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Cointegration between Economic, Ecological and Tourism Development

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Abstract
The well-developed countries have more options to attract tourists and generate profit from the tourism development. At the same time, the high volume of CO2 emissions, ecological risks, polluted nature restrict the tourism development in the country. The reorientation of global development to green growth provokes transformations in all policies of the country's development. It allows green countries to attract more tourists. In this case, the paper aims to analyze the relationships between economic growth, ecological indicators, and tourism development. Ukraine has chosen the EU vector of development. In this case, it is necessary to identify the targets for synchronizing the Ukrainian policies (economic, ecological, social, tourism, etc.) with the EU. The objects of the investigation were Ukraine and Visegrad countries for 2000-2020 years. The panel data was generated from World Data Bank, Eurostat, European Environmental Agency, and Ukrstat. The dependent variable – GDP (as an indicator of economic growth), independent – greenhouse gas emissions and share of renewable energy in the total energy consumption (ecological indicators), the volume of tourists (indicators of tourism development). At the first stage, the study used bibliometric analysis to identify publication activities' general tendency on the analyzed issues. The following methods were applied to check the hypothesis on cointegration between variables: panel unit root test, Pedroni panel cointegration tests, and the fully modified ordinary least squares and dynamic ordinary least squares panel cointegration techniques. The findings confirmed the relationships between economic, ecological, and tourism development. Thus, the decline of greenhouse gas emissions leads to increasing tourists, and as a consequence, it provokes GDP growth.

Keywords: tourist, tourism, sustainable development, economic growth, green economy.

JEL Classification: Z3, L83

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1. Introduction

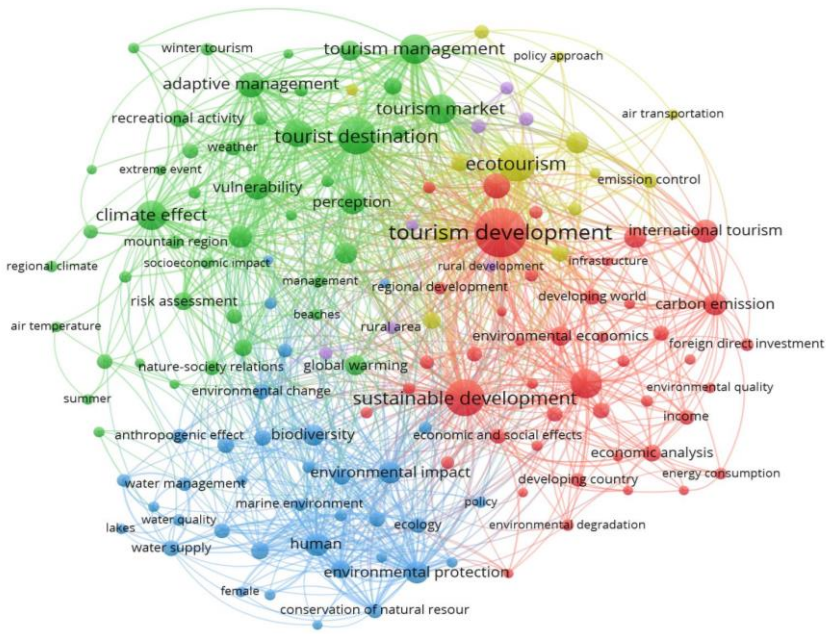
Globalisation provokes the stringing the free moving of the capital and people around the world. The countries try to attract additional capital to the country through tourism development. The world-leader countries have more options to attract tourists and generate profit from the tourism development. At the same time, tourism development is the option for the less-developed countries to attract new financial recourses for future development. Noting that on the tourists' decisions (in choosing the country for travelling) affect the vast range of determinants: ecological, infrastructure development, political stability, social security etc. (Gavurova et al. 2021). Thus, the high volume of CO2 emissions, ecological risks, polluted nature restricts the tourism development in the country (Kosikova et al., 2019).

Moreover, the reorientation of global development to green growth provokes transformations in all country development policies. It allows green countries to attract more tourists. In this case, it is actually to determine the relationships between economic growth, ecological indicators, and tourism development. Mostly the scientists analysed the different factors which affected tourism development. However, for creating an effective policy, it should be necessary to consider the casual relationships between core economic and ecological dimensions with tourism development. The object of the investigation was Ukraine and Visegrad countries. These countries have common borders. Besides, Ukraine could use the experience of Visegrad countries as they have already passed the issues which appear after joining the EU. The paper consists of the four main parts: literature review – using the bibliometric analysis to summarise the research background on analysing the issues of tourism development related to economic and ecological growth of the country; methods – explain the applied methods for checking the research hypothesis; results – describing the findings if the investigation; discussion – contains the comparison of the empirical results with the previous research; conclusion – summaries the findings and the options of theirs implementation to boost the tourism development in Ukraine based on Visegrad experience.

2. Literature review

The bibliometric analysis was applied to generalise the research background on the tourism development issues. The data for analysis was collected from Scopus. The core parameters to filter the papers were: language – English; time – 1991-2020; keywords – tourism, tourist, economic growth, environmental conditions. For the analyses after the filtering, 4 542 documents were selected for the analysis. The visualising of bibliometric analysis findings showed in Figure 1.

Figure 1. **The findings of bibliometric analysis of the paper, which focused on the investigation of tourism development**



Source: developed by the authors using the Scopus and VOSviewer

The findings of bibliometric analysis allowed identifying five core scientific directions which focus on the analysis of tourism development issues. The first (red cluster) merge the following scientific directions: sustainable development, economic growth, investment, and tourism development. The second cluster (green) merge investigations focused on tourism management, tourism market, tourist destination and perception. The third cluster (blue) focused on analyses of the relationship between tourism development and the environment. The fourth cluster (yellow) contained the following direction: green tourism, ecotourism, sustainable tourism. The fifth cluster focused on the analysis of heritage tourism.

The papers (Ágnes et al., 2018; Bacik et al., 2019; Mendoza-Moheno et al., 2021; Sundbo et al., 2007; Vasylieva et al., 2017; Kljucnikov et al., 2020a; Elzek et al., 2021, Vasilyeva et al., 2018; Vorontsova et al., 2018; Oláh et al., 2021; Ahmed & Streimikiene, 2021) proved that economic and social challenges, the paradigm of sustainable development, snowballing development of innovations and technologies provoked the changes in all sectors, and particularly in the tourism industry. Moreover, the economic and social challenges in the disadvantaged and touristic regions have made local businesses to create innovative solutions (Ključnikov et al., 2020b; Ključnikov et al., 2020c). In this regard, Mura & Kljucnikov (2018) confirmed that small and medium enterprises (SMEs) play a crucial role in tourism development. This is because SMEs play a significant role in the creation of workforce (Civelek et al., 2020a; Civelek et al, 2021a; Civelek et al., 2021b), the production of goods (Ključnikov et al., 2019; Žufan, et al., 2020; Civelek et al., 2020b), and the implementation of exporting (Civelek et al., 2020c) and innovative activities (Ključnikov et al., 2021; Civelek et al., 2021c).

Gusakov et al. (2020) highlighted that smart tourism requires the implementation of innovations. Das K. and Naskar K. (2018) justified that the tourism sector required well-developed infrastructure. At the same time, the infrastructure development needed additional financial resources. For developing countries, it was a challenge to find new additional resources for infrastructure development. Considering Scopus (Lee et al., 2008), the most cited paper confirmed that tourism development had a higher significant impact on economic growth in non-OECD than in OECD countries. Besides, the findings of heterogeneous panel cointegration showed the unidirectional causality relationships between tourism development and economic growth in OECD. At the same time, for non-OECD countries, the authors confirmed the bidirectional causality relationships between economic growth and tourism development. Balaguer J. & Cantavella-Jorda M. (2002) proved that international tourism positively impacted long-run economic growth in Spain. Furthermore, they highlighted that government policy had a crucial role in tourism development. A similar conclusion was made by (Kim et al., 2006) for the Taiwan case. Gunduz L. & Hatemi-J A. (2005) showed that tourism development boosted the economic growth in Turkey and vice versa. For checking the hypothesis, they used the leveraged bootstrap causality tests. Kurar İ. (2021) proved that tourism development had a positive effect on the local people development. Using the VAR modelling, Akbulaev & Salihova (2020) showed that tourism had a positive statistically significant impact on export. It was noted that pandemic COVID-19 has a negative impact on the economic development involving the tourism sector (Liu et al., 2021).

Cooper C. (2006), Krajcik et al. (2019), Rubanov et al. (2019), Yarovenko et al. (2021), Draskovic et al. (2021) and Novikov (2021) showed that knowledge gaps provoked by rapid social, economic and innovations development. Cooper C. proved that the tourism industry required effective knowledge management. Tovmasyan G. and Tovmasyan R. (2018) analysed the scientific tourism development in Armenia. They proved that scientific tourism allowed to share of knowledge and innovations among the countries. Scheyvens R. (2007), Tung and Cuong (2020) and Schilcher D. (2007) and Lakner et al. (2018) and Mariyakhan et al. (2020) analysed tourism to overcome poverty in developing countries. Michael Hall C. (2011) showed the dual character of tourism development under the sustainable development concept. Michael Hall C. (2011) highlighted that tourism provokes economic development. However, the increasing volume of tourism leads to increasing ecological issues (greenhouse gas emissions, waste etc.). Michael Hall C. (2011) and George B. (2020) confirmed the necessity of incorporating sustainable development principles in the tourism industry and enhancing sustainable tourism. Taliouris E. and

Trihas N. (2017) showed that the tourism industry required the implementation of corporate social responsibilities at the tourism companies. It was consequently provoking the development of sustainable tourism development.

Based on the EKC hypothesis (Environmental Kuznets Curve), Zaman et al. (2016) analysed the linking among economic growth (domestic investment and health expenditure), tourism development (number of tourists, tourism receipts and international tourism expenditures) and ecological determinants (carbon dioxide emissions and energy demand). They proved the tourism development provoked the growth of carbon dioxide emissions. Paramati et al. (2017) compared the tourism impact on carbon emissions in developing and developed countries. They confirmed that the negative impact of tourism on the environment was less in developed countries than in developing. At the same time, tourism development led to economic growth as in developing and developed countries.

Considering Figure 1, the new direction of scientific investigation was sustainable tourism. Butler (1999) highlighted that the concept of sustainable tourism was boosted due to the worldwide agenda "Our Common Future". Dube & Nhamo (2021) identify the ways of localisation of the SDG in the tourism industry. The most cited papers (based on Scopus 589 citations) Gössling (2002) analysed the impact of tourism on the environment. Gössling (2002) proved that increasing numbers of tourists had a substantial impact on the environment. In this case, Gössling (2002) justified the spreading of sustainable tourism. Nguyen & Dinh (2021) showed the negative impact of tourism development on the environment in countries with well-developed institutional quality. On this basis, Nguyen & Dinh (2021) confirmed the necessity to develop sustainable tourism and promote its benefits to society. Coope & McCullough (2021) confirmed the famous sports-tourism events should be more sustainable due to theirs high contribution to the carbon footprint.

Most investigations focused on analysing the relationship between ecological and tourism development, economic indicators and tourism development separately. Considering the mentioned above, the paper aims to check the relationships between economic growth, ecological determinants of the country's growth and tourism development.

3. Methods

The objects of the investigation were Visegrad countries and Ukraine for 2000-2020 years. The panel data was generated from World Data Bank, Eurostat, European Environmental Agency and Ukrstat (Table 1).

Table 1. **The analysed variables and their sources**

Variables	Symbol	Source
Gross domestic product	GDP	World Data Bank, Eurostat, and Ukrstat
Greenhouse gas emissions	GHG	European Environmental Agency and Ukrstat
Renewable energy in the total energy consumption	RE	European Environmental Agency, Eurostat, and Ukrstat
Volume of tourism	T	World Data Bank, Ukrstat and Eurostat

Source: developed by the authors.

The checking the hypothesis on cointegration between variables was realised by the following steps:

1. Build the model of investigations.

The dependent variable was gross domestic product per capita which indicated the economic growth of the country. The ecological indicators were greenhouse gas emissions and the share of renewable energy in the total energy consumption. Tourism development was measured by the number of tourists in the

country. Considering mentioned above and then using the findings of the papers Zaman et al. (2016) and Paramati et al. (2017), the research model could be presented as:

$$GDP = f(GHG, RE, T) \quad (1)$$

where GDP – gross domestic product per capita; GHG – greenhouse gas emissions; RE – share of renewable energy in the total energy consumption; T – number of tourists in the country.

For analysis, all data were taken in logarithm, which allowed to linearise data. Thus (1) could be written as:

$$lnGDP_{it} = \mu + \alpha lnGHG_{it} + \beta lnRE_{it} + \gamma lnT_{it} + \nu_{it} \quad (2)$$

where ν – the error term; i=1,..., N; t=1,..., T; α, β, γ – regression's parameters.

2. Check the stationarity of the panel date using the panel unit root test. The null hypothesis (H0) – collected data was non-stationary, and the alternative hypothesis (H1) – collected data was stationary.
3. Check the cointegration in panel data using Pedroni panel cointegration tests. The null hypothesis (H2) – collected data was cointegrated, and the alternative hypothesis (H3) – collected data was non-cointegrated.
4. Using the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) panel cointegration techniques, the long-run relationship among the country's economic, ecological, and tourism indicators was checked. The null hypothesis (H4) – collected data did not have the long-run relationship, and the alternative hypothesis (H5) – the panel data had the long-run relationship.

   For the analysis, the study used the EViews software.

4. Results

The descriptive statistics of the variables as shown in Table 2.

Table 2. **The findings of the descriptive statistic of the analysed variables**

Parameters	GDP	GHG	RE	T	Parameters	GDP	GHG	RE	T
Mean	4,26	5,14	0,86	7,38	**Kurtosis**	2,93	1,40	4,46	4,28
Median	4,32	5,12	0,89	7,41	**Jarque-Bera**	8,96	10,66	36,39	27,71
Maximum	4,63	5,67	1,23	7,95	**Probability**	0,01	0,00	0,00	0,00
Minimum	3,61	4,57	-0,01	6,25	**Sum**	425,85	514,05	86,24	737,75
Std. Dev.	0,23	0,39	0,28	0,40	**Sum Sq. Dev.**	5,11	15,13	7,87	15,94
Skewness	-0,73	-0,02	-1,29	-1,12					

Source: developed by the authors.

Despite the pandemic, the analysis result showed that the maxim number of tourists was in Poland in 2019. Besides, during the whole time, 2000-2020 Ukrainian number of tourists was lower than the average number in Visegrad courtiers. At the same time, the highest GDP per capita was in Czechia in 2019, and the GHG was in Slovakia in 2003.

Table 3. **The findings of panel unit root test**

Tests	Statistic Parameters	Variables			
		At level			
		GDP	GHG	RE	T
Levin, Lin & Chu	Statistics	-1,86	0,21	-0,22	0,07
	Probability	0,03**	0,58	0,41	0,53
Im, Pesaran and Shin W-stat	Statistics	0,71	1,40	1,97	1,14
	Probability	0,76	0,92	0,98	0,87
ADF-Fisher Chi-square	Statistics	6,38	5,23	2,24	5,28
	Probability	0,78	0,88	0,99	0,87
PP-Fisher Chi-square	Statistics	13,24	4,12	2,91	4,58
	Probability	0,21	0,94	0,98	0,92
Tests	**Statistic Parameters**	**at 1st difference**			
Levin, Lin & Chu	Statistics	-3,13	-4,03	-2,03	-3,83
	Probability	0,00*	0,00*	0,00*	0,00*
Im, Pesaran and Shin W-stat	Statistics	-2,27	-3,77	-3,49	-3,30
	Probability	0,01*	0,00*	0,00*	0,00*
ADF-Fisher Chi-square	Statistics	21,28	32,61	30,92	29,24
	Probability	0,02*	0,00*	0,00*	0,00*
PP-Fisher Chi-square	Statistics	36,66	57,47	138,97	44,94
	Probability	0,00*	0,00*	0,00*	0,00*

Note: *, ** represents significance at the 1% and 5% level.
Source: developed by the authors

The findings in Table 2 allowed concluding that at a level not all data were stationary, the only GDP per capita – stationary at 5% significance level. However, all data become stationary at the first level. These findings allowed rejecting the null (collected data was non-stationary) and accepting alternative (collected data was stationary) hypotheses at a 1% significance level. It allowed providing the next step – checking the cointegration in panel data. The findings of the Pedroni cointegration test showed in Table 3.

Table 4. **The findings of the Pedroni cointegration test**

Test	Within-dimension				Test	Between-dimension	
	Stat.	Prob.	Stat. *weighted*	Prob. *weighted*		Stat.	Prob.
panel v-statistic	1,09	0,14	1,28	0,10	group rho-statistic	1,25	0,89
panel rho-statistic	0,30	0,62	0,26	0,60	group PP-statistic	-1,33	0,09**
panel PP-statistic	-1,47	0,07**	-1,34	0,09**	group ADF-statistic	-1,48	0,07**
panel ADF-statistic	-1,61	0,05**	-1,44	0,07**			

Note: ** represents significance at the 5% level.
Source: developed by the author.

The findings of the Pedroni cointegration test showed that six among eleven findings had probability with statistical significance at a 5% level. It allowed concluding that data was cointegrated and rejecting the null hypothesis (collected data was cointegrated). The FMOLS and DOLS were provided at the next stage to check the long-run relationship between analysed variables.

Table 5. **The findings of long-run relationships between economic, ecological and tourism indicators of the country's development**

Variables		FMOLS		DOLS	
Dependent	**Independent**	**Coefficient**	**Probability**	**Coefficient**	**Probability**
GDP	GHG	1,370	0,001*	1,448	0,012**
	RE	0,881	0,000*	0,913	0,000*
	T	0,160	0,002*	0,134	0,019**
GHG	GDP	0,147	0,002*	0,195	0,016**
	RE	-0,328	0,000*	-0,376	0,000*
	T	-0,004	0,813	0,070	0,045***
RE	GHG	-2,318	0,873	-2,272	0,845
	GDP	0,670	0,000*	0,704	0,000*
	T	-0,054	0,321	0,075	0,000*
T	GHG	-0,230	0,001*	-1,044	0,021**
	RE	-0,321	0,853	-0,537	0,655
	GDP	1,340	0,481	1,720	0,583

Note: *, ** represents significance at the 1% and 5% level.
Source: developed by the author.

In all models, the R-squared was higher than 0.9. It allowed concluding that models and findings were adequate. The results of long-run relationships analysis showed that a 1% increasing of GHG, RE, T provoked the GDP growth: FMOLS – by 1.370, 0.881, and 0.16 respectively; DOLS – by 1.448, 0.913, and 0.134 respectively. All findings were statistically significant at 1% and 5%. At the same time, 1% increase in GDP led to growth GHG by 0.147 (FMOLS) and 0.195 (statistically significance – 1%), and an increase in RE led to declining of GHG by 0.328 (FMOLS) and 0.376 (DOLS). Considering the results, a 1% increasing in GHG provoked the decline of tourist numbers by 0.23.

5. Discussion

The research model was built considering the papers Zaman et al. (2016) and Paramati et al. (2017) and based on the EKC hypothesis. The results of calculations confirm the cointegration between the analysed variables. The obtained results showed that increasing greenhouse gas emissions, the share of renewable energy in the total energy consumption, the number of tourists in the country lead to economic growth. The results were similar as in the papers Zaman et al. (2016), Michael Hall (2011), Lee & Chang (2008). Besides, the growth of greenhouse gas emissions led to declining in tourists' number in the country. The findings on greenhouse gas emissions impact on renewable energy were the same as in the papers. Thus, the growth of the share of renewable energy in the total energy consumption by 1% led to declining the greenhouse gas emissions by 0.328 (FMOLS) and 0.376 (DOLS). Thus, tourism development required improving the country's ecological development through declining greenhouse gas emissions and spreading renewable energy.

6. Conclusion

The finding allowed confirming the hypothesis on long-run relationships between economic, ecological and tourism indicators of the country's development. Thus, the increase of greenhouse gas emissions and share of renewable energy in the total energy consumption (ecological indicators) and the number of tourists in the country (tourism indicators) provoke GDP per capita growth. Besides, the

number of tourists could be declined due to the growth of greenhouse gas emissions. Considering the findings, the increase of the share of renewable energy in the total energy consumption by 1% provoked declining greenhouse gas emissions by 0.328 (FMOLS) and 0.376 (DOLS). Noting that tourism development need not only affordable infrastructure but also require good quality of the environment. The government should provide green technologies and innovations that allow declining greenhouse gas emissions and increased renewable energy. In this case, the most effective instruments for expanding green technologies and innovations could be green tariffs, green credits, preferential taxation for green projects, promotion benefits of green energy among stakeholders (government, investors and society). Besides, the government should provide a program for developing local and regional tourism. It allows to attract new financial resources to the region and improve the quality of life. One of the core directions in the tourism sector is developing heritage, health, and sustainable tourism in the post-industrial region. This requires synchronising the tourism policy at all levels (from the government to the region). Besides, the government should start an active promotion program to enlarge knowledge about sustainable tourism and its benefits.

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