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IF INDUSTRIAL SECTOR DEVELOPMENT IS SUSTAINABLE: LITHUANIA COMPARED TO THE EU

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Abstract. Discussions about development of economies‘ structure and impact of economies structures on patterns and rate of economic growth of countries comprise a separate research area in classic field of economics - economic growth economics, and in a reletively newer field of research – comparative economics. If discussion in classic economic growth theories tackled proportions between agriculture industry, later, with rapid industrialization of currently developed countries, discussion its focus gradually swiched. After industrilization reached its saturation in developed countries and percentage of value added generated by agricultural sector diminished, development economists‘ discussion turned field of efficiency of economic sectors, estimated by total factor productivity (TFP). The paper is devoted to analysis of tendencies of industrial sector development. Admitting that percentage of value added generated in industrial sector diminishes as county develops and value added generated by service sector increases, we claim, that industry does not loose its importance. In oposite, despit servise sector grow and obviously will rapidly develop in observable futire, industry remain the very important consumer of natural, energectical, capital resources and human resources. It is difficult to underestimate industries role in the process of sustainable development of counries development. This paper suggests a sequently devised glance at historical path of industry sector development in Lithuania. Selected indicators of other countries or the EU are used for comparison reasons having a purpose to shed a light on peculiarities – similiarities and differences – of Lithuanian industrial sector development. Insights generated in the result of simple economic comparative analysis of selected counties, we believe, would allow select methodology allowing gradual transforming of Lithuanian industry into more efficient, sustainable and competitive economic sector conditioning the faster economic growth of Lithuania and similar countries, which encounter similar issues and tackle similar economic and politic aims.

Keywords: Structural changes, manufacturing, absolute structural change rate, intensity coefficient, dissimilarity index.

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1. Introduction

Each country, let it be developed or developing, seeks to develop sustainably. An intense and rich discussion in this area has been progressed many dacades, and myriad of facets of better economic, social and environmental welbeing has been elaborated, ranked and agregated (Prakash 2013; Mačiulis, Tvaronavičienė 2013). Nevertheles, it is remains undisputble that way towards sustainable developmet lies through more efficient performance of counties’ economies. Economies of countries are not homogenious, they are characterized by different economic structures and different their transformation patterns. Here we need to point out, that treatment of a concept “economic structure” can vary in scientific literature and an be used in unexpected contexts for an economist sometimes (Lankauskienė, Tvaronavičienė 2013). Here we need to

clarify that in this paper by "economic structure" of economy structure of GDP is being meant. In the context of considered issues agriculture, industry and services comprize economy of a country; their proportional value added is being understood as "economic structure" or "structure of economy" – concepts, which will be used as synonimous in this paper.

2. Countries' economic structururures and economic growth patterns: glance to theoretical genesis

Economic structures' analyzis, scientific questions of their transformation patterns and impact of those patterns on economic growth are attributed to the separate strand of economic growth literature. The most promiment predecessor of so called Stuctural-Change model is Nobel laureat W.Arthur Lewis, who formulated his ideas in the mid-1950s; later his ideas were further elabotared by John Fei and Gustav Ranis (Todaro, Smith 2009: 115). In order to present esence of the research in simplified way, Structural-Change model could be described in the following way. Hence, in the Lewis model the country's economy consists of two conditional sectors: low productivity agricultural sector and developed, much more productive industrial sector. Movement of labor force from agricultural sector to industrial triggers economic growth of the whole economy due to higher productivity achieved. Now observing transformations of economies' structures in various countries – developed and developing – we can just state, that countries indeed moved towards industrialization, with all consequences for development predicted by W.Arthur Lewis. Main criticism of Structure-Change model was about limitations of reserach coused by strong emphasis of labor force, which is supposed to transfer from agricultural to industrial sectors. The researches, which followed these, expanded rnage of driving forces of structural change. Hence, later developed Patterns-of-Development analysis model focused on wider set of factors implicating structural changes.

Strucural changes were perceived as broder concept, i.e. authors talk about economic, industrial and institutional structural changes. In contrast to the Lewis model, not movement of labour force, but incresed savings and investment are perceived by Patterns-of-Development analysts as necessary but not sufficient conditions for economic growth. In addition to the accumulation of capital, both physical and human, a setof interrelated changes in the economic structureare required for the transition to a modern economic system (Todaro, Smith 2009: 120). To comment from contemporary prospective, considerations of Patterns-of-Development analysts are hardly denyable, alas due to lack of focus, they do not provide a methodalogycal tool for further analysis. Here, in contrast to W.Arthurs Lewis, too broad scope of accecting factors are being discussed, what naturally, exist but approach itself is not sufficiently instrumental for analysist of contemporary economic structures (not even pointing out to too broad concept of economic structure used).

The research is being developed further and structural changes are analyzed by Harvard economist Hollis B.Chenery and his colleagues (Todaro, Smith 2009: 121). The scientists examined patterns of development of numerous countries during the postwar period. Their empirical studies, both cross-sectional and time-series of differenly developed countries led to the following insights. Development process can be characterized by shift from agriculture to industrial production, accumulation of physical and human capital, change of consumer demand from necessities to more sophisticated manufactured goods and services and change of other processes, which are more attributed to development (not to economic growth) economy; i.e. migration to towns, increase of population etc. What is interesting, that proponents of this school call for development specialist "let the facts speak for themselves" (Todaro, Smith 2009: 121).

We took a glance at theoretical approaches towards economic driving forces. To conclude, several consistent patterns could be distinguished: country development can be accelerated by diminishing share of agriculture and increasing industrial sector. This process in principle is finished in developed countries. After cetairn level of country development is achieved, service sector starts to growth more rapidly, what causes changes in economy sector. Share of value added in industry stops growing or even starts to decline (it does not mean absolute production volums decrease). The proceses of economic structure transformation are complex i.e. variety of factors affect that process. Trnasformation of economic structure should lead to higher efficiency of country's economy, what means higher total factor productivity (TFP). Despite all spectrum of theories of economic growth, main production factors are same: labor, capital (local or foreign origin) and technologies. Since countries differ by resource endowment, limited resources naturally impact economy structure of a country. After this short excursion into field of economic structures transformation studies let us concentrate on industry development peculiarities and factors, afecting its economic performance.

2. Statistical view into industry sector of Lithuania and other countries

As it can be seen from overview of evolution of economic theories of economic restructuring, question about the most propriet structure of separately taken country, irrespective of its stage of development can not be answered directly; all suggestions have to very context sensitive and take into account availability and of productivity production factors (labor, capital, technology). As it was mentioned above, resource endowments are very important, especially in cases, when a country is resource dependent, as e.g. Lithuania, which is energy dependent.

In this paper we will tackle industrial sector of economy. Let us look in specific seequence at statistical data characterizing industry development and produce insights about further prospects. The method used is the simpliest clasical economic method – comapative analysis. Scientific novelty here lies not in a method used, but in sequence, in which the comparative analysis is being performed. Hence, the following data is to be extracted and compared:industry share in in economy of a country. The industry share will be expressed by value added (% of GDP) generated by industrial sector. Since countries (at least European) are cahracterized by mature industries, i.e., are already passed their intensive development periods, disparities would indicate limits withing which industrial sector varies in contemporary conditions:energy intensity of economy, estimated by GDP per unit of energy use.

The comparisson of countries would allow to estimate national "energy productivities", which depend on economic structure (Tianli *et al.* 2011; Wangjiraniran *et al.* 2011; Vosylius *et al.* 2013) (but not only, of course Lankauskienė, Tvaronavičienė 2012). Energy intensity, which is to be perceived as productivity of one of production factors (energy productivity) depends on behaviour of household (heating, refrigerating), transport mode, level of technology, institutions, incuding energy consumption culture etc. Anyway, industry is important consumer of energetic resources, hence disparities in countries, most likely will be replicated in all compounding consumers;

1) energy import, expressed in percentage terms has to be taken ito account. Reasoning behind this sequence of comparative analysis is following: country can allow a luxury ofbeing energetically inefficient if it has own energetic resources and does not depend on energy import. That context has to be taken into account while evaluating Lithuania's or any other country's propspects to develop sustainably and remain competitive in mid-range;
2) alternative and neuclear energy (percent of total energy use) has to follow already comparisons indicated above. The purpose of this step of comparative analysis is to clarify if tendencies in alternative energy fostering allow contribution of this kind of energy to sustainable and competitive development of industry in the future. If there is no tendency groth tendency, it means that alternative energy does not play propriate role in sustainable development;
3) high technology exports as % of manufactured goods, we believe, has to be observed. This characteristic of industry development would provide information, necesseary to induce tendencies of all considered indicators into one generalizing picture. In case country appeared not sufficiently energy efficient and additionally energy dependent, well developed high technology sector of industry could mitigate negative effects and condition rather high international competitiveness;
4) concluding remarks about current economic structure, industrial development ant plausible future trends are to be formulated.Let us start comparative analysis of economic structures by a glance at interactive industry map 2009-2013. Development of industry is estimated by industry value added, expressed in percent of GDP in the EU and neighbouring countries (snapshot of the EU and neigbouring countries is provided in Figure 1).

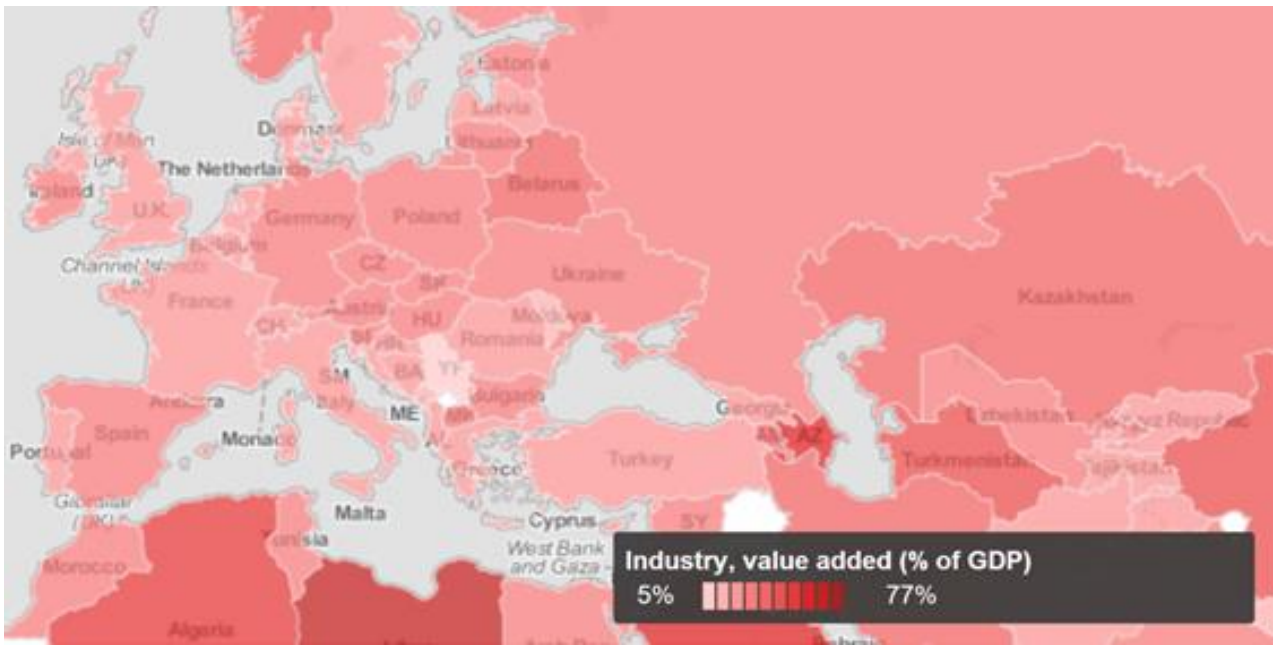

Fig.1. Industry development in the EU and neigbouring countries (year 2009-2010)

Source: The World bank http://data.worldbank.org/indicator/NV.IND.TOTL.ZS?display=map

The economic map lets provides a useful economic view of interested part of the world. It appears Lithuania, which is an object of our investigation is sufficiently industrialized and, in principle, and not particularly differs from other European countries: seems industrialized as Germany, but less as e.g. France. In order to reveal peculiarities a closer glance is needed. Let us choose data reflecting industrialization in the EU, Lithuania, Netherlands and Luxemburg. The explanation of choice logics is following: the EU average will serve as benchmark letting to orient for comparative economist how remote Lithuania is from statistical European Union average, Lithuania serves as object of investigation, the Netherlands is randomly chosen representative of European Union and Luxembourg stands for exceptionally well developed country. The latter country was chosen with purpose to indicate if considerable disparities among developed countries can be found. The change of value added generated in industry, expressed in percentage terms during 2004-2011 year period is presented in Figure 2.

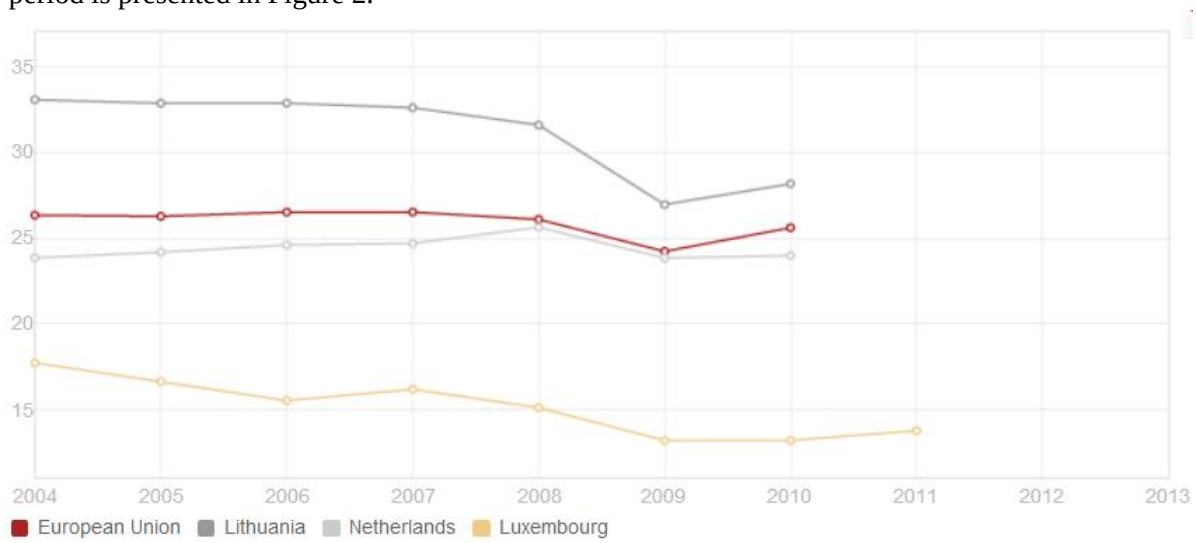

Fig. 2. Industry development in selected countries during period of 2004-2011 years (Value added of industry,% of GDP)

Source: The World bank, http://data.worldbank.org/indicator/NV.IND.TOTL.ZS/countries/EU-LT-NL-LU?display=graph

A closer look to selected countries reveals that Lithuania has a higher share of industry in its GDP if to compare it to the EU average. Selected representative of developed the EU country's – Netherlands –

confirms the impression. Luxemburg as rich and especially well developed country just to does not rely on industry at all. The presented above Figure 2 provides additional information to the economic industry map (Fig.1). Industry mapping and graphs provide information of different level of abstraction, which enhances understanding of industry development patterns. Here, in this paper we do not go beyond, i.e. into industry composition and sub-sectorial change (Dudzevičiūtė 2013). For Lithuania we draw a conclusion, that according of industry share in GDP, it belongs to the mostly industrialized European Union countries.

By continuing juxtaposing Lithuania with other countries we will aim to find out if Lithuanian industry can be treated as sustainably developing and competitive. We will follow sequence of comparative analysis resented above and will present charts attributed to the second step, i.e. we will compare energy intensities in the world, the EU, Lithuania, Japan and China. Before commenting the graphs (Figure 3) depicting change of energy efficiency, expressed by GDP generated per unit of energy, let us stop on providing argumentation, why those specific regions and countries are to be compared. Our main aim is to provide relevant context for Lithuania, which serves as object of our investigation. Hence, selection of the EU is natural. We introduce world, in order to understand how bad Lithuanian performance is, since world average is far away from an excellence benchmark. We incorporate China into comparison deliberately as well. China, as we know is a very important world market player putting heavy emphasis on industrial export. China is energy dependent country (Zhang *et al*. 2013) hence, if comparison showed that it is less energy efficient than Lithuania, it might have led to serious conclusions about plausible inefficiency of Lithuanian industry. Japan is introduced as a country with the highest energy efficiency in the world (Vlado 2012) in order to observe if a gap between the EU and Japan exists. The comparison of selected regions and countries is displayed below (Figure 3).

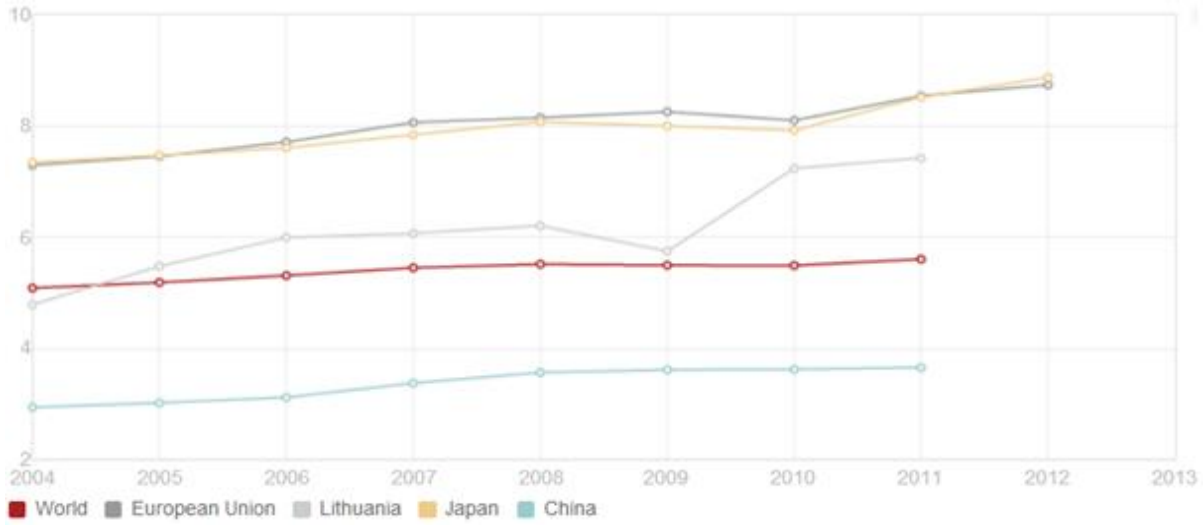

Fig.3. Change of energy intensity of economies in chosen regions and countries during period of 2004-2012 years (GDP per unit of energy use, constant PPP $ per kg of oil equivalent)*

Source: International Energy Agency http://www.iea.org/stats/index.asp; The World bank http://data.worldbank.org/indicator/EG.GDP.PUSE.KO.PP.KD/countries/1W-EU-LT-JP-CN?display=graph

*GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to 2005 constant international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States

Concluding comments are as follows: China is big world market player with energetically inefficient and environment hostile industry (Zhang et *al.* 2013; Wu *at al.* 2013). Lithuania surpasses China and the average of the world but still remains rather energy inefficient country. It lags behind the EU average considerably. Japan is being considered as the most energy efficient country. Alas, technologies "has limit" as Japan's scientists claim (Vlado 2012) and Japan appears near the EU average. It seems spillover of technologies between the EU and Japan has no obstacles in the contemporary globalized world; alas technological progress has not reached Lithuanian economy yet.

Following a sequent logic of statistical data comparisons, let us juxtapose energy imports, expressed in percentage terms in the same deliberately chosen regions and countries, i.e. world, the EU, Lithuania, Japan and China. Argumentation of choosing the indicated set of countries remains the same. Hence, dependence of those countries on energy imports is provided below (Figure 4). Despite there a lot of energy security perceptions and respective indicators can be found (Tvaronavičienė 2012) high percentage of import of energy use, undoubtedly, is one of them.

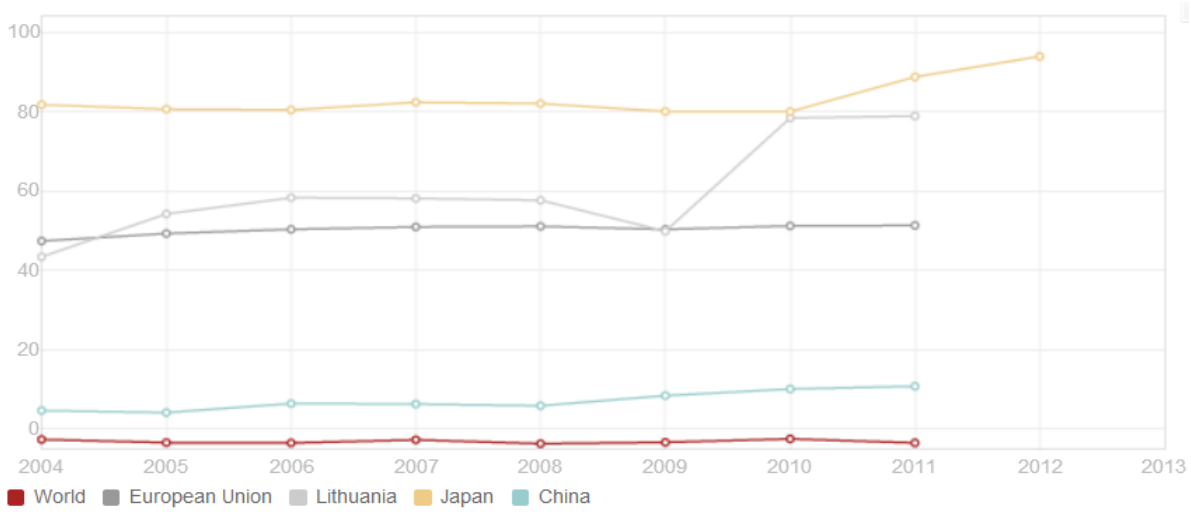

Fig.4. Energy dependence of selected countries during period of 2004-2012 years (Energy imports, net, % of energy use)*

Source: International Energy Agency http://www.iea.org/stats/index.asp, The World bank http://data.worldbank.org/indicator/EG.IMP.CONS.ZS/countries/1W-LT-EU?display=graph

*Net energy imports are estimated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport.

In global context Lithuania's energy dependence is high. Only Japan, which is especially energy efficient, is dependent almost at the same level. Fukushima explosion increased its dependency even more and share of energy import surpassed Lithuanian share of energy import.

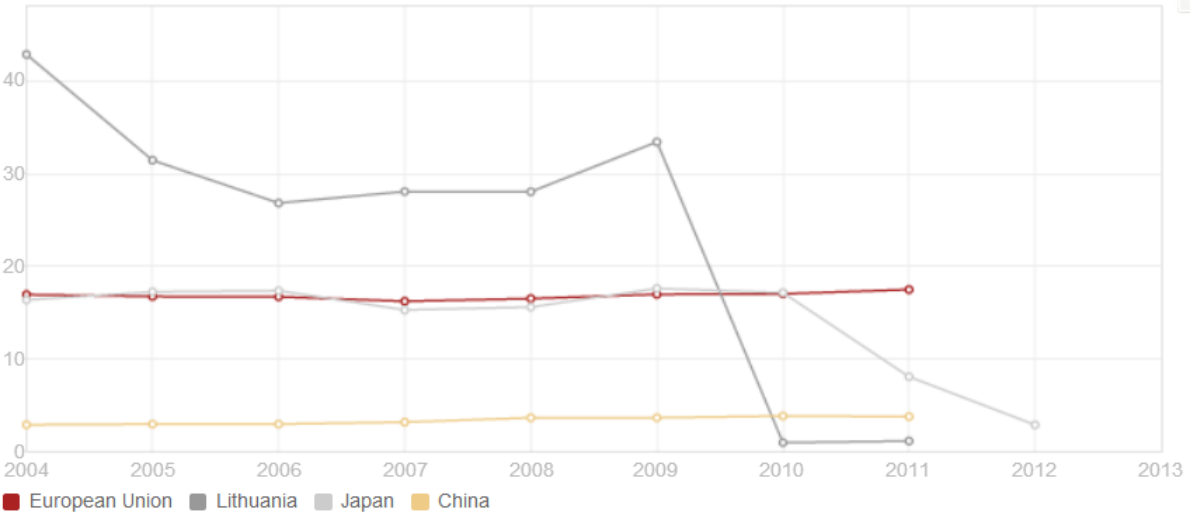

Fig.5. Impact of nuclear power stations functioning terminating in Lithuania and Japan (alternative and nuclear energy, % of total energy use)

Source: International Energy Agency http://www.iea.org/stats/index.asp, The World bank http://data.worldbank.org/indicator/EG.USE.COMM.CL.ZS/countries/EU-LT-JP-CN?display=graph

Lithuania's energy dependency soared after closure of Ignalina nuclear energy plant in year 2009 (Miškinis *et al.* 2013). Sharp decline in alternative and nuclear energy, produced in Japan and Lithuania resulted in terminating of functioning nuclear power stations is reflected above in Figure 5. Share of alternative energy from renewable sources is that low (Miškinis *et al.* 2013) that does not affect general trends observed by comparison statistical data of interest.

In order to judge if the peculiarities of industry development threaten industry sector sustainable and competitive development let us, as devised in the sequence of analysis conducting provided above, let us examine high-tech industry export performance. Notable, that currently Lituania's export have not yet lost its international competitiveness (Smaliukienė *et al.* 2012). Returning to economic comparison we draw attention that this time we will take into account only Lithuania and neighboring Baltic countries – Latvia and Estonia. The target for comparison has been chosen due to the following reasons. Taking into account that well developed countries outperform Lithuania in our comparative analysis we strive to juxtapose countries of very similar history and economic capacity. Such approach, we believe, would allow estimating Lithuanian industry performance more objectively. Recall, that Lithuania is the biggest of those three small countries, second is Latvia and Estonia is the smallest one. High-tech industrial export of those countries, measured by absolute values, is presented below (Figure 6).

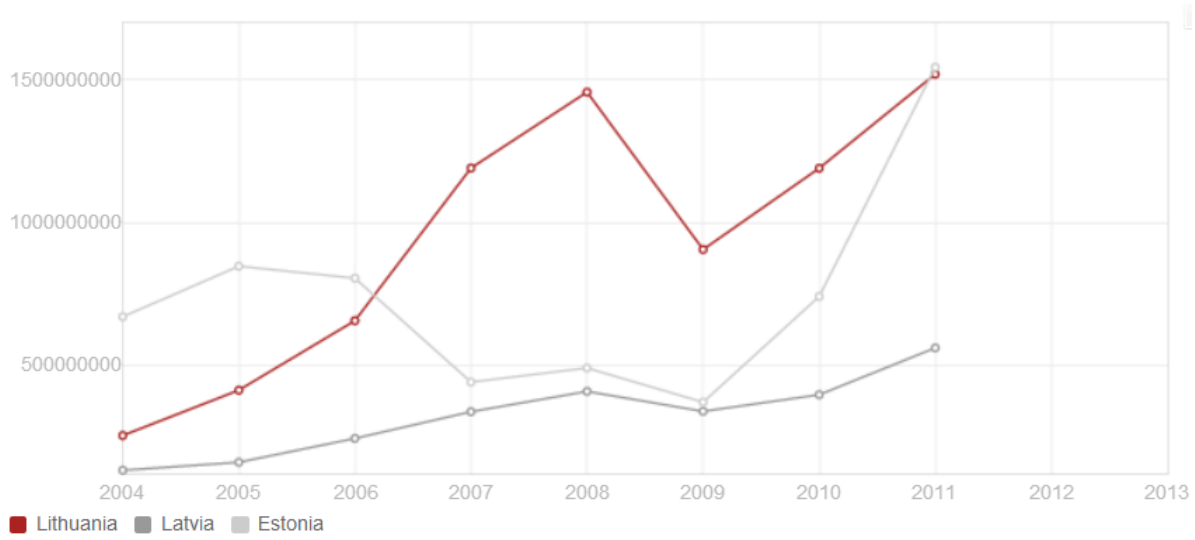

Fig.6. High-technology exports*, absolute volume in current US$

Source: World bank, http://data.worldbank.org/indicator/TX.VAL.TECH.CD/countries/LT-LV-EE?display=graph

* High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery

Comparison reveals that Estonia being twice smaller than Lithuania increased considerably high-tech industrial exports and reaches Lithuanian data. In order to formulate final insights let us compare the same indicator expressed in percentage terms for Lithuania, Latvia, Estonia, and the EU this time (Figure 7).

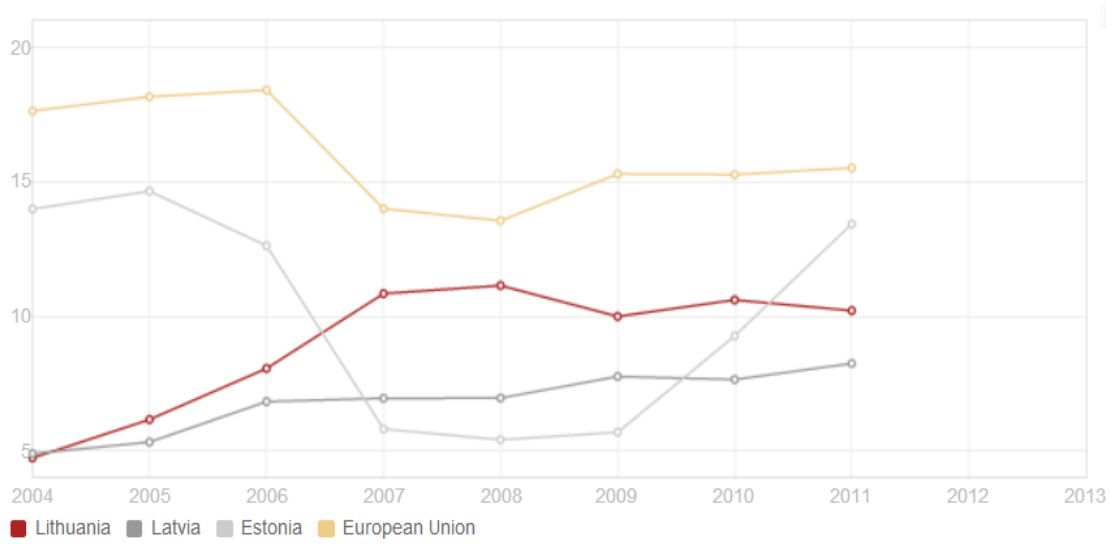

Fig.7. High-technology exports*, % of manufactured exports

Source: World bank, http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS/countries/LT-LV-EE-EU?display=graph

Comparison displays that, despite Lithuania's high-technology exports in absolute monetary values are increasing; share of high-technology exports remain relatively unchanged. Estonia with very similar development level in that respect performs much better and moves towards the EU average. Lithuania has to take those indicators into account respond by relevant policy implications.

Concluding remarks

Industry share in Lithuania is comparatively high in the EU context. It could be bas well claimed that the share is high in the context of developed countries Lithuania is exceptionally energy dependent. Import dependency will persist in nearly observed future, and there is low probability that energy prices would decrease significantly. Lithuania has to restructure its industry. Share of high-tech industry is very low and has to be increased: the task is complicated followed by complex implementation. Another way, which is not alternative but rather complimentary, is to estimate energy intensity of each industrial subsector and foresee further trends of its development. Energy consumption has to be forecasted, energy intensities estimated. Industrial subsectors threatening continue increasing energy intensity has to be restricted, and more energy efficient ones supported. Such approach, together with stimulation of high-tech industries would allow following path towards sustainable and competitive industry development.

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