The Impact of Blue Economy and Economic Growth on Climate Changes in Baltic Countries

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Abstract. *The main goal of this research is to identify the causality relations between the greenhouse gases emissions, the blue economy and the economic growth based on a panel of annual data from the three Baltic countries, members of the European Union during 2009-2018 period. After applying stationarity and cointegration tests, the long term cointegration coefficients shall be determined with the help of the Pooled Mean Group (PMG) estimator. Granger causality estimation based on the Vector Error Correction Model (VECM) was applied to identify the causality relationship between the variables and to detect the direction of causality. Based on the identified causality relations, the Blue Economy has a significant influence on greenhouse gas emissions on the short and long run. Unidirectional causality relations have been identified from the economic growth on the greenhouse gases emissions on a long and short term, as well as from the economic growth on the Blue Economy on a short term.*

Keywords: greenhouse gases emissions, Pooled Mean Group estimator, long term cointegration, economic growth

JEL Classification: F62, Q01, Q22, Q54

1. Introduction

The economy of the seas and oceans is needed for the welfare and the prosperity of the humankind. Thus, seas and oceans represent safe sources of food, energy, minerals, health, free time, and they also provide the transport of more than 90% of the worldwide traded goods (UNEP - United Nations Environment Programme, 2016).

Most recently, the sea industry experienced major transformation from the traditional field of the maritime transport, fishing, extractions of oi land gas, to new activities: wind energy, exploration and production of petrol and gases at a great depth, aquaculture in the sea, maritime mining, cruises, maritime surveillance and marine biotechnology. All these activities in oceans and seas generate a complexity of risks, among which the most important are strongly related to the health of the oceans and seas: the over-exploitation of the marine resources, pollution, temperature increase and the levels of seas and oceans, the acidifica-tion and loss of biodiversity.

According to European Commission (2020a, pp. 2-3), blue economy refers to those sectors related to “oceans, seas and coasts” and there are traditional sectors such as “Marine living resources, Marine non-living resources, Marine Renewable energy, Port activities, Shipbuilding and repair, Maritime transport and Coastal tourism” and also emerging sectors with a great potential for development like “Ocean energy, Blue bioeconomy and biotechnology, Marine minerals, Desalination, Maritime defence, and Submarine cables”.

World Bank (2017) defines the term as the "sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health". This definition seems to be closer to the one offered by European Commission (n.d.) for blue growth, a strategy adopted in 2012 "to support sustainable growth in the marine and maritime sectors". The term is relatively new, being brought into the attention of the United Nations Conference on Sustainable Development which took place in Rio de Janeiro in 2012. The ocean economy became blue economy in the context of a green economy that aims to be sustainable, non-pollutant and contributing to poverty eradication (United Nations, 2014). Thus, there are differences between these terms. Potgieter (2017) highlights that not all ocean activities can be part of a blue economy, the last implying sustainability as a characteristic. World Wide Fund for Nature (2015) also noted these nuances of the terms and published the "principles for a sustainable blue economy", referring to the fact that the blue economy is not inherently considered sustainable by all organizations even if it should be. Voyer et al. (2018, p. 18) also analyse the various definitions given to blue economy and conclude that these should be seen as an "opportunity for flexibility and adaptability".

Another term often used as a synonym for blue economy is ocean economy. United Nations Conference on Trade and Development (n.d.) refers to ocean economy as a term "also known as the blue economy" that "encompasses a sustainable economy", highlighting the sustainable component of this economy. According to OECD (2019, p. 138), the various terms used for ocean economy do not include the "environmental dimensions" as blue economy which has a broader meaning does.

Despite these differences in terminology, there is general consensus regarding the importance of the blue economy. World Bank and United Nations Department of Economic and Social Affairs (2017) mention the socio-economic benefits brought by the blue economy which leads to "inclusiveness and poverty reduction" but also address the environmental impact of this economy on the planet. Thus, it is important for all countries having a blue economy to analyze the carbon footprint of each sub-sector and implement the adequate measures to make it sustainable. Blue economy is that economy where our ocean ecosystems bring economic benefits but also efficient, equitable and sustainable benefits (CSIRO, 2015). A „blue economy" reaches the correct balance between the economic potential brought by oceans and seas with the need of protecting them on a long term.

The connection between blue economy and climate change is bidirectional: on one hand, there are sectors of blue economy that are not sustainable and contribute to climate change and an increase of greenhouse gas (GHG) emissions and on the other hand, the climate change determined by economic activities (not only by blue economy) affect the quality of coastal tourism, the quality of oceans and of people living near a coastal area. As United Nations Environment Programme (2019) mentions, GHG emissions "are depriving … oceans of oxygen", oceans attracting 93% of all GHGs. The consequences of GHG on oceans are important, having a direct impact on water temperature, its level and the marine life. The entire blue ecosystem is thus affected. These changes should lead to an increased interest in protecting water and developing a sustainable blue economy that does not maintain this vicious circle of GHGs produced by economic activities related to oceans and seas.

The accent was put on the need to identify the blue economy in measurable and calculable terms, because in this way we can set standards for the analysis of various systems determining the way in which the industrialisation of the oceans and the sea can be carried out without their degradation (Smith-Godfrey, 2016).

The purpose of this paper is to investigate the causality relations between the blue economy, the climate changes, and the economic growth in three Baltic countries in Europe (Estonia, Latvia and Lithuania). The study of these relations is important because they could efficiently manage the use of the economic potential of the seas and oceans and reach all the sustainable develop-ment objectives including the reduction pf the greenhouse gases. Up to the present there were no studies on the causality relations among the greenhouse gases and the blue economy, most of the studies being focused on the influence of the economic growth on the performance of the environment or of the climate changes on the blue economy.

The structure of the paper is as follows: section 2 presents a short revision of the literature regarding the blue economy and the effects generated by the activities in the maritime field on the environment, the 3rd section describes the variables included in the analysis and the methodology used, the 4rd section presents the empirical results and discussions and the last section presents the conclusions of the study carried out.

2. Materials and Methods

2.1 Data Analysis

When analysing the causality nexus among the greenhouse gases emissions, the blue economy and the economic growth we used a data panel with annual data for the three Baltic countries, taken from the database of the European Commission available on the official website and from the report published online (EC, 2020), for the period 2009-2018. We opted for an analysis of a pack of data because there is a low number of information regarding the blue economy and in consequence a low number of information included in the model because the concept was not approached by other research studies and gained a significant importance in the EU starting with 2009, when the European Commission published the first information on this subject. In order to meet the objective proposed, we used within the econometric model the following variables: the total value of greenhouse gases expressed in thousands of tonnes (GHG), the gross added value from the blue economy expressed in millions of Euros (GVA), the real GDP per capita expressed in Euros (GDP and GDP2).

The European Commission characterised the economic significance of the blue economy in the region of the Baltic Sea considering that this region has all the elements required to provide the sustainable development of the maritime economy, because it is registered by a low unemployment as compared to the rest of EU, high economic growth rates and low government debts. (EC 2014).

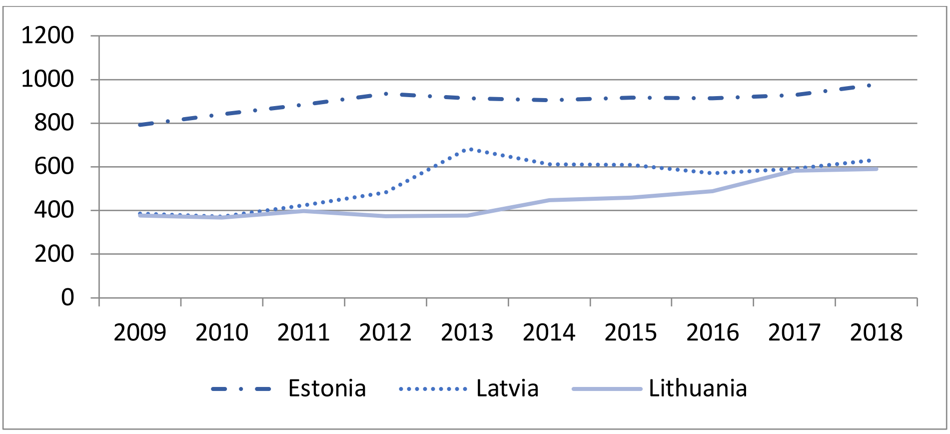


Figure 1. Gross Added Value (GVA) (millions of Euro)

The highest added value in the countries from the Baltic Sea region comes from the maritime transport, but the highest employment in the sectors of tourism and fishing. The maritime transport increased constantly in the last decade in the Baltic countries as a reflection of the intensification of the international cooperation and economic growth, the number and the size of the ships being continuously growing. In the Baltic Sea there were noticed climate changes generated by the climate variability on fishing in the last three decades. These changes aim the reduction of the cod stock determined by unfavourable reproduction conditions related to the climate and unsustainable fishing. In the region the role of aquaculture is small, but also the sand and gravel extraction, the petrol and gases are not yet extracted in the Baltic Sea. Some countries in the region started the energy production by building offshore windmills which are gaining in importance.

In all the three Baltic countries, the economies are sustained by the sector of services, most of the gross value being generated by this sector, to an extent of 60% in Lithuania and Estonia and 64% in Latvia. (World Bank, 2019).

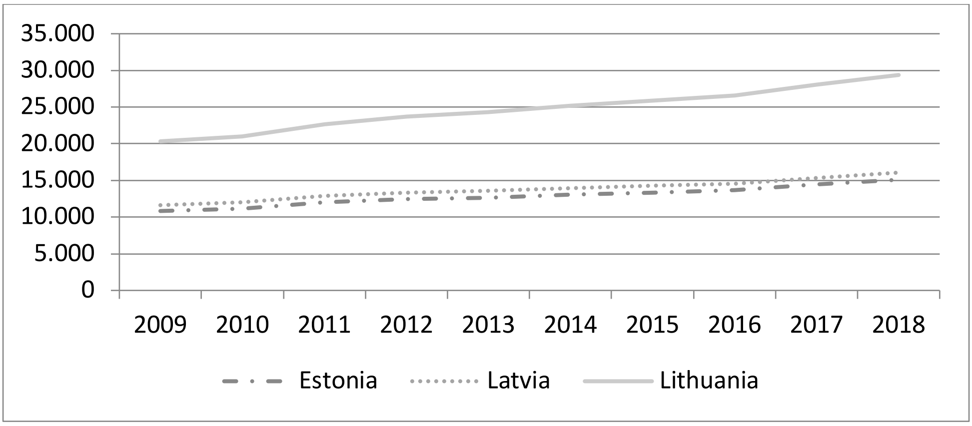


Figure 2. Real GDP per capita (euro/capita)

After the negative impact generated by the world economic crisis, in the period 2009-2018 the economies of the three analysed countries increased gradually as a consequence of the measures taken by government the most important being: the reduction of expenses, competitive exports, the growth of the trust on the international credit markets, but also a suitable climate for business (Miskinis et al., 2019). The economic growth registered in all three states can be considered fast if it is compared with the rate of growth on the level of EU 28. Therefore, we notice that on the level of the year 2018, Lithuania registers a level of GDP per capita 50% higher as opposed to 2009 and Estonia and Latvia registered a double GDP per capita as compared to 2009. This fast-economic growth created favourable conditions to make the three Baltic countries closer to the EU 28 average from the point of view of the development.

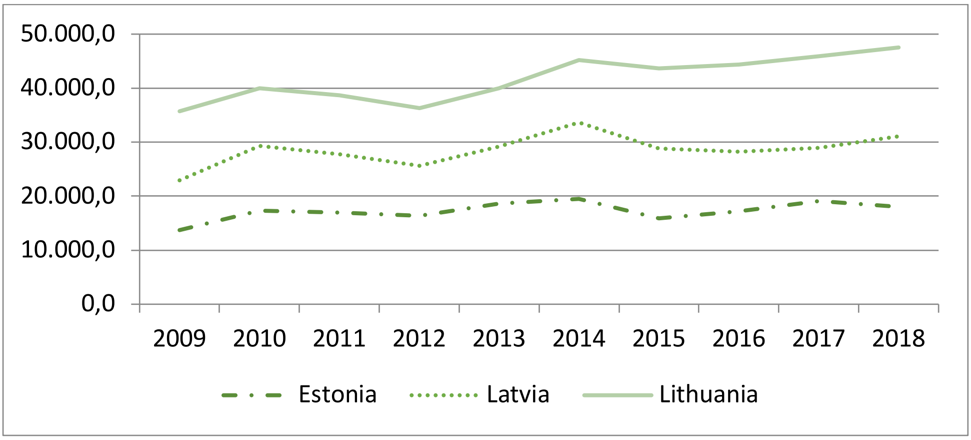


Figure 3. GHG emissions (Thousand tonnes)

Based on the prognosis regarding the GHG emissions (Roos et al., 2012) we reached the conclusion that Estonia, Latvia and Lithuania can meet the targets set in the EU package for climate and energy, although they represent a huge challenge for these states.

As for the climate changes from the region of the Baltic Sea we forecast that by the end of this century, the temperature will growth with 2-4° C with direct consequences but also indirect on the salinity, nutrients, oxygen concentration, the level of the phosphates, migration or disappearance of the species (European Commission, 2014). The three Baltic States implemented similar reduction tools for the GHG emissions, based on the requirements of the EU accession, but these measures determined different effects on the GHG emissions. This can also be explained by the dimension of each country but also by the dimension of each country but also by the primary energy supply and final energy consumption levels (Streimikiene, 2007).

2.2 Research Methodology

The objective of this study is represented by the identification and analysis of the causality relation between the climate changes, the blue economy, and the economic growth in the Baltic Countries (Estonia, Latvia and Lithuania).

Starting from the equations used within the studies regarding the impact of the economic growth on the environment [Bădîrcea et al., 2020], we developed the following equation corresponding to the present study:

$$GHG_{it} = f(GVA_{it}, GDP_{it}, GDP^2_{it}) \quad (1)$$

In order to research the causality relation between the variables included in the mode, after making the logarithm of the data, the equation (1) becomes:

$$lnGHG_{it} = \alpha_i + \delta_{it} + \beta_{1i}lnGVA_{it} + \beta_{3i}lnGDP_{it} + \beta_{4i}lnGDP^2_{it} + \mu_{it} \quad (2)$$

where i=1,2,3 represent the three Baltic Countries included in the panel, t=2009,..,2018 represent the time period for which the analysis is made, μ_{it} express the value of the residual term, β_i are coefficients associated to the variable of the model, α_i and δ_i are the parameters that allow for the possibility of country-specific fixed effects and deterministic trends.

The first stage which we need to go through in the analysis of the causality relation among the variables included within a model is represented by testing the stationarity of the data used. This testing is accomplished with the help of the unitary root tests specific for the panel data. Within this study we chose to use the test proposed by Levin-Lin-Chu (LLC, 2002) involving a common unit root process, so that this test does not allow the possibility that the data of a variable from a certain country included in the panel to be stationary and for another country to have a unitary root.

The second stage involves that application of the cointegration tests to check the existence of a cointegration relation among the variables included in the analysis. In this sense we used the two cointegration tests based on the Engle-Granger two-step (Engle and Granger, 1987) specific for the panel test data: the Pedroni test (1999, 2004) and the Kao test (Kao et al., 1999).

If there are at least one cointegration relation among the variables of the model, the long term cointegration coefficients will be determined by help of the Pooled Mean Group (PMG) estimator of Pesaran, Shin and Smith (PSS, 1999). This model takes the cointegration form of the simple Autoregressive Distributed Lag (ARDL) model and adapts it for a panel setting by allowing the intercepts, short-run coefficients and cointegrating terms to differ across cross-sections. This method is superior to the traditional techniques, does not consider the integration order of the variables and it is widely used within the analysis based on a low number of observations. The mathematical equation used is the following:

$$\Delta lnGHG_{it} = \beta_i + \sum_{j=1}^{n} \alpha_1 \Delta lnGHG_{i,t-j} + \sum_{j=1}^{n} \alpha_2 \Delta lnGVA_{i,t-j} + \sum_{j=1}^{n} \alpha_3 \Delta lnGDP_{i,t-j} + \sum_{j=1}^{n} \alpha_4 \Delta lnGDP_{i,t-j}^2 + \emptyset_1 lnGHG_{i,t-j} + \emptyset_2 lnGVA_{i,t-j} + \emptyset_3 lnGDP_{i,t-j} + \emptyset_4 lnGDP_{i,t-j}^2 + \varepsilon_{it} \quad (3)$$

The null hypothesis involves the lack of cointegration and it is not given by the relation $\emptyset_1 = \emptyset_2 = \emptyset_3 = \emptyset_4 = 0$, while the alternative hypothesis involves the existence of at least one co-integration relations and it is given by the relation$\emptyset_1 \neq \emptyset_2 \neq \emptyset_3 \neq \emptyset_4 \neq 0$.

If the variables are cointegrated, a vector error correction model (VECM) is used to identify the long and short-term causality relations. This model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VECM has cointegration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term (ECT) since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The estimated values of the error correction term show the speed of adjustment from short-run to lung-run equilibrium in the models depending on the sign of the associated coefficient.

After confirming the long-run relationship between the variables in the model by applying the PMG and combined cointegration techniques, the Granger causality can be applied to investigate the direction of causality among the variables. The Error Correction Model (ECM) based Granger causality test is applied to investigate the direction of causality between the variables.

3. Empirical results and discussions

To show the correlation coefficients between variables a correlation matrix is used. Each cell in the table shows the correlation between two variables. A correlation matrix is used to summarize data, as input into a more advanced analysis, and as a diagnostic for advanced analyses (see Table 1).

Table 1. Correlation matrix for the variables in Baltic States

	ln*GHG*	ln*GVA*	ln*GDP*	lnGDP^2
ln*GHG*	1.0000			
	-			
ln*GVA*	0. 7547	1.0000		
	(0.0000)	-		
ln*GDP*	0. 6432	0. 3200	1.0000	
	(0.0001)	*(0. 0847)*	-	
lnGDP^2	0. 6506	0. 3288	0.9998	1.0000
	(0.0001)	*(0. 0760)*	*(0.0000)*	-

Note: ln*GHG* is natural logarithm of greenhouse gas emissions, ln*GVA* is natural logarithm of the gross value added, ln*GDP* is natural logarithm of real gross domestic product per capita and lnGDP^2 is square of natural logarithm of real gross domestic product per capita.

The result of the correlation matrix indicates the fact that there is a positive correlation between the variables of the model, but this has a higher intensity in the case of the gross value added from blue economy, greenhouse gas emissions and real GDP per capita, s compared with the economic growth and with the gross added value from the blue economy.

The results of the unit root test LLC point out the fact that all variables are stationary at level or at first difference. So, for all variables is rejected the null hypothesis of unit root after first difference, and it is accepted the alternative hypothesis of no unit root (see Table 2).

Table 2. Unit root test results at level and at first difference for the variables in Baltic countries

	Methods	Common unit root process LLC
ln*GHG*	Statistic (*p-value)*	-1.0911 (*0.1376*)
dln*GHG*	Statistic (*p-value)*	-4.3861 (*0.0000*)
ln*GVA*	Statistic (*p-value)*	-0.2465 (*0.4028*)
dln*GVA*	Statistic (*p-value)*	-2.5135 (*0.0060*)
ln*GDP*	Statistic (*p-value)*	-2.2356 (*0.0127*)
dln*GDP*	Statistic (*p-value)*	-3.8967 (*0.0000*)
lnGDP^2	Statistic (*p-value)*	-2.0371 (*0.0208*)
dlnGDP^2	Statistic (*p-value)*	-3.7308 (*0.0001*)

Note: ln*GHG* is natural logarithm of greenhouse gas emissions, ln*GVA* is natural logarithm of the gross value added, ln*GDP* is natural logarithm of real gross domestic product per capita and lnGDP^2 is square of natural logarithm of real gross domestic product per capita, LLC is Levin-Lin-Chiu test

Cointegration test should be performed on the level form of the variables and not on their first difference. The first cointegration test is the Pedroni test. Considering that all variables are stationary at a first different, there were made cointegration tests necessary to check if there is a long term cointegration relation among the variables of the model (see Table 3).

Table 3. Pedroni co-integration test for the variables in Baltic countries

Alternative hypothesis: common AR coefficients (within-dimension)				
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-1.0522	0.8537	-1.1745	0.8799
Panel rho-Statistic	1.2017	0.8853	1.0500	0.8532
Panel PP-Statistic	-2.6977	0.0035	-3.6991	0.0001
Panel ADF-Statistic	-4.6430	0.0000	-5.5559	0.0000
Alternative hypothesis: individual AR coefficients (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	1.9545	0.9747		
Group PP-Statistic	-3.6251	0.0001		
Group ADF-Statistic	-6.0580	0.0000		

Note: v-Statistic is non-parametric variance ratio statistics, rho-Statistic is panel version of a non-parametric statistics that is analogous to the familiar Phillips Perron rho-statistics, PP-Statistic is Phillips and Perron test, ADF is Augmented Dickey-Fuller test

The results of the test presented in table 3 showing within-dimension part, four of the eight statistic tests reject the null hypothesis while the in between dimension part, two of the three statistic tests accept the alternative hypothesis. This fact points out the existence of a long term cointegration relation among the variables of the model.

Taking into account the fact that not all the results included in the Pedroni test indicates the existence of a cointegration relation among the variables of the model, in order to provide the accuracy of the analysis was carried out by the cointegration test Kao. Kao is the first author to suggest the test for cointegration in homogeneous panels (see Table 4).

Table 4. Kao co-integration test for the variables in Baltic countries

	t-Statistic	Prob.
ADF	-4.312725	0.0000
Residual variance	0.021171	0.0000
HAC variance	0.016932	0.0000

The Kao test statistics are calculated by pooling all the residuals of all cross-sections in the panel (Hoang, 2010). It is assumed in Kao's test that all the cointegrating vectors in every cross-section are identical. The Kao test follows the same basic approach as the Pedroni tests but specifies cross section specific intercepts and homogeneous coefficients on the first-stage regressors. Kao Residual Cointegration test also shows that null hypothesis of no cointegration is rejected and the p-value (0.0000) gives a strong evidence that the variables have a long run relationship.

Assessing the long term cointegration coefficients was carried out by using the PMG estimator. The results from table 5 point out the fact that on a long term there is a cointegration relation among the greenhouse gases emissions, the long term cointegration coefficients. The results from table 5 point out the fact that on a long term there is a cointegration relation among the greenhouse gases emissions, the blue economy and the economic growth. Analysing the coefficients associated with the variables ln*GDP* and lnGDP^2 we can formulate the conclusion that this panel of three Baltic countries is on the U shape curve (conventional EKC) on a long run, because the coefficient associated to the linear term GDP per capita is negative and that associated to the nonlinear term (GDP^2) is positive. This result does not support Environmental Kuznets Curve Theory according to which greenhouse gas emissions increase within the first phase of the economic growth and decrease after reaching a certain point (see Table 5).

Table 5. Long run estimates – Pooled Mean Group (PMG) model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
		Long Run Equation		
ln*GVA*	1.4876	0.3279	4.5363	0.0007
ln*GDP*	-60.653	13.4314	-4.5157	0.0007
lnGDP^2	3.0783	0.7117	4.3248	0.0010

Note: ln*GVA* is natural logarithm of the gross value added, ln*GDP* is natural logarithm of real gross domestic product per capita and lnGDP^2 is square of natural logarithm of real gross domestic product per capita

As for the blue economy, according to the results obtained from Table 5, this influences positively the greenhouse gases emissions, therefore for a growth with a unit of the gross added value in the blue economy there will be an increase of 1.487 units of the greenhouse gases emissions. This might be explained by the fact that the economic activity from the seas and oceans is only based on the use of the renewable energy resources, but n traditional sources liberating in the atmosphere harmful gases for the environment. Another example in this sense is represented by the sector of maritime transport, liberating in the atmosphere a higher quantity of CO_2, the most important greenhouse gas. The first data obtained from the EU system to monitor, report and verify CO_2 emissions from ships over 5000 gross tonnage showed that they emitted more than 138 million tonnes of CO_2 into the atmosphere in 2018 (3) (see Table 6.).

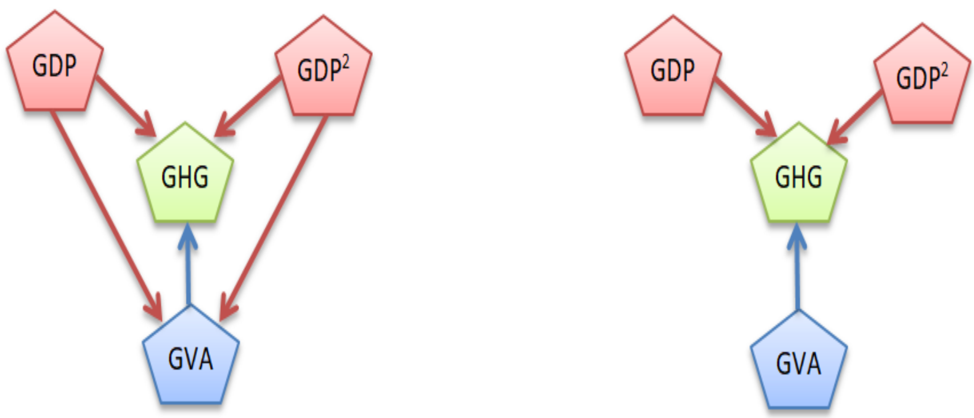
Table 6. VECM estimation for the variables in Baltic countries

Error Correction:	d(ln*GHG)*	d(ln*GVA)*	d(ln*GDP)*	d(lnGDP^2)
ECT(-1)	-0.6296	-0.1199	-0.0412	-0.9004
	(0.1465)	(0.1324)	(0.0402)	(0.6621)
d(ln*GHG*(-1))	-	0.0270	0.0480	0.8933
		(0.8367)	(0.2285)	(0.1738)
d(ln*GVA*(-1))	0.5968	-	-0.0726	-1.2099
	(0.0015)		(0.1604)	(0.1552)
d(ln*GDP*(-1))	9.1715	12.9673	-	3.9640
	(0.0489)	(0.0021)		(0.8506)
d(lnGDP^2(-1))	-0.7058	-0.6973	-0.0183	-
	(0.0136)	(0.0070)	(0.8152)	

Note: ln*GHG* is natural logarithm of greenhouse gas emissions, ln*GVA* is natural logarithm of the gross value added, ln*GDP* is natural logarithm of real gross domestic product per capita and lnGDP^2 is square of natural logarithm of real gross domestic product per capita, *VECM* is Vector Error Correction Model, *ECT* is lagged error correction term

The existence of a cointegration relationship between the variables of the model implies the existence of a causality relationship at least from one direction. To determine the causality relationship between greenhouse gas emissions, gross value added from blue economy, GDP and GDP2, the Granger test based on VECM framework was used. This test shows if there is a short-run, long-run or strong causality between the variables. To explain the long-run causal effects, the t-statistics of the ECT are analysed. If the value of t-statistics is negative, then there is a long-run relationship among variables. As for the existence of a short-term relation among variables, this is given by the p-value granted for the coefficients associated with each variable. Therefore, if the p-value is lower than 0.5, then the null hypothesis with the lack of cointegration is rejected and it is accepted the alternative hypothesis of a existence of a short term causality relation among the variables of the model.

The results obtained regarding the existing causality relation among the greenhouse gases, the blue economy and the economic growth were summed up in the figure below.



a) Short-run relationships b) Long-run relationships

Figure 4. Summary of Granger causality relationships in Baltic countries

According to the results obtained in the Figure 4, the direction of causality on the short run is from gross domestic product (GDP and GDP^2) to greenhouse gas emissions (GHG) and from GDP and GDP^2 to gross value added from blue economy (GVA). This means that, on the short run, the levels of greenhouse gas emissions and those of gross value added from blue economy do not have any influence on GDP and GDP^2. On the other hand, the direction of causality from gross value added from blue economy to greenhouse gas emissions, on the long and short run, demonstrate the real influence that blue economy has on greenhouse gas emissions.

Moreover, the results above prove that economic growth and gross value added from blue economy has a significant influence on reducing greenhouse gas emissions on a long and short run in the three Baltic countries, while on a short run the influence of economic growth on blue economy was identified, meaning that for the countries with a high level of pollution the level of economic growth is important when they aim for results on a long run, but at the same time they have to focus on other measures on a short run in order to reduce the negative impact that the activities from the maritime field generate on the climate changes.

4. Conclusions

The purpose of the paper is to analyse the correlations among the blue economy, the climate changes, and the economic growth in the three Baltic countries in Europe (Estonia, Latvia and Lithuania). The motivation of choosing these three Baltic States resides in the fact that they implemented similar reduction tools for the GHG emissions, based on the requests of the EU accession but these measures determined different effects on the GHG emissions.

The novelty element of the paper is represented by the causality relations among the greenhouse gases emissions, the blue economy and the economic growth under the form of a data panel in the period 2009-2018, using the PMG and VECM methods and taking into account the fact that there is a lower number of information regarding the blue economy and studies analysing the effects generated by the maritime activities on the climate changes. At the same time, this type of analysis was not approached in other research studies and gained a significant importance in EU starting with 2009, when the European Commission published the first information on this subject.

Another novelty element of the paper is using and including the gross added value in the chosen pattern in the blue economy (GVA) synthesizing all the economic activity fields within the blue economy because the analysis of a single cause generating changes on the environment might lead to contradictory results in a multi-varied natural environment, representing a major uncertainty resource for future projections.

Therefore, the results obtained indicate the fact that on a long term there is a cointegration nexus among the greenhouse gases emissions, the blue economy, and the economic growth. As for the blue economy, according to the results obtained they influence positively the greenhouse gases emissions. This can also be explained by the fact that the economic activity from the seas and oceans sector is rather based on traditional sources liberating harmful gases in the atmosphere rather than on renewable energy sources. Moreover, we identified unidirectional causality nexus and from the economic growth on the greenhouse gases emissions on a short and long term, as well as from the economic growth on the blue economy on a short term.

Although EU set norms regarding the marine fuels (Directive 2001/81/CE) as well as obligations regarding the monitoring, reporting and checking the emissions with the purpose of protecting and improving the quality of the environment and of the human health against the SOx and CO_2 emissions in the air generated by the maritime transport, there is no legislative text specific for EU regarding other sources of gases emissions as for example the NOx from the international maritime transport. In this context, the future research studies might focus on the effects of these emissions.

The limitations of this study can be outlined on one hand, by the fact that the analysis only includes the Baltic Countries and therefore we propose to include other EU countries within our study. On the other hand, once the threats on the oceans and seas will be more varied, we shall include other macroeconomic variables in the proposed model.

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