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EXPORT, ENERGY CONSUMPTION AND ECONOMIC GROWTH INTER-LINKAGES: THE CASE OF LITHUANIA

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Abstract

This paper has aimed to examine the causal relationships between energy consumption – economic growth, export – energy consumption and export – economic growth in Lithuania during the period of 1998 – 2015. Descriptive statistics analysis and econometric techniques have been applied for this purpose. Granger causality test has been used to a time series data set to determine the causality between variables. The results of Granger causality test have shown unidirectional causality running from GDP to energy consumption, from export to GDP and from export to energy consumption. It is obvious that GDP and export play significant roles in accelerating energy consumption in Lithuania. The determination of the causal links between energy consumption – economic growth, export – economic growth and energy consumption – export has provided policy makers with the main insights to formulate future policy directions for sustainable economic development in Lithuania.

Keywords: economic growth; energy consumption; export; Granger causality; Lithuania.

JEL classification: F10; O47; Q43.

1. INTRODUCTION

The relationships between energy consumption, export and economic growth have received increasing attention within years (Dawe, 1996; Destek, 2016; Foster, 2006; Furouka, 2017; Jun, 2007; Lin and Moubarak, 2014; Sharma and Dhakal, 1994; Uk Polo, 1994; Ullah, 2009). In the context of different economies, researchers around the world have tried to find the truth about the factors which impact on economic growth. Over the years, key concepts have been analyzed with the aim to explain their effects on variability of growth (Pirlogea and Cicea, 2012). From the theoretical point of view, unidirectional, bidirectional and neutrality approaches have prevailed in the latest studies (Adewuyi and Adeniyi, 2015; Ahmed and Azam, 2016; Balitskiy *et al.*, 2016; Ee, 2016; Mutascu, 2016; Saidi and Hammami, 2015; Shahzad *et al.*, 2017; Trost and Bojnec, 2015) examining the

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relationships among energy consumption, export and economic growth. Despite the fact that the results of the studies have varied across the countries, the relationships between energy consumption, export and economic growth may be described as one of these three types of relationships. It should be noted that these three types of approaches within the scientific literature may be due to the selections of the countries, data time spans, empirical econometric model settings or other explanatory variable selections (Chen *et al.*, 2016). Moreover, it is worth noting that energy consumption has been a relatively new factor seen as a driving force of economic growth that has not been included in the growth models (Pirlogea and Cicea, 2012). Trade openness is an important factor of economic growth and the increase in export promotes the economic activities and the energy demand (Sadorsky, 2012). Competition in international markets increases efficiency by concentrating resources in sectors in which the country has a comparative advantage (Mishra, 2011).

In recent years increasing energy consumption in the European Union countries has posed serious development constraints. In the next twenty years energy consumption will continue to grow. It has been estimated that global energy demand will increase around fifty percent (Ozkan, 2011; Dudzeviciute and Tamosiuniene, 2014). Energy is considered as the basic input used in the production process and a precondition of sustainable economic development (Alam *et al.*, 2016).

According to Gokmenoglu *et al.* (2015), export effects on economic growth by promoting the domestic producers to use better resources and to be more competitive in the international markets. Export plays a big role for the balance of payments of countries and creates the job opportunities. The export of a country is often considered as an indicator of its competitiveness (Neves *et al.*, 2016).

The presence of the causal relationships among energy consumption, export and economic growth has important implications on development strategies in Lithuania.

The object of the research: causal relationships between energy consumption – economic growth, export – economic growth and energy consumption – export in Lithuania.

The aim of the research: this research attempts to provide more reliable estimates of the relationships among energy consumption, export and economic growth in Lithuania during the period of 1998 – 2015.

Limitation of the research: the research has been bounded by three indicators, such as energy consumption in thousand tons of oil equivalent (TOE), export as a percentage of GDP and GDP per capita. Other indicators have not been considered in this paper. It is the main limitation of this investigation. Despite the limitation, the research highlights causal relationships, which are expected to be useful for policy makers in Lithuania.

Scientific contribution of this paper. Firstly, the Lithuanian economy is energetically dependent, export is a driving force of economic growth and high energy-intensive production makes significant share in exports, also a great contribution to total value added (Dudzeviciute, 2013). Secondly, the lack of such kind of research in Lithuania where these variables (export, energy consumption, economic growth) are examined together. Applying systematic approach, the authors combine these key factors and assessing causality among them provide the main insights for policy formulation.

The paper is divided into sections. Section 2 is aimed at the recent studies overview and research methodology. The long-run relationships between energy consumption – economic growth, export – economic growth and energy consumption - export are examined in the Section 3. Section 4 summarizes the results of the research and provides the main insights for policy implication.

2. EMPIRICAL EVIDENCE AND RESEARCH METHODOLOGY

2.1 Causal relationships among energy consumption, export and economic growth in recent studies

Energy consumption – economic growth nexus

The relationship between energy consumption and economic growth has received increasing attention in recent years. Historically the relationship between energy consumption and economic growth has undertaken massive attention in the scientific literature after 1970s energy crises pioneered by Kraft and Kraft (1978). Energy consumption – economic growth nexus has been examined by a great number of studies (Ahmed and Azam, 2016; Alper and Oguz, 2016; Apergis and Payne, 2012; Bartleet and Gounder, 2010; Belke *et al.*, 2011; Bildirici, 2016; Bobinaite *et al.*, 2011; Campo and Sarmiento, 2013; Chen *et al.*, 2012; Eggoh *et al.*, 2011; Kahia *et al.*, 2016; Masih and Masih, 1996; Saidi and Hammami, 2015; Tang *et al.*, 2016). The subject of relationship between energy consumption and economic growth has been still unresolved issue theoretically and empirically as well. From policy perspective, the direction of the causality between energy usage and economic growth may have a significant impact on energy conservation policies Kalyoncu *et al.* (2013). Overall, some useful findings for policy implication have been revealed and different views have been described.

The first view discloses the unidirectional causality running from energy consumption to economic growth, known as *growth hypothesis* (Destek, 2016). This relationship has shown an energy dependent economy and limited access to energy supply can result in poor economic growth. In this case, policy implication should aim at improving access to energy for population and industries. The second view indicates the unidirectional causality from economic growth to energy consumption, known as *conservation hypothesis.* In this case economic growth is the main factor, which causes energy consumption (Paul and Bhattacharya, 2004). Energy management policies with the increase of energy efficiency will have no adverse impact on economic growth (Ouedraogo, 2013). Also prior studies have presented bidirectional causality between energy consumption and economic growth, known as *feedback hypothesis* (Payne, 2009). It implies two-way causal relationship, that energy usage and economic growth Granger cause each other. Finally, some studies have detected the absence of causality between energy consumption and economic growth, which is called as *neutrality hypothesis.* According to Ouedraogo (2013), under this scenario, policy addressed to promote energy consumption will not have effects on economic growth. The main insights of the latest studies supporting unidirectional, bidirectional relationships and the absence of causality between energy consumption and economic growth have been revealed below.

The study of Alper and Oguz (2016) examined the causal relationship between renewable energy consumption and economic growth in the EU counties covering the period of 1990–2009 and employing autoregressive distributed lag and causality test. The results have shown no causality between renewable energy consumption and economic growth in Cyprus, Estonia, Hungary, Poland, and Slovenia. Causality running from economic growth to energy consumption has been found in Czech Republic. Additionally, Bulgaria has supported the growth approach, referring to the causality from renewable energy consumption to economic growth. Ahmed and Azam (2016) investigated the causal nexus between energy consumption and economic growth for 119 countries from all over the world in the period of 30 years. The empirical results have revealed that 18 countries

support the existence of feedback hypothesis, 25 countries confirm growth hypothesis, 40 countries hold conservation hypothesis, while 36 countries suggest neutrality hypothesis between energy consumption and economic growth. Streimikiene and Kasperowicz (2016) examined the long-run relationship between economic growth and energy consumption, fixed capital and total employment for 18 EU countries during the period of 1995–2012. The results have revealed the positive and statistically significant relationships among energy consumption, gross fixed capital and economic growth. Mutascu (2016) investigated energy consumption – economic growth nexus in the countries of the Group of Seven (G7) during the period of 1970 – 2012. The findings have shown bidirectional causality between energy consumption and GDP in Canada, Japan and United States. Unidirectional causality running from GDP to energy consumption has been found in France and Germany, while no causality has been detected for Italy and United Kingdom. Narayan (2016) re-examined the nexus between energy consumption and economic growth through the predictability framework for 135 countries covering the period of 1984 – 2010. The findings have revealed a strong support for the neutrality hypothesis. Developing countries (90 countries) have confirmed the conservative hypothesis, although a panel of 32 lower middle-income countries have suggested that energy consumption per capita has predicted real GDP per capita. The paper of Balitskiy *et al.* (2016) evaluated the relationship between energy efficiency, consumption of the natural gas and economic development in the European Union over the period of 1997 – 2011. It has become obvious that the increasing economic output in the EU countries results in the growing consumption of the natural gas. According to the researchers, the findings might be relevant for formulating the policy framework increasing energy efficiency. Furouka (2017) analyzed the case of the Baltic States during the period of 1990 – 2011 and found that in these countries the economic development causes the expansion of renewable electricity consumption, but not vice versa.

To conclude, recent studies have shown that causality varies across the countries observed due to the period of study and the use of econometric techniques. The subject of relationship between energy consumption and economic growth has been still unresolved issue theoretically and empirically as well. From policy perspective, the direction of the causality between energy usage and economic growth may have a significant impact on energy policies.

Export – economic growth nexus

The nexus between export and economic growth has still been a subject of extensive debate since the 1960s. Four prevailing approaches have been described in recent studies regarding export – economic growth nexus (Fosu, 1990; Wernerheim, 2000). The first approach is export-led growth. This approach has suggested that export promotes economic growth (Dritsaki, 2013; Ee, 2016; Lee, 2011; Trost and Bojnec, 2015). Economic policy should be addressed to speed up the industrialization process of the countries by opening markets to foreign trade and, ultimately, economic growth (Sharma and Dhakal, 1994; Dawe, 1996). The second approach is growth-driven export. It indicates that export follows economic development (Mishra, 2011; Abbas, 2012; Tekin, 2012; Gokmenoglu *et al.*, 2015). Referring to this view, policy makers should focus on growth factors and ensure effective allocation of resources. The third approach based on bidirectional causality between export and economic growth. It implies two-way causal relationship between variables (Jun, 2007; Dritsaki and Stiakakis, 2014; Hussaini *et al.*, 2015). That is, economic

growth causes export and vice versa. Finally, the fourth approach states that there is no causal relationship between export and economic growth (Marwan *et al.*, 2013).

Although the export – growth nexus has been still unresolved issue, however, some findings have been revealed in some studies (Foster, 2006; Jun, 2007). The study of Marwan *et al.* (2013) examined the relationship between export and economic growth in Sudan using annual data for the period of 1977 – 2010. The research has revealed no causal relationship between the variables. It has implied that export does not cause economic growth and vice versa. A bidirectional causal relationship between export and economic growth has been confirmed by the study of Dritsaki and Stiakakis (2014). Their research was focused on Croatia for the period of 1994 – 2012. Moreover, Szkorupova (2014) studied causal relationship between foreign direct investment, export and economic growth in Slovakia using the data of 2001 – 2010. The study has revealed a positive impact of foreign direct investment and export on economic growth. Gokmenoglu *et al.* (2015) found unidirectional causality running from economic growth to export in Costa Rica over the period of 1980 – 2013. Trost and Bojnec (2015) analysed export – economic growth nexus in Slovenia using the quarterly data for the period of 2001 – 2014. The results of the research have shown the causality from export to economic growth. Hussaini *et al.* (2015) examined export – growth nexus for India for the period of 2001 – 2014. The study has confirmed bidirectional causality between export and GDP. More recently, Ee (2016) studied the validity of export-led growth approach in selected Sub-Saharan African for the period from 1985 to 2014. The results have revealed a long-run and a positive impact of export on economic growth.

Generally speaking, recent studies have revealed a positive relationship between export and economic growth; however, the direction of the causality varies across the countries observed.

Energy consumption – export nexus

The relationship between energy consumption and export is a significant area of research. According to Adewuyi and Adeniyi (2015), if energy use causes export, it shows that any drops in energy consumption arising from government policy such as energy conservation polices will bring about reduction in export. On the other hand, promotion of economic performance through export facilitated by trade liberalization will be jeopardized by energy conservation policies. A review of literature has revealed that there have been a number of studies on the link between energy consumption and export (Adewuyi and Adeniyi, 2015; Al-mulali and Sheau-Ting, 2014; Damette and Seghir, 2013; Roy and Yasar, 2015; Sadorsky, 2011; Shahzad *et al.*, 2017; Zheng *et al.*, 2011). Empirical analysis has shown mixed findings. According to Sadorsky (2011), over the past 30 years many economies have experienced large increases in trade and energy consumption. This has brought up an important question about trade effect on energy consumption. The author did research to study the impact of trade on energy use in a sample of 8 Middle Eastern countries from 1980 to 2007. The study has revealed Granger causality from export to energy consumption, and a bidirectional relationship between import and energy use. These results should be important and have implications for energy and environmental policies. Zheng *et al.* (2011) investigated the impact of export on industrial energy intensity to explore the possibility of reducing energy intensity through greater export in China. In general, with a dataset of 20 industrial sub-sectors over the period of 1999 – 2007, the results have suggested that greater export debases energy intensity of the industry. Taking into account the great differences in sub-sector characteristics, the researchers have concluded that there is no general export policy that would work for all industry in reducing

energy intensity. The characteristics and situations of individual industrial sub-sectors should be taken into consideration. Al-mulali and Sheau-Ting (2014) performed econometric analysis and determine the relationships between trade-energy consumption, trade-CO_2 emission, exports-energy consumption, exports-CO_2 emission, imports-energy consumption, and imports-CO_2 emission from 1990 to 2011. 189 countries from six different regions have been included into research. The study has revealed a long-run positive relationship between the trade variables-energy consumption and between the trade variable- CO_2 emissions in all the regions, excluding Eastern Europe. Moreover, at the country level, the results have indicated the feedback long-run positive relationship between the trade variables, energy consumption and CO_2 emission in the countries with a high level of economic development and significant share of trade to GDP. The study of Adewuyi and Adeniyi (2015) examined the relationship between energy use and trade, i.e. export and import from 1971 to 2010 in selected West African countries. Insignificant linkage between energy consumption and export has been found in Benin. Moreover, the results have shown one-way positive relationship running from energy use to import of the country. For Cote d'Ivoire, energy consumption has had insignificant relationship with export and import as well. With respect to Ghana and Nigeria, the causality has run from energy use to export. The case of Senegal has suggested bidirectional causality between variables. Finally, the case of Togo has indicated that export and import are insignificantly linked with energy consumption. The authors have suggested different policy implications across the selected West African countries. Moreover, the paper of Shahzad *et al.* (2017) empirically examined the cointegrating relationship between carbon emissions, energy consumption, trade openness and financial development in Pakistan using annual data for the period of 1971 – 2011. The results of Granger causality test have indicated a unidirectional causality from energy consumption, trade openness and financial development to carbon emission; and a bi-directional causality between energy consumption and financial development.

All in all, recent studies have shown mixed findings regarding energy consumption – export nexus. In this light, different policy implications across the countries should be suggested.

2.2 Data and methodology

In recent papers, various methodologies have been applied for the studies of relationships among energy consumption, export and economic growth. It should be noted, that contemporary research is usually based on correlation, regression and causality analysis or combinations of these methods. Granger causality test is the most commonly applied in such kind of the studies (Ee, 2016).

Table no. 1 has presented the summary of the recent studies using Granger causality test for the detecting relationships among energy consumption, export and economic growth.

This research has been based on Eurostat annual data over the period of 1998 – 2015 in Lithuania. The values of indicators are presented in Table no. 2. Final energy consumption expresses the sum of the energy supplied to the final consumer's door for all energy uses. It is the sum of final energy consumption in households, industry, transport, services, agriculture, etc. (Eurostat, 2015c). Export as a percentage of GDP reveals the role of export in the country's economy. GDP per capita shows the level of economic development. These indicators are most often used in economic research, analyzing economic growth in various aspects.

Table no. 1 – The summary of the recent studies using Granger causality test

Research object	Authors (year)	Countries	Period	Direction of causality
Export – Economic growth nexus	Shihab *et al.* (2014)	Jordan	2000 – 2012	Growth → Export
	Dritsaki and Stiakakis (2014)	Croatia	1994 – 2012	Export ↔ Growth
	Szkorupova (2014)	Slovakia	2001 – 2010	Export → Growth
	Trost and Bojnec (2015)	Slovenia	Quarterly data for the period of 2001 – 2014	Export → Growth
	Hussaini *et al.* (2015)	India	1980 – 2013	Export ↔ Growth
	Gokmenoglu *et al.* (2015)	Costa Rica	1980 – 2013	Growth → Export
	Ee (2016)	Sub-Saharan African	1985 – 2014	Export → Growth
Energy consumption – export	Al-mulali and Sheau-Ting (2014)	189 countries from six different regions	1990 – 2011	Energy consumption ↔ Export (in majority of the countries)
	Adewuyi and Adeniyi (2015)	West African countries	1971 – 2010	Energy consumption ↔ Export; Energy consumption ↔ Export; Energy consumption ≠Export (no causality).
Energy consumption – economic growth nexus	Alper and Oguz (2016)	European Union	1990 – 2009	Energy consumption ≠ Growth (no causality); Growth → Energy consumption; Energy consumption → Growth.
	Ahmed and Azam (2016)	119 countries from all over the world	The period of 30 years	Growth → Energy consumption; Energy consumption → Growth; Energy consumption ↔ Growth; Energy consumption ≠ Growth (no causality).
	Mutascu (2016)	Group of countries G7	1970 – 2012	Growth → Energy consumption; Energy consumption ↔ Growth; Energy consumption ≠ Growth (no causality).
	Narayan (2016)	135 countries	1984 – 2010	Growth → Energy consumption; Energy consumption → Growth; Energy consumption ≠ Growth (no causality).
	Bildirici (2016)	China	1987 – 2013	Energy consumption → Growth
	Tang *et al.* (2016)	Vietnam	1971 – 2011	Energy consumption → Growth
	Kahia *et al.* (2016)	MENA Net oil exporting countries	1980 – 2013	Growth → Energy consumption; Energy consumption ↔ Growth.

Source: summary made by authors

Table no. 2 – The dynamics of indicators in Lithuania

Years / indicators	Final energy consumption, TOE	Export, % of GDP	GDP per capita, EUR
1998	4472	39.1	2800
1999	4052	32.4	2900
2000	3767	38.5	3600
2001	3920	44.0	3900
2002	4087	47.3	4400
2003	4214	46.2	4900
2004	4402	47.3	5400
2005	4672	53.8	6300
2006	4933	55.6	7400
2007	5218	50.4	9000
2008	5138	57.1	10200
2009	4650	51.9	8500
2010	4814	65.3	9000
2011	4793	75.0	10300
2012	4913	81.6	11200
2013	4794	84.0	11800
2014	4893	80.9	12400
2015	4869	75.9	12800

Source: Eurostat (2015b, 2015c, 2015d)

The research consists of some steps, which are presented, in Figure no. 1. Descriptive statistics analysis has allowed assessing the dynamics of different variables (energy consumption, export, economic growth) over two decades. Correlation analysis helps to detect relationships among variables under consideration.

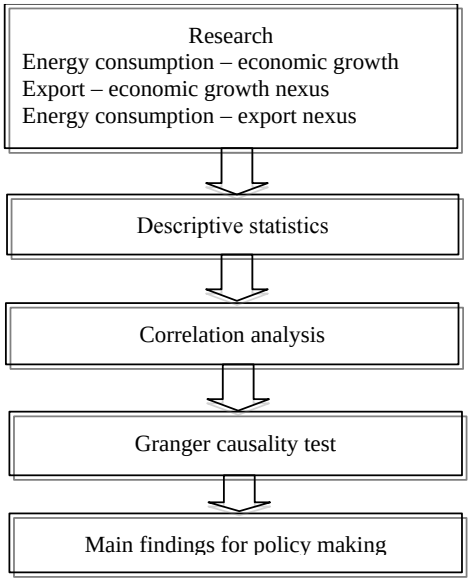

Figure no. 1 – The framework of the research

Granger (1969) causality test has been employed to modeling the relationships and for the estimation of causality among energy consumption, export and economic growth. The advantage of the Granger causality is that it demonstrates the likelihood of the causation or the lack of such causation more forcefully than does simple correlation (Stern, 2011).

Granger causality test is expressed by two regression equations as follows (Mehmood, 2013; Gokmenoglu *et al.*, 2015; Dudzeviciute and Tamosiuniene, 2014):

$$y_t = \beta_{1,0} + \sum_{i=1}^{p} \beta_{1,i} y_{t-i} + \sum_{j=1}^{p} \beta_{1,p+j} x_{t-j} + \varepsilon_{1t} \quad (1)$$

$$x_t = \beta_{2,0} + \sum_{i=1}^{p} \beta_{2,i} y_{t-i} + \sum_{j=1}^{p} \beta_{2,p+j} x_{t-j} + \varepsilon_{1t} \quad (2)$$

where: p is the number of lags, β- parameter, ε- error.

If the p parameters $\beta_{1,p+j}$ are jointly significant then the null hypothesis that x does not Granger cause y can be rejected. Similarly, if the p parameters $\beta_{2,i}$ are jointly significant then the null hypothesis that y does not Granger cause x can be rejected. Granger causality test is based on the concept of causal ordering and assumption as follows: a variable x is said to Granger cause another variable y if past values of x help predict the current level of y given all other appropriate information (Stern, 2011; Dudzeviciute and Tamosiuniene, 2014).

All calculations have been performed applying Windows-based econometric software Eviews v. 8.0.

3. THE EXAMINATION OF THE RELATIONSHIPS

3.1 The analysis of relations among energy consumption, export and economic growth

In this section, the long-run relationships among energy consumption, export and economic growth have been examined in Lithuania. The analyzed period involves the years from 1998 to 2015. Descriptive statistics analysis has been performed and the results have been presented in Table no. 3.

Table no. 3 – Descriptive statistics

Variables	Mean	Max	Min
Final energy consumption, TOE	4589	5218	3767
Export, % of GDP	57	84	32
GDP per capita, Eur.	7600	12800	2800

Source: authors' calculations based on Eurostat data (Eurostat, 2015b, 2015c, 2015d)

As table above has shown, the values of indicators vary over the period. Taking into consideration maximum and minimum values of the variables, the most significant changes in percent have been in GDP per capita. It is obvious that GDP per capita has varied mostly over the specified period of time. This indicator has informed about the level of economic development of the country. Figures no. 2, no. 3 and no. 4 show the association between these variables in Lithuania.

Figure no. 2 – Interrelationships between variables of export and economic growth
Source: Eurostat data (Eurostat, 2015c)

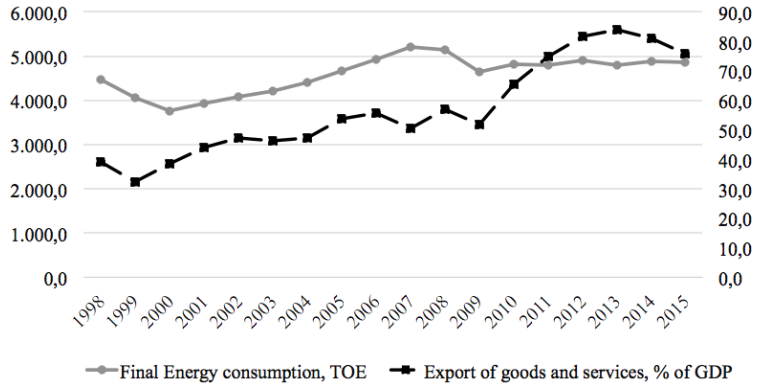

Figure no. 3 – Interrelationships between variables of energy consumption and export
Source: Eurostat data (Eurostat, 2015b)

Further, correlation analysis has been applied for the determination of the relationships among variables under consideration.

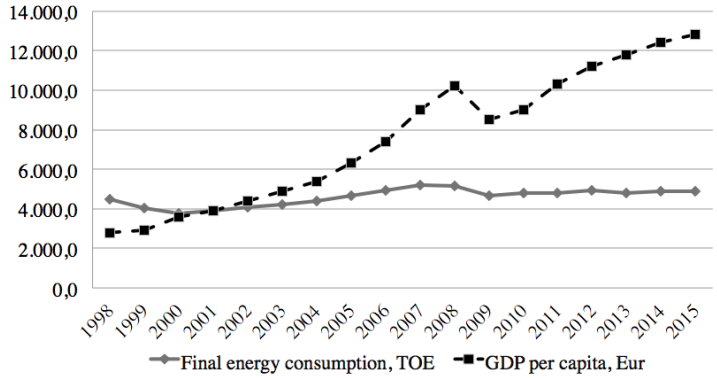

Figure no. 4 – Interrelationships between variables of energy consumption and economic growth
Source: Eurostat data (Eurostat, 2015d)

In Lithuania the positive relationship between energy consumption – economic growth, export – economic growth and energy consumption – export has been indicated. It means that all variables have moved to the same direction that is as one variable increases the others go up also and vice versa. To get detailed information about the relationships and their significance, the correlation has been calculated and its significance assessed.

Table no. 4 has comprised Pearson's correlation coefficients and their significances, which have been checked using t statistic. The correlation analysis has led to the conclusion about the significant and strong relationship between energy consumption and economic growth; significant and very strong relationship between export and economic growth; and significant and moderate interrelationship between energy consumption and export.

Table no. 4 – Pearson's correlation between variables

Variables	Correlation coefficient	t^{stat}	t^{cr}	Significance*
Energy consumption and economic growth	0.80	5.34	2.12	+
Export and economic growth	0.92	9.50		+
Energy consumption and export	0.65	3.41		+

Note: *+ significant; - insignificant

Source: authors calculations based on Eurostat data (Eurostat, 2015b, 2015c, 2015d)

Although the correlation analysis has informed about the strength of the relationships, but it has said nothing about the causality. To this end, the Granger causality test has been applied to a time series data set to determine the causality between variables.

3.2 Causality analysis

Granger causality test has been used in this section in order to study the forerunner-lag relationship between energy consumption and economic growth; export and economic growth; and energy consumption and export. One variable is said to Granger causes another variable if past values of one variable help predict the current level of another variable. Granger test is based on the concept of causal ordering. The results after applying Granger test for Lithuania are presented in Table no. 5. The null hypothesis is rejected if probability associated to F-statistic is ≤0.10. Conversely, the null hypothesis is accepted if the associated probability of F statistic is >0.10.

Table no. 5 – The results of Granger causality test

Null hypothesis	Observations / Lags	F-statistic	Probability	Test results
GDP does not Granger cause of Energy consumption	Obs.: 13	46.0165	0.0214	Rejected
Energy consumption does not Granger cause of GDP	Lags: 5	3.63466	0.2297	Accepted
GDP does not Granger cause of Export	Obs.: 15	2.64960	0.1203	Accepted
Export does not Granger cause of GDP	Lags: 3	3.46190	0.0711	Rejected
Export does not Granger cause of Energy consumption	Obs.: 13	227.335	0.0044	Rejected
Energy consumption does not Granger cause of Export	Lags: 5	0.84091	0.6220	Accepted

Source: authors' calculations based on Eviews v. 8.0

The results of Granger causality test have revealed new empirical insights into the long – run relationships among variables. Firstly, the analysis has shown unidirectional causality

running from GDP to energy consumption. It has supported conservation approach. In this case economic growth is the main factor, which causes energy consumption. Secondly, Granger causality test has shown unidirectional causality from export to energy consumption. Generally speaking, the growth of GDP and exports accelerate energy consumption in Lithuania. It can be explain by the economic structural changes and the structure of export. From 1998 to 2015, service sector contribution to total value added increased from 60.2 percent to 66.5 percent, the industrial sector has almost remained the same and agriculture, forestry and fishing decreased from 8.7 percent to 3.6 percent (Eurostat, 2015e). Over the period of 1998 – 2015, high energy-intensive production has made over 30 percent in export structure of Lithuania (Dudzeviciute, 2013). Moreover, the research has revealed unidirectional causality from export to GDP. This has suggested export-led growth. The Lithuanian export makes significant share in GDP. From 1998 to 2015, the contribution of export to GDP increased from 39.1 percent to 75.9 percent (Eurostat, 2015b). So, export promotes economic growth, which requires more energy. As a result of this, energy consumption is increasing. Taking into account the Lithuanian energy dependency, which increased from 49.8 percent in 1998 to 78.4 percent in 2015 (Eurostat, 2015a) and the limitation of energy resources, enhancing energy efficiency and finding new alternatives would be an appropriate way to maintain and increase export volumes and, at the same time, economic growth. Also, economic policy should be addressed to speed up the industrialization process of Lithuania by investigating and opening new markets for export.

Next section summarizes the results of the research and provides the main insights for policy implication.

4. CONCLUSIONS

The paper investigates the long – run relationships between energy consumption – economic growth; export – economic growth and energy consumption - export in Lithuania. Applying systematic approach, the authors have combined these variables and assessing causality among them revealed the main insights addressed to policy making. It is the main scientific contribution of this paper.

The correlation analysis has led to the conclusion about the significant and strong relationship between energy consumption and economic growth; significant and very strong relationship between export and economic growth; and significant and moderate interrelationship between energy consumption and export.

The results of Granger causality test have provided new empirical insights into the long – run relationships among variables examined. The research has shown unidirectional causality running from GDP and export to energy consumption. It has supported conservation approach and states that economic growth and export are the main factors, which causes energy consumption. Moreover, Granger causality test has shown unidirectional causality from export to GDP. This has suggested export-led growth, where the main focus should be on industrialization process of Lithuania by investigating and opening new international markets for export and, ultimately, economic growth. The expansion of export can promote economic growth through different channels, such as openness, which increases sectors efficiency, attracting high inflow of foreign direct investments or improving living standards in the country.

On the one hand, increase in GDP and export promotes energy consumption. On the other hand, increase in export accelerates economic growth. Taking into account that

Lithuania is energetically dependent country and energetic resources are limited, increasing energy efficiency and the investigation for energy alternatives would be appropriate ways to contribute to economic development of Lithuania.

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