgaria, Czech Republic, Poland and Romania. However, economic globalization reduces environmental pollution in Estonia. In case of social globalization, it seems globalization increases environmental pollution in Czech Republic and Latvia while increasing social globalization reduces carbon emissions in Slovenia. Further, political globalization reduces environmental pollution in Croatia, Czech Republic, Hungary, Romania, Slovenia, Estonia and Lithuania.

In context with policy implications, our findings suggest that the policymakers of these countries should review and minimize the harmful effects of economic globalization on the environment. They should bring strict environmental rules to both domestic and foreign firms to adopt environmentally friendly production structure. In particular, the governments of these countries should encourage exporter firms to efficient energy usage and to increase renewable energy usage. Although social globalization does not have a significant impact on the environment, some projects should be organized to increase the environmental awareness of immigrants coming to the country as an extension of the social globalization process. In addition, incentives should be given to tourism companies and touristic hotels to increase the share of renewable energy consumption within the energy mix. Finally, based on the finding that political globalization reduces environmental pollution, it is necessary to increase the number of agreements to reduce the environmental pollution signed by governments and to continue the stringent measures for the objectives in these agreements.

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