THE RESEARCH OF THE ECONOMIC STRUCTURAL CHANGES: ENERGY CONSUMPTION ASPECT*

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Abstract. This study consists of two research aspects. First of all, the author analyses the relationship of energy consumption and economic growth in the context of 13 selected countries in the period of year between 1990 and 2010. Secondly, using statistical techniques the paper takes into account cross-sectoral dependence when analyzing the relationship between energy consumption and economic structures of the same countries. Based on the energy consumption, the countries are divided into three groups: low energy consumption group, middle energy consumption group, and high energy consumption one. Statistical methods, including correlation analysis are employed for the estimation of the structural changes of economy and relationship between energy consumption and economic structure in each of the three groups. In general, the results of this study indicate that energy consumption is closely related to all economic activities for all groups of countries; however the case of Lithuania reveals the absence of relationship between energy consumption and industrial sector. Moreover, in the context of comparative analysis, China, as a high energy consumption country, has a completely different picture of economic structure as well as relation between energy consumption and structural changes. Economic sectors, such as industry, services and agriculture depend on energy resources, but in different degree in these three groups of countries.

Keywords: Economic structure, structural changes, energy consumption, industry, services, agriculture.

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1. Introduction

The relationship between energy consumption and economic growth has attracted a lot of attention in academic research. Scientists discuss the causality between economic growth and structure and energy consumption – the question whether this relationship exists and what is its nature has been raised (Dudzevičiūtė 2012, Vosylius *et al.* 2013, Tvaronavičienė 2012). The studies on energy consumption and economic growth have proposed the four major hypotheses, such as growth, conservation, feedback and neutrality (Ozturk 2010; Georgantopoulos 2012). The growth hypothesis says that energy consumption is an essential component in economic growth (Tvaronavičienė 2012, Vosylius et al. 2013). The presence unidirectional causality from energy consumption to economic growth signals the economy is energy dependent (Apergisu aad Danuletiu 2012; Vosylius *et al.* 2013).

The analysis of eighty two countries revealed the absence of causality between energy consumption and real GDP per capita whereas unidirectional causality from real GDP per capita to energy consumption for the middle and high income countries Huang *et al.* (2008). Ozturk (2010) did research of 51 countries and confirmed that there was long-run causality running from GDP to energy consumption for low income countries and a bidirectional causality for middle income countries. Conservation hypothesis suggests that energy conservation policies may have little or no impact on economic growth (Apergisu, Danuletiu 2012; Bobinaitė *et al.* 2011). This hypothesis was confirmed by Huang *et al.* (2008), analyzing 19 low income countries. Feedback hypothesis states there is bidirectional causality between energy consumption and economic growth. It reflects the interdependence associated with energy consumption and economic growth. Mahadevan and Asafu-Adjaye (2007) in a study of energy exporting developing countries supported this hypothesis and bidirectional causality between energy consumption per capita and real GDP per capita. Shahbaz *et al.* (2011) analyzing causality relationships between electricity consumption, capital and economic growth for Romania, found the presence of bidirectional causality as well between electricity consumption and economic growth. Feedback hypothesis was supported in many scientific studies (Mishra and Sharma 2009; Lee, C. and Lee, J. 2010; Ozturk 2010; Constantini and Martini 2010; Belke e*t al.* 2011).

Neutrality hypothesis supports the absence of causality between energy consumption and economic growth (Cheng-Lang *et al.* 2010; Chen *et al.* 2012). It implies that energy conservation policies will have an insignificant impact on economic growth (Apergisu and Danuletiu 2012; Vosylius *et al.* 2013).

Paper problem is related to the continuing scientific debate over the establishment of interaction between energy consumption and economic growth and structure.

Research aim is related, on the one hand, to the economic structural changes of the selected countries; on the other hand, to analysis of relationships among energy consumption and different economic structures.

Research methods: overview of scientific literature, comparative analysis of statistical data applying statistical methods.

2. Energy consumption and economic growth: empirical studies review of 2007-2012

Economic growth in academic works is defined and described by the growth of the gross domestic product (GDP) or GDP per capita mostly. GDP is the most widely-spread global indicator which is used to determine the country's economic level of development (Grybaitė 2011; Smaliukienė *et al.* 2012; Lankauskienė, Tvaronavičienė 2012; Tvaronavičienė 2012, Lapinskienė, Tvaronavičienė 2009). On the basis of the scientists' considerations, GDP in this paper will be used as a synonym for economic growth.

Recently published studies on the relationship of energy consumption and economic growth have been carried out in two ways – some scientists (Ho and Siu 2007; Lee and Chiu 2011; Apergis and Payne 2012) examine the relationship between separate energy resources and economic growth, others (Mehrara 2007; Chontanawat *et al.* 2008*;* Narayan and Smyth 2008; Akinlo 2009; Payne 2010; Apergisu and Danuletiu 2012; Ozturk 2012; Vosylius *et al.* 2013) analyse the relationship between a total energy consumption and economic growth.

Mehrara (2007) examined the causality between energy consumption and economic growth for three oil-exporting countries: Iran, Kuwait and Saudi Arabia. Two different test methods are used to test for causality, namely, the error correction model and Toda-Yamamoto (1995) procedure. The results based on both approaches consistently show a unidirectional long-run causality from economic growth to energy consumption for Iran and Kuwait and unidirectional strong causality from energy consumption to economic growth for Saudi Arabia. The results support the neutrality hypothesis of energy consumption and economic growth for Iran and Kuwait and vice versa for Saudi Arabia. The findings reveal that increased GDP requires enormous energy consumption in Saudi Arabia. According to author, it seems misleading to recommend the same policy for different oil-exporting countries (Mehrara 2007). Ho and Siu (2007) report the following findings for Hong Kong: (1) there is a long run equilibrium relationship between real GDP and electricity consumption, (2) a one-way causal exists from electricity consumption to real GDP, (3) there exists possible structural change in the relationship between electricity consumption and economic activities in 1990s. Chontanawat *et al.* (2008) test for causality between energy and GDP us-

ing a consistent data set and methodology for over 100 countries. The empirical evidence shows that the causality from energy to GDP exists and it is more prevalent in the developed OECD countries compared to the developing non-OECD countries. The research of Narayan and Smyth (2008) examines the relationship between capital formation, energy consumption and real GDP in G7 countries using panel unit root, panel cointegration, Granger causality and long-run structural estimation. The authors find that capital formation, energy consumption and real GDP are cointegrated and that capital formation and energy consumption Granger cause real GDP positively in the long run. The study reveals that a 1% increase in energy consumption increases real GDP by 0.12-0.39%, while a 1% increase in capital formation increases real GDP by 0.1-0.28% (Narayan and Smyth 2008). In Chiou-Wei *et al.* (2009) study the relationship between energy consumption and economic growth is considered as an imperative issue in energy economics. In this research, both linear and nonlinear Granger causality tests are applied to examine the causal relationship between energy consumption and economic growth for Asian countries as well as the United States. The findings of the study support a neutrality hypothesis for the United States, Thailand, and South Korea while unidirectional causality running from Philippines and Singapore. Empirical evidence reveals that energy consumption may have affected economic growth for Taiwan, Hong Kong, Malaysia and Indonesia (Chiou-Wei *et al.* 2009). Payne (2010) in the investigation employs United States annual data from 1949 to 2006 to compare the causal relationship between renewable and non-renewable energy consumption and real GDP, respectively. Given the sample size of the study, the Toda-Yamamoto causality tests reveal the absence of Granger-causality between renewable or non-renewable energy consumption and real GDP which supports the neutrality hypothesis. Ozturk (2010) in the study uses the panel data of energy consumption and economic growth (GDP) for 51 countries from 1971 to 2005. Firstly, a relationship between energy consumption and economic growth is investigated by employing panel cointegration method. Secondly, panel causality test is applied to investigate the way of causality between the energy consumption and economic growth. Finally, the authors test whether there is a strong or weak relationship between these variables. The empirical results of this study reveals

that energy consumption and GDP are cointegrated, however no strong relation is found between energy consumption and economic growth for all income groups countries. The panel causality test results reveal that there is long-run Granger causality running from GDP to energy consumption for low income countries and there is bidirectional causality between energy consumption and GDP for middle income countries. The findings of this study have important policy implications and it shows that this issue still deserves further attention in future research (Ozturk 2010). Lee and Chiu (2011) in the study apply panel data analysis to examine the short-run dynamics and long-run equilibrium relationships among nuclear energy consumption, oil prices, oil consumption, and economic growth for developed countries in the period of 1971-2006. According to the authors, the panel cointegration results show that in the long run, oil prices have a positive impact on nuclear energy consumption, suggesting the existence of the substitution relationship between nuclear energy and oil. Furthermore, the panel causality results find evidence of unidirectional causality running from oil prices and economic growth to nuclear energy consumption in the long run, while there is no causality between nuclear energy consumption and economic growth in the short run (Lee and Chiu 2011). Apergis and Payne (2012) examine the relationship between renewable and non-renewable energy consumption and economic growth for 80 countries over the period of 1990–2007. The scientists confirm that the Pedroni heterogeneous panel cointegration test show a long-run equilibrium relationship between real GDP, renewable energy consumption, non-renewable energy consumption, real gross fixed capital formation, and the labor force with the respective coefficient estimates positive and statistically significant. Furthermore, the results from the panel error correction model reveal bidirectional causality between renewable and non-renewable energy consumption and economic growth in both the short- and long-run (Apergis and Payne 2012). The study carried out by Apergisu and Danuletiu (2012) examines the relationship between energy consumption and economic growth for the economy of Romania over the period of 2000-2011. A cointegration and error correction model is employed to determine the causal relationship. Cointegration test reveals a long-run equilibrium relationship between real GDP, energy consumption, the labor force, and real gross fixed capital formation with the respective

coefficients positive and statistically significant. The Granger-causality results indicate both short-run and long-run causality from energy consumption to economic growth which supports the growth hypothesis (Apergisu and Danuletiu 2012). The results of the recent studies carried out by different scientists are summarized in the Table 1.

Table 1. Overview of studies on the energy consumption and economic growth

Author/year	Methodology	Object of research	The hypothesis supported			
			Growth	Conservation	Feedback	Neutrality
Mehrara (2007)	Cointegration; Error correction model; Toda-Yamamoto procedure	Three oil-exporting countries: Iran, Kuwait and Saudi Arabia	+			+
Ho and Siu (2007)	Unit root test; Error correction model	Hong Kong	+			
Chontanawat *et al.* (2008)	Hsiao procedure: Granger-causality, Akaike final prediction error.	30 OECD countries and 78 non-OECD countries	+			+
Narayan and Smyth (2008)	Unit root test, panel cointegration, Granger causality, structural estimation.	G7 countries	+			
Chiou-Wei *et al.*(2009)	Linear and nonlinear Granger causality tests	Asian countries and the United States	+			+
Payne (2010)	Toda-Yamamoto causality tests; Granger-causality test	United States				+
Ozturk (2010)	Cointegration method; Granger-causality test	51 countries	+		+	
Lee and Chiu (2011)	Cointegration method; Granger-causality test	Developed countries	+	+	+	
Apergis and Payne (2012)	Pedroni heterogeneous panel cointegration test; error correction model	80 countries	+		+	
Apergisu and Danuletiu (2012)	Cointegration and error correction model; Granger-causality test.	Romania	+			

Source: author's

Considering the results of the previous studies, different hypotheses were tested; however the biggest part of empirical surveys supported the growth one. Taking into account the different methodologies used in the studies, it seems that different combinations of methods can be applied.

3. Research of energy consumption and economic structure dependence

3.1. Methodology

The research was guided by the prevailing theories in scientific literature (Mehrara 2007; Mishra and Sharma 2009; Lee and Lee 2010; Ozturk 2010; Constantini and Martini 2010; Belke e*t al.* 2011; Georgantopoulos 2012; Apergisu and Danuletiu 2012; Vosylius *et al.* 2013) on the basis of which the hy-

pothesis was formulated: *there is a direct correlation between energy consumption and economic growth.* In order to support or reject the hypothesis, the correlation analysis, which was carried out with *Microsoft Excel* programs, was used. Also this paper uses recently developed panel techniques that accommodate both structural breaks and cross- sectoral dependence simultaneously. Thirteen countries, including Lithuania, were selected for the research. From the perspective of Lithuania, the purpose was to select as more as possible different countries that have their own characteristics of development and distinguish by some economic indicators from others in global context. So, different criteria were applied for these countries selection; they are summarized in the Table 2. Section 3.2 tests the hypothesis associated with the energy consumption and economic growth, which is

presented by GDP per capita, while Section 3.3 reports an overview of the energy consumption and economic structure in different groups of countries.

Table 2. Criteria for the selection of countries

Countries	Criteria	Description
US, China, Japan	World Trade centers	These countries make about 30% of World trade: US- 14%; China-11%; Japan-5%.
Germany, France, UK	Significant impact on EU economy and policy	These countries make about 40% of EU-27 export and about 50% of GDP.
Denmark, Sweden	Scandinavian countries that are characterized by successful development	These countries have one the highest indicator of GDP/ capita (more than 40 thou EUR) in the EU-27.
Switzerland, Norway	They are involved in TOP10 of the world countries by economic and social welfare	GDP/capita makes 71 thou EUR in Norway and 61 thou EUR in Switzerland. The richest population of the world live in these countries.
Latvia, Poland	These countries are close neighbors of Lithuania and have similar economic structure. They have accessed to EU at the same time.	

Source: World Bank, Eurostat

Based on the energy consumption, the countries are divided into three groups: low energy consumption group, middle energy consumption group and high energy consumption group. Concluding remarks are given in Section 4.

3.2. The research of relationship between energy consumption and economic growth

The statistics of different countries were used to determine the relationship between energy consumption (kg of oil equivalent) per USD 1000 GDP of particular years and GDP per capita in thou USD. The period of 1990-2010 is under examination (Fig. 1).
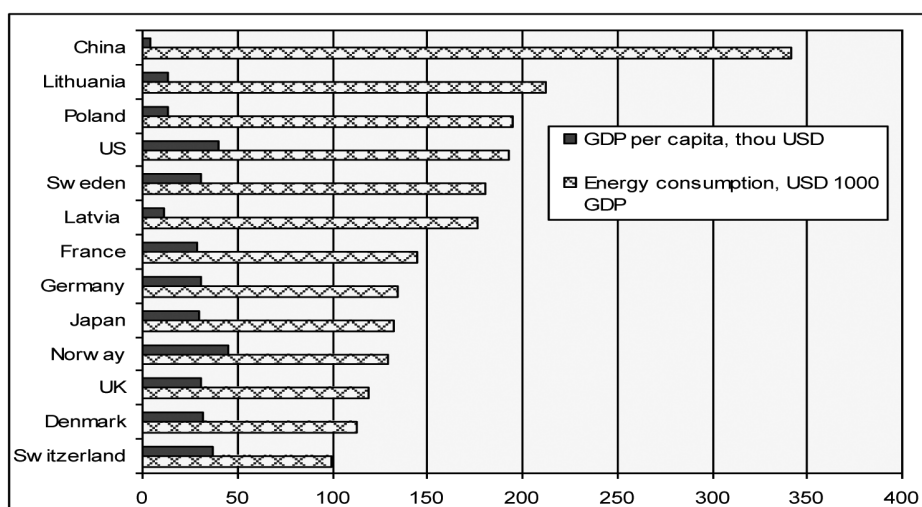

Fig.1. Energy consumption and economic growth, average data of 1990-2010

Source: World Bank, author's

As the Figure 1 shows, average annual energy consumption in the period of 1990-2010 varies from the highest of 342 kg of oil equivalent per $1000 GDP in China to the lowest of 99 kg per $ 1000 GDP in Switzerland. By energy consumption the countries are divided into four groups: low energy consumption group, middle energy consumption group, and high energy consumption group (Table 3).

Table 3. The groups of countries based on energy consumption

Groups based on energy consumption	Countries
Low energy consumption	Switzerland, Denmark, UK, Japan, Norway, Germany, France.
Middle energy consumption	Sweden, Latvia, US, Poland, Lithuania.
High energy consumption	China

Source: World bank, author's

Seven of 13 selected for research countries belong to low energy consumption group. These countries use from 99 kg to 145 kg of oil equivalent energy. Five countries belong to middle energy consumption group. Energy used per $1000 GDP in middle group countries varies from 170 kg to 212 kg of oil equivalent. The highest energy consumption rate is in China (over 340 kg of energy used per $ 1000 GDP).

Further, the relationship between energy consumption and GDP per capita is examined in selected countries (Table 4).

Table 4. Average energy consumption (kg of oil equivalent per $ 1000 GDP) and GDP per capita (USD)

Year	Low energy consumption group's countries		Middle energy consumption group's countries		High energy consumption group's countries	
	Energy consumption	GDP/capita, USD	Energy consumption	GDP/capita, USD	Energy consumption	GDP/capita, USD
1990	145	27463	288	12721	691	1101
1995	140	29281	274	11914	470	1849
2000	127	32573	197	14497	325	2667
2001	129	32925	200	14806	299	2868
2002	125	33054	196	15207	297	3108
2003	127	33245	190	15777	307	3398
2004	124	33971	183	16546	325	3719
2005	121	34536	172	17239	316	4115
2006	119	35366	162	18119	307	4611
2007	114	36158	157	18982	284	5239
2008	115	35963	154	19009	280	5712
2009	115	34420	156	17810	273	6206
2010	116	35041	160	18446	270	6819
Correlation	*-0,97*		*-0,93*		*-0,72*	

Source: World Bank, author's

The results of the research show negative interrelationship between energy consumption and GDP per capita in every analyzed countries' group: as GDP per capita grows, energy consumption decreases. Taking into account 1990-2010 average data, it is notable that as the country consume less energy, as stronger relationship with GDP per capita exists. China has the highest energy consumption level, but the lowest interrelationship with GDP per capita. This analysis rejects formulated hypothesis in Section 3.1 that a direct correlation between energy consumption and economic growth exists.

The structural changes in economy of three groups of countries and energy consumption dependence on these one will be analyzed next.

3.3. Energy consumption and economic structures: the review of the selected countries

The research was guided by analyzing the average date of GDP structure and energy consumption for the period of 1990-2010 years. The analysis of the average data shows the biggest share of industry sector in economy of China, Norway and Poland. It makes from 35 to 46 percent of GDP (Fig. 2).
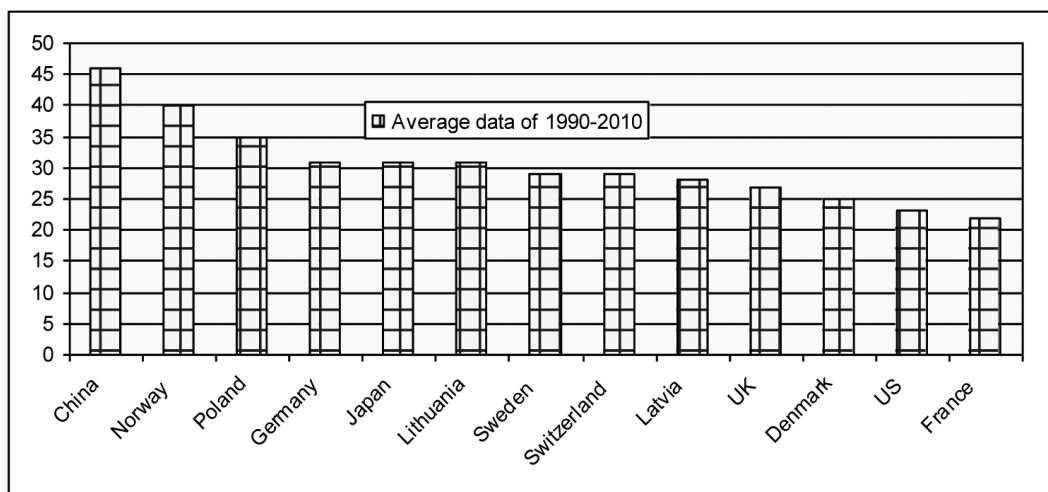
Fig.2. Industry's share in GDP

Source: World Bank, author's

Lithuania with 31% of industry's share in GDP belongs to the same group as Germany and Japan. Industry sector's share in GDP varies from 27 to 29 percent in UK, Latvia, Switzerland and Sweden. France, US and Denmark have the least shares of industry. They make from 22-25 percent.

Service sector dominates the GDP in twelve selected countries except China, where industry takes bigger share of economy than services (Figure 2, 3).
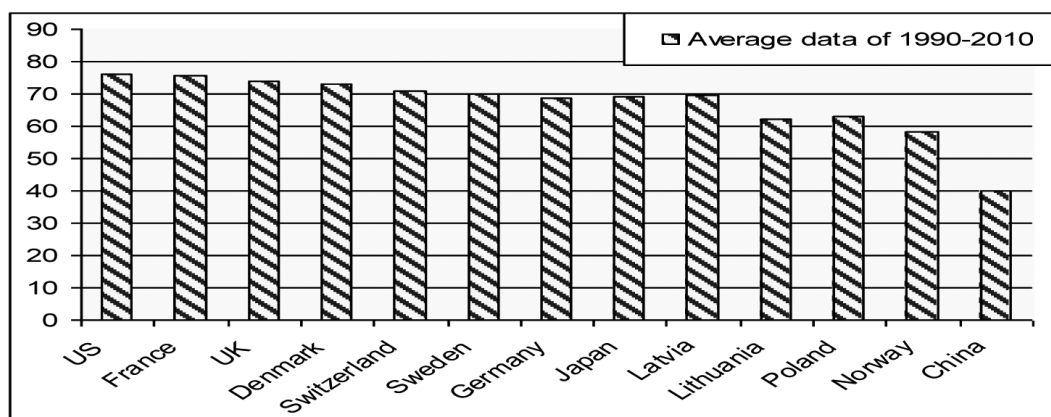

Fig.3. Service sector's share in GDP

Source: World Bank, author's

Services sector makes from 69 to 75 percent in nine countries under examination. According to the average data of 1990-2010, Lithuania as well as Poland and Norway belong to the same group, where service sector produces from 58 to 62 percent of GDP. Agriculture sector took about 14 % in GDP in China for the period of 1990-2010. Lithuania, Latvia and Poland belong to the group of countries, where agriculture makes from 5 to 7 percent. The least importance (about 1%) of agriculture exists in Japan, US, Germany, UK. In France, Sweden, Denmark, Norway and Switzerland agriculture sector makes from 2 to 3 percent. In or-

der to determine the relationship between energy consumption and economic structure of different countries, the correlation analysis is carried out. Referring to the previous examination, China distinguishes from the other countries for high energy consumption. Over a period of ten years, the energy consumption has decreased by 60% in China, but it remains the highest indicator all over the world. In the same period of time, industry's share in GDP has increased by 6 percentage points, service sector's share has grown by 11 percentage points, and agriculture's share in GDP has gone down by 17 percentage points (Table 5).

Table 5. The relationships of energy consumption and economic structure in China

Year	High energy consumption country- China			
	Energy consumption (kg of oil equivalent)	Share of GDP, %		
		Industry	Services	Agriculture
1990	691	41	32	27
1995	470	47	33	20
2000	325	46	39	15
2001	299	45	40	14
2002	297	45	41	14
2003	307	46	41	13
2004	325	46	40	13
2005	316	47	41	12
2006	307	48	41	11
2007	284	47	42	11
2008	280	47	42	11
2009	273	46	43	10
2010	270	47	43	10
Correlation		*-0,72*	*-0,93*	*0,97*

Source: World Bank, author's

The correlation analysis indicates strong negative relationship between energy consumption and industry's share of GDP (0,72) and very strong negative relationship (0,93) between energy consumption and services' sector in China as well. It means that when industry's share of GDP increases, energy consumption per $ 1000 GDP decreases in China. The stronger relationship of the same direction exists between energy consumption and services' sector. The agriculture's share of GDP decreased from 27 % in 1990 to 10 % in 2010 in China. Services' sector increased from 32 % to 43 % in the same period of time. The analysis shows positive and very strong relationship (0.97) between energy consumption and agriculture's share of GDP. As agriculture's share of GDP decreases, energy consumption per $ 1000 GDP decreases too. The research of relationship between energy consumption and economic structure of the middle energy consumption group's countries shows very strong positive relationships of energy consumption and industry's (0,87) as well as agriculture's sector (0,89). Energy consumption and services' sector are negatively interrelated (Table 6). Over a period of ten years, energy consumption has decreased by 44%, industry's share in GDP has decreased by 12 percentage points, service sector's share has grown by 21 percentage points, agriculture's share in GDP has gone down by 10 percentage points in the middle energy consumption group's countries.

Table 6. The relationships of energy consumption and economic structure

Year	Middle energy consumption group				Lithuania			
	Average of energy consumption (kg of oil equivalent)	Share of GDP, %			Energy consumption (kg of oil equivalent)	Share of GDP, %		
		Industry	Services	Agriculture		Industry	Services	Agriculture
1990	288	37,2	50,2	12,6	349	30,9	42,1	27,1
1995	274	30,8	62,7	6,5	326	31,5	57,6	10,9
2000	197	27,5	68,7	3,8	214	29,8	63,9	6,4
2001	200	26,7	69,6	3,7	229	30,7	63,8	5,5
2002	196	26,2	70,3	3,5	229	29,7	64,9	5,4
2003	190	26,5	70,1	3,3	217	31,6	63,4	5,0
2004	183	27,2	69,3	3,5	204	33,1	62,3	4,7
2005	172	27,1	69,8	3,2	178	32,9	62,3	4,8
2006	162	25,3	71,8	2,9	162	32,9	62,8	4,3
2007	157	27,5	69,5	3,0	161	32,6	63,5	3,9
2008	154	26,8	70,5	2,7	155	31,6	64,7	3,7
2009	156	24,7	72,7	2,6	166	27,0	69,7	3,4
2010	160	25,6	71,6	2,8	167	28,2	68,3	3,5
Correlation		*0,87*	*-0,88*	*0,89*		*0,02*	*-0,81*	*0,85*

Source: World Bank, author's

The analysis shows as services' sector share of GDP increases, energy consumption decreases and vice versa. The case of Lithuania shows the same interrelationships of energy consumption and service sector's tendencies as well as agriculture sector's as in the middle energy consumption countries, however, the relationship between energy consumption and industry's is non-existent. In the low energy con-

sumption group's countries energy consumption has decreased by 20% over a period of ten years. Economic structure's tendencies are the same as in middle energy consumption group's countries: industry's share in GDP has decreased as well as agriculture's sector; service's sector share in economy has grown. The analysis shows that the strongest positive correlation of energy consumption can be observed in relation to the agriculture sector (correlation coefficient of 0,98), positive correlation also exists between energy consumption and industry's (correlation coefficient of 0,82) (Table 7). Negative interrelationship has been determined between energy consumption and service's sector (correlation coefficient of 0,87). Thus when service's share in GDP increase, energy consumption amount tends to decreased, which indicates that the service's sector is not energy-intensive in low energy consumption group of countries.

Table 7. The relationships of energy consumption and economic structure

Year	Low energy consumption group			
	Average of energy consumption (kg of oil equivalent)	Share of GDP, %		
		Industry	Services	Agriculture
1990	145	32,5	64,6	2,9
1995	140	29,9	67,7	2,4
2000	127	29,7	68,5	1,8
2001	129	28,7	69,5	1,8
2002	125	28,1	70,3	1,7
2003	127	27,6	70,9	1,5
2004	124	27,7	70,8	1,5
2005	121	28,1	70,6	1,3
2006	119	28,5	70,2	1,3
2007	114	28,2	70,6	1,3
2008	115	28,3	70,5	1,2
2009	115	25,8	73,1	1,1
2010	116	26,5	72,3	1,2
Correlation		*0,82*	*-0,87*	*0,98*

Source: World Bank, author's

All things considered, it seems that industry's and agriculture sectors keep decreasing in all three groups of countries. Service sector's share in the economy of the countries has increased over a period of ten years. Energy consumption has decreased in all groups of countries; however China remains the biggest consumer of energy for $1000 GDP among selected countries. Energy consumption correlates with economic structures of the countries in the same or opposite directions, although the case of Lithuania

showed the absence of correlation between energy consumption and industry's sector. It means that the industry share's variation in GDP can not be predicted referring to the dynamics of energy consumption; and according to the tendencies of energy consumption, the assumption about industry's sector could not be made as well.

Conclusions

● Recently published studies on the relationship of energy consumption and economic growth have been carried out in two ways – some scientists examine the relationship between separate energy resources and economic growth, others analyze the relationship between a total energy consumption and economic growth. The researches on energy consumption and economic growth have proposed the four major hypotheses, such as growth, conservation, feedback and neutrality. Most of the studies showed that there is a close correlation among these economic factors, but causality remains an open debate.

● Over a period of ten years, in China, as a high energy consumption country, energy consumption has decreased by 60%. The main structural changes of Chinese economy has associated with the decrease in agriculture sector's share by 17 percentage points, while service and industry have grown by 11 and 7 percentage points respectively.

● In the middle energy consumption group countries, the average of energy consumption has decreased by 44 %. In the same period of time, middle energy consumption group has reported the structural changes in the economy, as follows: the shrinkage of industry and agriculture sector by 12 and 10 percentage points respectively, while the share of service sector has grown by 21 percentage points. The analysis revealed the same structural tendencies in Lithuanian economy as well.

● In the low energy consumption group, the average of energy consumption has fallen by 20 % over a period of ten years. Industry and agriculture sector have decreased by 6 and 2 percentage points respectively, while service sector has reported the growth of 8 percentage points in GDP.

● The research has discovered that in all three energy consumption groups of countries (low, middle and high), there exists close relationship between energy consumption and economic growth. Economic

growth leads energy consumption negatively. In the high energy consumption group, the relationship is not as strong as in the low and middle one.

● After further in-depth analysis of the energy consumption and economic structural variation related data, the results indicate the following aspects: (a) in the high energy consumption group, there is close and negative relationship between energy consumption and industry as well as service's sector; and agricultural sector leads energy consumption positively; (b) in the middle energy consumption group, industry and agriculture leads energy consumption positively; energy consumption and service's sector interrelates negatively; the case of Lithuania showed the absence of correlation between energy consumption and industry's sector; (c) in the low energy consumption group, industry and agriculture leads energy consumption positively and services negatively.

● In this paper the author has overviewed the main tendencies of structural changes in the selected countries economy. However, further investigation is still needed to assess the robustness of these preliminary conclusions and to have a deeper understanding of structural development.

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