

EXPORT COMPETITIVENESS AND DOMESTIC PRODUCTIVITY FACETS: CASE OF LITHUANIA

Irina Travkina¹, Manuela Tvaronavičienė²

*Department of Economics and Management of Enterprises,
Vilnius Gediminas Technical University, Saulėtekio al. 11, LT-10223 Vilnius, Lithuania
E-mails: ¹irina.travkina@vgtu.lt (corresponding author); ²manuela@vgtu.lt*

Received 03 October 2010; accepted 30 December 2010

Abstract. The relationships between export competitiveness and separate productivity factors are complex. Since the late 1990s debates on these relationships have been strongly influenced by the Krugman hypothesis, which states that the competitiveness could be measured directly by productivity. In the paper it is assumed, that export competitiveness is derivative of main factors' productivities, therefore properly presented and juxtaposed data on labour, capital and energy productivity/intensity would provide with new insights about character of relations between export competitiveness and main production factors productivities. Practical approach for predicting the Lithuanian export competitiveness future change direction by using listed indicators is being suggested. As a result, possible implications of main productivity factors impact on further export competitiveness have been foreseen.

Keywords: international trade, export competitiveness, productivity, intensity.

Reference to this paper should be made as follows: Travkina, I.; Tvaronavičienė, M. 2011. Export competitiveness and domestic productivity facets: case of Lithuania, *Journal of Business Economics and Management* 12(1): 49–68.

JEL classification: F14, L16, O40

1. Introduction: context of competitiveness and export competitiveness

The paper analyses Lithuania's international trade competitiveness from an exporting economic sectors' perspective. The research is organized as follows. The first and second parts focus on export competitiveness from a long-term perspective to capture the main trends of economic sectors' export potential developments. In those two parts Lithuania's performance is being assessed from a mezzo (i.e. sector) perspective, by tracking exporting sectors' development tendencies. The third part focuses on indicators of sectors' competitiveness. Character of three main production factors; such as labour, capital and energy, productivities change is being discussed in this part. Generalizing insights are being formulated.

International competitiveness criteria have to reflect the success for which sectors compete with each other over shares of national and, especially, global export markets

(Travkina, Tvaronavičienė 2010). This approach in principle complies with the European Commission's attitude, by which "competitiveness is the ability to produce goods and services which meet the test of International markets, while at the same time maintaining high and sustainable levels of income or, more generally, the ability of (sectors) to generate, while being exposed to external competition, relatively high income and employment levels..." (European Commission 1999).

Taking into account the fact, that separate economic sectors are more open in sense of trade than the wholly taken national economy, competitiveness measuring embraces ability to export, even more, emphasis on export has to be put. As Rowthorn, for example, asserts, "the prosperity of a region is determined primarily-... all those activities which bring income into the region by providing a good or service to the outside world" (Rowthorn 1999).

If to get back towards development of discussion around content of "competitiveness" notion, Krugman's input has to be emphasized. Hence, Krugman indicates (1994), that if international trade competitiveness has any meaning, then it is simply another way of saying 'productivity'; because "the growth rate of living standards essentially equals the growth rate of domestic productivity, not productivity relative to competitors, but simply domestic productivity". Michael Porter, who is the pioneer of competitiveness theory, also suggests that the best measure of competitiveness is productivity: "The competitiveness, then, is measured by productivity. Productivity allows to support high wages, a strong currency and attractive returns to capital, and with them a high standard of living" (Porter, Ketels 2003). Approach is officially adopted as national competitiveness is already being defined as "ability to produce goods and services that meet the testing of international competition" (Ministry of Economy of the Republic of Lithuania 2003). Later same ideas are replicated, for example, in Lithuanian long-run strategy (2007). Not concentrating on theoretical discussion on competitiveness notion genesis, which has already been presented (Travkina, Tvaronavičienė 2010), authors state, that in the paper, it has been admitted that the sector competitiveness could be measured by such output indicators as export value growth of all sectors, and further it is claimed that sector competitiveness' meaning in principle coincides with international trade competitiveness meaning and could be used as synonymous categories.

The second strand of literature is devoted to sector competitiveness measurement. Export competitiveness relation to indicators reflecting certain dimensions of domestic productivity is being emphasized. It is assumed that data on labour productivity, capital and energy intensity by each sector (European Commission 2009), properly presented and juxtaposed, would provide with new insights about international trade competitiveness and domestic productivity relations.

2. Peculiarities of international trade growth in Lithuania: industrial cross-sector perspective

According to the definition, international trade is the exchange of capital, goods and services across international borders or territories. It represents a significant share of gross domestic product (GDP). While foreign trade theories, embracing the earliest, such as

mercantilism, has been presented throughout much of history (Travkina, Tvaronavičienė 2010), its economic, social, and political importance has been on the rise in recent centuries. Industrialization, transnational corporations, advanced transportation, outsourcing and globalization have a significant impact on the international trade system.

Lithuania became an independent state in 1990, what has led to radical political, economic and social changes in foreign trade which were partially conditioned by change of economic policy and new agreements. Specifically, foreign trade was liberalized due to a number of unilateral decisions and treaties, which created the current Lithuanian foreign trade regime and trade policy-making structure.

In this part we concentrate on the external factors that affect Lithuania’s international trade with a special focus on the industrial sectors. Analysis of Lithuanian foreign trade development according to aforementioned reforms and statistical data is made for three stages (Travkina *et al.* 2009):

- *the first period*, after the Declaration of Independence (1990–1997);
- *the second period*, during and after a crisis in Russia and other CIS countries (1998–2003);
- *the third period*, after the accession to the EU (the year 2004).

Despite trade volumes were increasing during the entire considered time span, including all three conditionally distinguished periods, trade balance was negative. The share of exports during the first and the second distinguished periods has been at the level of 40–50% of GDP, during the third period – 50–60% of GDP (Fig. 1).

The international trade during *the first period* was characterized by dominant trade relationships with two of the most important Lithuania’s foreign trade partners of the integrated economic systems: the East, represented mainly by State of the Commonwealth of Independent States (CIS), and the West, represented by the European Union. Lithuanian trade with the European Free Trade Association (EFTA), the Central European

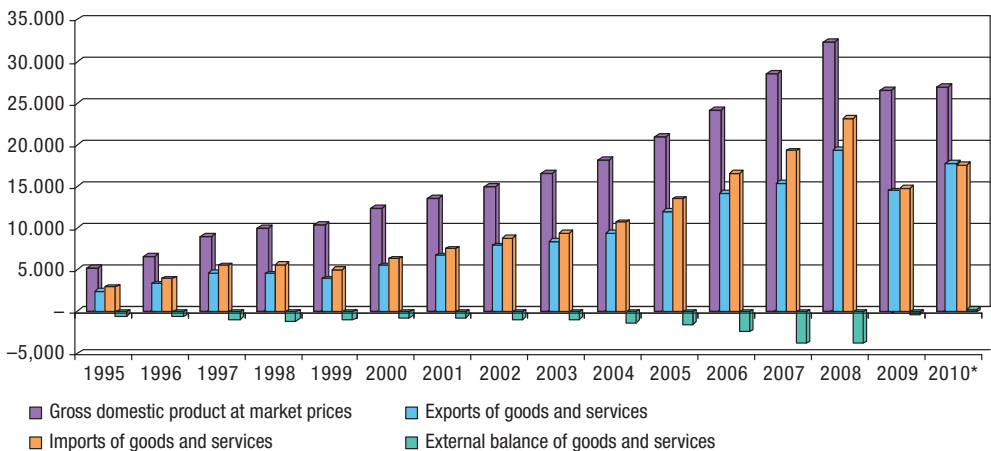


Fig. 1. Lithuanian GDP and international trade volumes during 1995–2010, mill. EUR
Source: data from EUROSTAT (2010* – EUROSTAT forecast)

Free Trade Association (CELP) countries changed gradually as treaties were signed, shares of United States and Japan changed respectively as international relationships were shifting towards European countries. The bigger part of trade deficit accounted for complications related to difficulties with crude oil, which was further being refined in Lithuanian ‘Mažeikių nafta’, import. A significant portion of exports, actually, accounted for re-exports. Not all international movement of goods is being reflected by official statistics, because of smuggling. Anyway, despite some inaccuracies, general trends of international trade are sufficiently clear.

During *the second distinguished period*, i.e. the years 1998–2003, the main factor impacting international trade was severe crisis in Russia and other CIS countries. Lithuania gradually redirected its exports from West to East. Later, in the year 2003, the pace of foreign trade slowed down even more considerably: the increase of the volume of imported goods was only 6.0%, while the volume of exported goods export increased by 9.1%. The main feature of that year was that exports grew faster than imports, similarly like in the period of 2000–2001, and unlike in the year 2002. The growth of export would have been even more impressive, if not the overhaul of ‘Mažeikių Nafta’.

At the beginning of *the third period* (in 2004) a number of factors retarded Lithuania’s export prospects. First, ‘Mažeikių Nafta’, managed by the Russian oil giant ‘Yukos’, has been in operational paralysis and there was a threat of the uncertainty in the oil supply continuity. Second, factor retarding successful export was conditioned by political issues: Russian officials restricted reciprocally imports from European Union countries (including Lithuania’s agricultural products). During the third period imports developed more vigorously compared to exports. Consequent negative trade balance was quite high.

It is noticeable that industry, accounted for 27–33% of GDP (see Fig. 2), is mostly export-oriented type of economic activity which comprised 64–73% of all export during the first and the second distinguished periods and 79–83% of Lithuanian export during the third period, i.e. during the years 2004–2009. Consequently, further in this

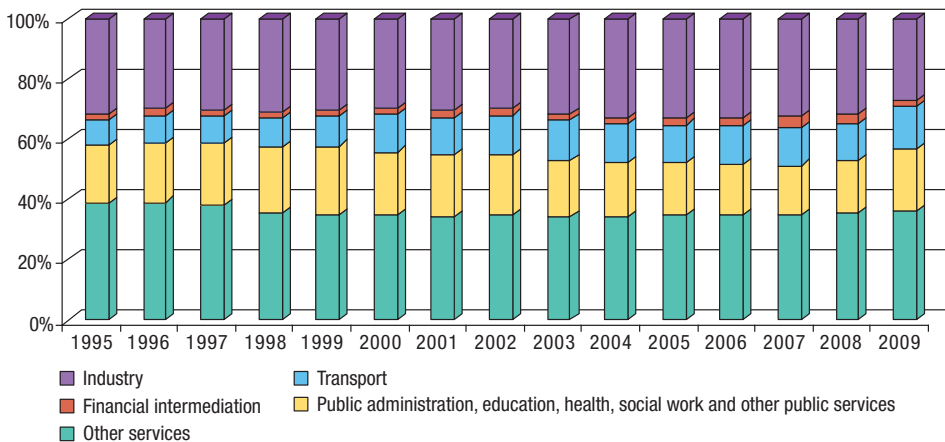


Fig. 2. Lithuanian GDP by type of economic activity, mill. EUR
 Source: Data from EUROSTAT

part exporting sectors' trends in Lithuania during the period of 1999–2009 are being discussed. Particular attention is being paid to industry; cross-industrial sector prospective tackled. Authors strive to provide a picture of how industrial sectors exported during a considered time span; to trace tendencies by identifying which sectors expanded their exports, which contracted them. Besides trend analysis, specialization concept of exporting sectors will be introduced and applied.

Available data let us observe cross-industrial sectors' relative growth or decline during considered 10-year period. Hence, sectors' export performance is being expressed by ratio of GDP generated in a particular sector and overall GDP, generated by Lithuania. That ratio, which, actually, provides us with structure of industry export is expressed in percentage terms. Graphical view of industrial sectors' exports structure introduces specifics of considered sectors' performance. Recall, that export structure provided in that particular manner let us indicate which sectors performed better or worse comparing with performance of overall economy, which during the 1999–2009 period, in principle, demonstrated rather significant growth. Growth, respectively, was characteristic of overall export as well. Close look at change of export structure during considered years (Fig. 3) let us indicate that Lithuanian industry went through considerable transformations in terms of its ability to compete in international markets. Accession to the European Union on 1 May 2004 statistically reflects in the 2005 data.

To generalize, industries, which comprise more than 10% of export, are as follows: food, drink and tobacco; chemicals; iron, steel, engineering, metal and equipment; construction, electricity and mining (recall, that industries themselves do not reflect concrete products; in opposite, products exported are attributed to listed industries).

Due to globalization processes during the considered 1999–2009 period Lithuania's industry sectors' competitiveness changed rather significantly and towards different

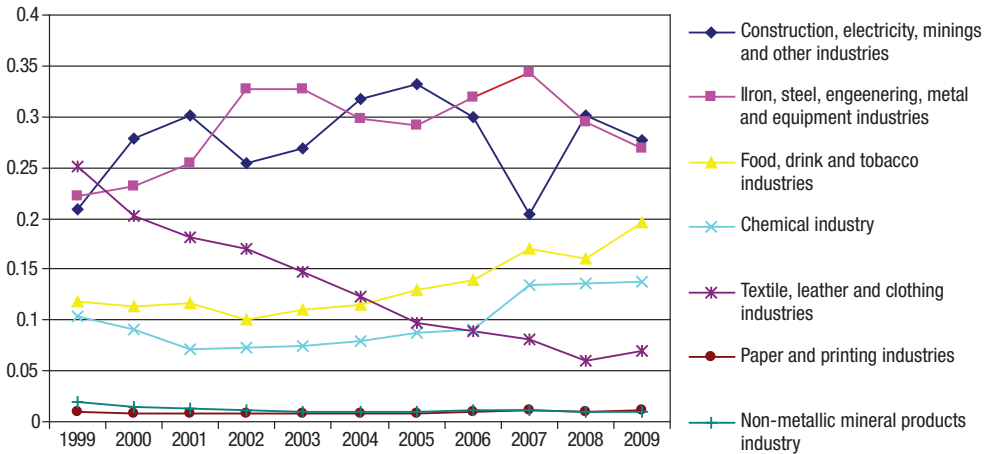


Fig. 3. Lithuania's export during the 1999–2009 period reflected by share of overall industrial sector's export, %

Source: Absolute values are provided by EUROSTAT (Standard international trade classification), percentage expression of export structure computed by authors

directions; i.e. some industrial sectors gained additional competitiveness, while some sectors lost it, respectively (Travkina *et al.* 2009). The sector, where Lithuania has lost significant share in export structure is textile, leather, and clothing industries. Sectors, which strengthened their international competitiveness, are: food, drink and tobacco industries; chemical industry; iron, steel, engineering and equipment industries; construction, electricity, mining and other industries.

Another characteristic of international trade competitiveness is export specialization. As the new economic geography theory, represented by Krugman suggests, trade integration leads to agglomeration and specialization of economic activities. Krugman notices that adverse sector shocks in major fields of activity might exert major economic consequences in terms of aggregate activity, employment and workers' displacement. In other words, the evolution of economic sector's specialization is an important macroeconomic issue since the degree of specialization reflects the exposure of the country to important external sector shocks (Crabbe *et al.* 2007). There are a few ways of nation's export specialization measuring, however majority of scientists (Bikker, Haaf 2002; Beine, Coulombe 2007; Sapir 1996; Bernatonyte, Normantiene 2009) propone the Herfindahl-Hirschman (HHI) index as the most informative and rather customized for measuring specialization of exporting industrial sectors. In Fig. 4 data of the Lithuania's export specialization, expressed by the HHI index is being presented.

$$HHI = \sum s_i w_i,$$

where $i = 1, 2, \dots, n$; s_i – the share of exporting industrial sector i ; w_i – the weight attributed to the export share of a particular exporting industry's sector i ; n – the number of exporting industry's sectors.

The change of the HHI index of export, or specialization, in our case, might reveal to what extent given industries are becoming more specialized or diversified, regardless of how the export structures of other countries are transforming. A higher numerical value of index indicates that the country develops exports in a smaller range of sectors and hence is more specialized.

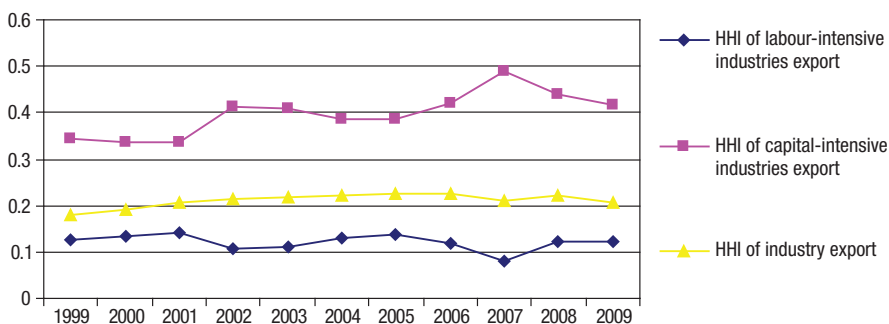


Fig. 4. Herfindahl-Hirschman index (HHI) of Lithuania's industrial sector's export during 1999–2009 (Division of industries into labour-intensive and capital-intensive is presented below, in Table 1)

Source: Data from EUROSTAT, index calculated by authors

The average export specialization is rising from 1999 till 2007. It could be explained that, after the transition period Lithuania raised productivity in capital-intensive sectors, which had increased its average export specialization. It is clearly seen that starting from 2005 specialization in labour-intensive export is decreasing rather significantly, what might indicate gradual shift of Lithuania from labour-intensive to other type of export.

3. Export competitiveness and productivity of main production factors

3.1. Labour as main factor of production

As it was indicated in the introduction into competitiveness issue, we intend to deal with context of competitiveness and export competitiveness. When export competitiveness is being perceived as productivity, which is a composite of productivities of main production factors, context of competitiveness has much to do with structure of production factors. To put that in other way, we tackle productivity issue by keeping parallel sight on change of structure of production factors, specifically of labour, capital and energy, in our case. Change of structure of production factors would be reflected by factors' intensities (labour, capital and energy intensities). Productivities of the considered production factors will be given next to intensities and discussed below intensities characteristics. Hence, let us start from labour as production factor scrutinizing Lithuania's industry.

Labour input is measured by the number of persons employed, intensity of work and labour productivity (European Commission 2009; Klacek *et al.* 2009; Subrahmanya 2006). The simplest measure of labour as factor of production is the number of employees. Number of persons employed during the 1995–2008 period in Lithuanian industry was increasing by 1% per year, during the considered period – by 13% (Table 1).

More useful measure of labour as factor of production is labour productivity (Fig. 5, Table 1) and intensity of work (explanations of computing is given below Table 1).

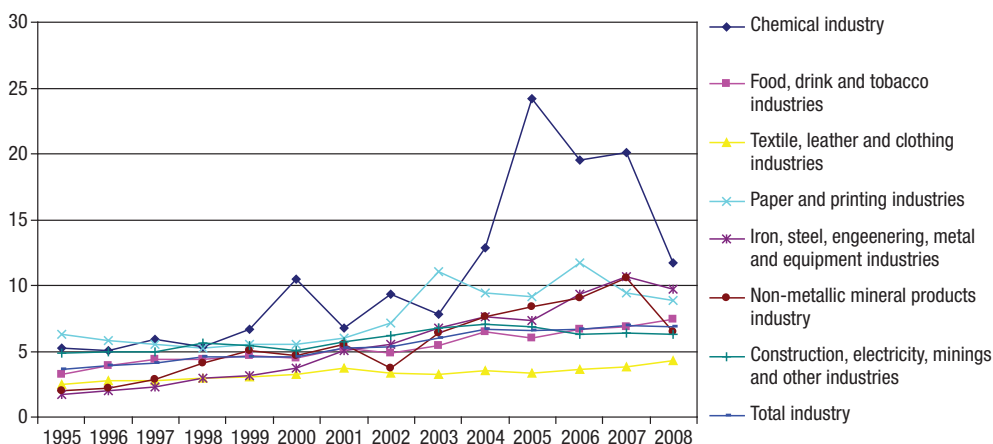


Fig. 5. Labour productivity of Lithuania's industrial sectors during 1995–2008

Source: Data from EUROSTAT, index calculated by authors

(Labour productivity is as a ratio of output per labour-hour to an input; where $labour\ productivity = \frac{Gross\ Value\ Added, EUR}{Worked\ hours, h}$)

Table 1. Percentage change in the labour as factor of production use in Lithuanian industry during the period of 1995–2008

	Change** in the number of hoursworked, 1995–2008 (%)	Change** in the labour productivity, 1995–2008 (%)	Change** in the intensity of work***, 1995–2008 (%)	Change in the intensity of work, 1995–2008
Labour intensive industries:				
<i>Food, drink and tobacco industries*</i>	–18%	227%	–56%	Medium-decreased
<i>Textile, leather and clothing industries*</i>	–29%	170%	–41%	Medium-decreased
Paper and printing industries	40%	141%	–29%	Low-decreased
Construction, electricity, mining and other industries	63%	131%	–27%	Low-decreased
Capital intensive industries:				
<i>Chemical industry*</i>	28%	226%	–56%	Medium-decreased
Iron, steel, engineering, metal and equipment industries	–22%	554%	–82%	High-decreased
Non-metallic mineral products industry	–10%	329%	–70%	High-decreased
Total industry	–9%	189%	–55%	Medium-decreased

Source: data from EUROSTAT, computed by authors

**export-oriented industrial sectors with high and medium decreasing change of work intensity (3 marked sectors comprised 70% of all industry export in the year 2009);*

***change index, % = calculated index in 2008 / calculated index in 1995;*

****work intensity is measured as number of hours worked in relation to gross value added generated in respective industrial sector.*

Provided data let us reveal gradual change of structure production factors in Lithuanian industry: labour, as factor of production is being used less intensively; the tendency is valid for labour measured in the number of hours worked, and by work intensity.

To conclude, labour as factor of production lost its comparative importance in production and contributes more for GDP generation in services. The second insight contains a generalized claim that labour, as factor of production, is being substituted by other factors of production.

To return to cross-industrial sector characteristics, it is worth to re-emphasize that absolutely all considered sectors are characterized by negative growth rates in the intensity of work. Comparisons of separate industrial sectors let us distinguish what was mainly

due to a decrease in the number of persons employed. Naturally, the number of hours worked is closely related to the number of persons employed. As number of hours worked decreases more than the number of persons employed, it means a decrease in the number of hours worked per person. Generalizing results of industrial sectors grouped according to the level of work intensity are being juxtaposed in Table 1. Five industry sub-sectors with high and medium negative change of work intensity have been distinguished: food, drink and tobacco industries; textile, leather and clothing; chemicals; iron, steel, engineering, metal and equipment industries and non-metallic mineral products industries. It is worth mentioning that three of indicated five sectors are strongly export-oriented industries and in the year 2009 comprised 70% of all industry export.

Now, after concluding that labour as production factor is being used losing its previous importance if considered in terms of hours spent, at the same time a raise of labour productivity is evident (Table 1). Change in the labour productivity, in 1995–2008 (%) varies across sub-industries: from 131% in construction, electricity, mining and other industries to 554% in iron, steel, engineering, metal and equipment industries. Generalizing remark is that labour productivity increased significantly and only in export-oriented industries, this increase is 234% (export-oriented industries that comprised 89% of all Lithuania's industry export in the year 2009, are food, drink and tobacco industries, textile, leather and clothing industries, chemical industry iron, steel, engineering, metal and equipment industries).

3.2. Capital as main factor of production

In much of the path dependency literature, capital formation implies increase in production capacity (Jain *et al.* 2009) and, by improving other factors of production, contributes to the sectors' competitiveness (European Commission 2009). Furthermore, capital goods inject technology, innovation and intangibles (e.g. software) into the production process, thus facilitating change and reorganization (Chichilnisky, Heal 1993; Klacek 2008). In addition, capital formation/investment decisions are forward-looking and, therefore, closely linked to the medium- and long-term expectations of the sectors' competitiveness and, finally, countries' economic growth (Tvaronavičienė 2006; Gardiner *et al.* 2004; Hausmann *et al.* 2005).

Overall picture of capital input for production in the considered industrial sectors during 1995–2008 is based on the consumption of fixed capital. The data presented in Table 2 shows that industry's consumption of fixed capital has increased by 39% during the considered period, but not all industrial sectors reduced the intensity of capital consumption (explanations of computing is given below Table 2). Capital as factor of production, in contrast to labour, strengthens its comparative importance: a diminution in capital share (i.e. capital intensity) of overall industrial GDP structure is determined namely by increment in consumption of fixed capital.

At the level of industrial sectors (Table 2) we argue that seven of all eight considered industries are defined by positive growth rates in consumption of fixed capital. It is important to note here that there are at least two kinds of increase fulfilling different functions significantly. On the one hand, an increment in consumption of fixed capital determines

Table 2. Percentage change in the capital as factors of production use in Lithuanian industry during the 1995–2008 period

	Change** in the consumption of fixed capital, 1995–2008 (%)	Change** in the capital productivity, 1995–2008 (%)	Change** in the capital intensity***, 1995–2008 (%)	Change in the capital intensity, 1995–2008
Labour intensive industries:				
<i>Food, drink and tobacco industries*</i>	58%	118%	–15%	Low-decreased
Textile, leather and clothing industries	104%	59%	69%	High-increased
Paper and printing industries	118%	91%	10%	Low-increased
<i>Construction, electricity, mining and other industries*</i>	47%	145%	–31%	Medium-decreased
Capital intensive industries:				
Chemical industry	–15%	340%	–71%	High- decreased
<i>Iron, steel, engineering, metal and equipment industries*</i>	25%	344%	–71%	High-decreased
Non-metallic mineral products industry	93%	153%	–35%	Medium-decreased
Total Industry	39%	151%	–31%	Low decreased

Source: data from EUROSTAT, computed by authors

*export-oriented industrial sectors with increasing consumption of fixed capital and decreasing capital intensity (3 marked sectors comprised 75% of all industry export in the year 2009);

**change index, % = calculated index in 2008 / calculated index in 1995;

***capital intensity is measured as the consumption of fixed capital in relation to gross value added generated in perspective industrial sector.

the implementation of innovation decisions made to increase efficiency and productivity of industrial sectors. On the other hand, industrial sectors are significantly dependent on the necessity of permanent investment to their local innovation systems and to their absorptive capacities. It is noticeable that high level of permanent investment can operate as a barrier to entry, imply a higher degree of risk and influence the cost structures.

As a result, we revealed four industrial sectors with increasing consumption of fixed capital and capital productivity (Fig. 6, Table 2), herewith decreasing capital intensity: food, drink and tobacco industries; construction, electricity, mining and other industries; iron, steel, engineering, metal and equipment industries; and non-metallic mineral products industry. It is noticeable that three of indicated four sectors are the mostly export-oriented industries and comprised 76% of all industry export in the year 2009. In case of not going into further analysis, suggested corollary would claim existence of positive

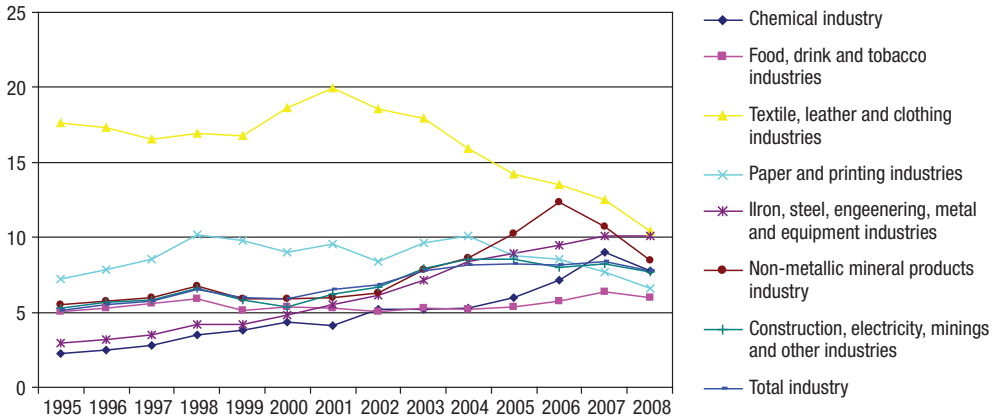


Fig. 6. Capital productivity of Lithuania’s industrial sectors during 1995–2008
 Source: Data from EUROSTAT, index calculated by authors (capital productivity is as a ratio of output per fixed capital consumption, an input; where $capital\ productivity = \frac{Gross\ Value\ Added, EUR}{Consumption\ of\ fixed\ capital, EUR}$)

relationship between requirement for permanent investment and capital efficiency of indicated industrial sectors, i.q. similarly to labour input, the substitution of capital for other factors of production.

3.3. Energy as main factor of productivity

Competitiveness and energy as main factor of productivity

The competitiveness of industries, in general, can be improved by improving the efficiency of the major factors inputs of production, namely, labour (3.1 part), capital (also known in scientific literature as technology – 3.2 part), energy (3.3 part) and raw materials (in this article will not be discussed). Most work, particularly by energy economics, has focused on energy efficiency improvement, among other factor inputs, as an important strategy for enhancing competitiveness at mezzo-level (Subrahmanya 2006). This is because a significant portion of operating costs of any industrial sector is in the form of energy costs. Any reduction in operating costs is bound to increase the competitive edge of the industry, as energy efficiency improvement. This will be particularly significant for energy-intensive industrial sectors.

Energy input involves work that moves or transforms matter, and includes a range of fuels based on some natural resources (Thompson 2006). The literature presents a different range of structuring energy input by two types: renewable or non-renewable energy sources (Table 3).

Table 3. Sources of energy

Renewable energy sources:	Non-renewable energy sources:
1. Biomass (wood)	1. Fossil fuels (oil, natural gas, coal)
2. The sun, wind, sun, geothermal and hydro-energy	2. Nuclear fuel

Source: data from International Energy Agency (IEA); Arbex, Perobelli 2009

The relationship between industrial sector’s energy intensity (as input indicator) and industrial sector’s output growth (as output indicator) has received increasing attention in recent years. While energy is an essential input to industrial sectors’ growth and its competitiveness in modern economies – energy consumption is also expected to be a limiting factor to economic growth, as other factors of production such as labour and capital cannot do without energy. Limited natural resources, particularly non- renewable (Table 3), imply a serious drag on industry’s growth and its competitiveness that may eliminate most or all of the positive influence of main factors of production such as labour and capital. However, the use of renewable resources may allow a sustained output indicators growth despite natural environment limitations. It can also be argued that the impact of energy consumption on sectors’ growth will depend on the structure of energy demand (1), energy intensity of industries (2) and the stage of sectors’ growth of the country concerned (3). Moreover, if energy consumption and environment policies affect the rate of productivity and the growth of the population, they will also have effects on long-run growth.

(1) The structure of energy demand in Lithuania

Lithuania is the largest of the Baltic States and provides some industrial infrastructure that is lacking elsewhere in the country, such as oil refining and chemicals. Like its Baltic neighbours, Lithuania has a high level of import dependency, based on oil and gas from Russia. On the other hand, the energy supply in Lithuania was different – till the end of 2009 it had nuclear power and in recent year has only some domestic oil production. Starting in 2010 it also imports a significant amount of electricity due to fluctuations in domestic supply and increasing prices (Janeliūnas 2008).

The structure of Lithuania’s energy demand (Fig. 7) is similar to the other Baltic countries in some aspects, such as the fact that there is a significant amount of biomass (wood) used for domestic heating and the transport sector accounts for the largest share of countries’ energy consumption (Fig. 8). The growing service sector is now nearly as

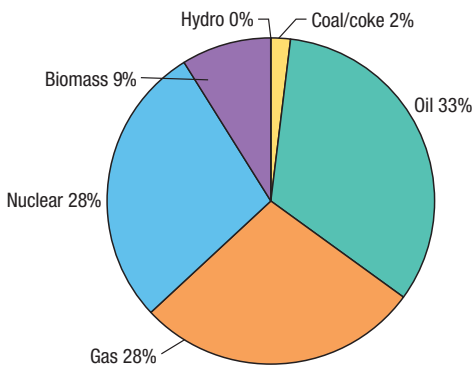


Fig. 7. Primary Lithuania’s energy consumption by fuel, 2008 (%)
 Source: data from EUROSTAT, computed by authors

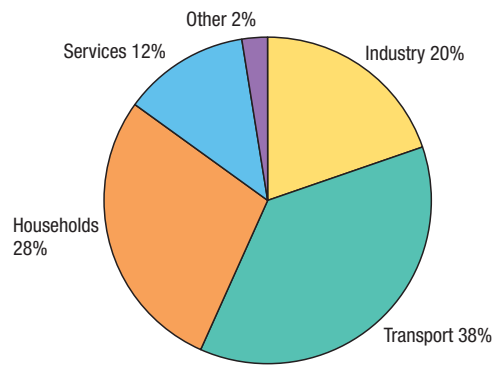


Fig. 8. Final energy consumption by Lithuania’s economic sectors, 2008 (%)
 Source: data from EUROSTAT, computed by authors

intense a consumer of electricity as industry, together accounting for 61% of total Lithuania’s electricity consumption in 2008.

Most work, particularly by the National Energy Agency and European Commission, has focused on the structure of Lithuania’s energy demand, its change developments. The aim of this part has been to survey the structure of Lithuania’s energy demand by industrial level. For that purpose we have constructed Lithuania’s energy consumption taxonomy for a range of main Lithuania’s industrial sectors and the results are presented in Table 4, Fig. 9. All sectors have been classified in three groups by energy consumption’s level during 2005–2008 period (explanations of computing is given below Figure 9, Table 4).

When analyzing the data from Table 4, Figure 9, it is worth noting that the most energy-intensive industries are a mix of sectors that represent export-oriented industries. For instance, chemical industry is high energy-intensive sector while the group of iron, steel, engineering, metal and equipment industries is medium-low energy-intensive one.

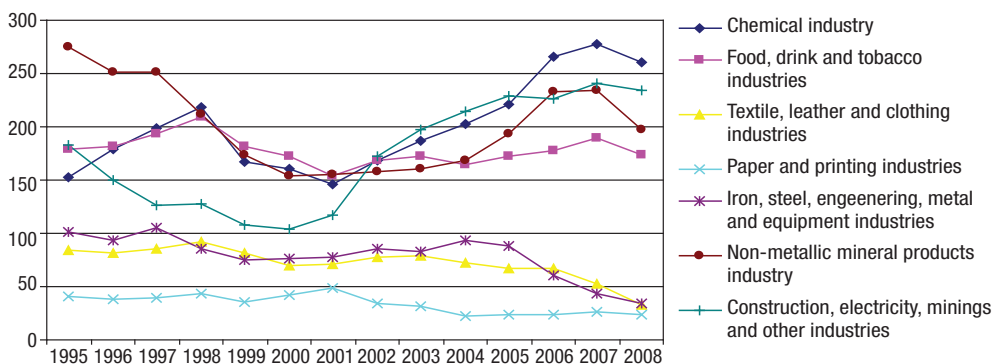


Fig. 9. Final Lithuania’s energy consumption by main industrial sectors during 1995–2008, ktoe
 Source: EUROSTAT

Table 4. Final Lithuania’s energy consumption taxonomy by main industrial sectors, average 2005–2008 (%)

Industrial sector	Energy/VA (%)	Groups of energy consumption
Non-metallic mineral products industry	1178	High
<i>Chemical industry*</i>	1087	
<i>Food, drink and tobacco industries*</i>	251	Medium-High
Textile, leather and clothing industries	137	
Paper and printing industries	113	Medium-low
<i>Construction, electricity, mining and other industries*</i>	72	
<i>Iron, steel, engineering, metal and equipment industries*</i>	63	

Source: data from EUROSTAT, computed by authors: Energy – energy consumption by industrial sectors (average 2005–2008, toe); VA – gross value added by industrial sector (average 2005–2008, mill. EUR)

*export-oriented industrial sectors comprised 89% of all industry export in year 2009

(2) *Energy intensity of industrial sectors in Lithuania*

The same approach as for labour and capital productivity/intensity was followed to use the energy intensity taxonomy (Table 5). Energy intensity is defined as the volume of the purchases of energy products (measured in tonnes of oil equivalent (toe)) in the production process of the industrial sector relative to value added, which is the inverse of energy productivity, measured as the ratio of gross value added to energy inputs (Fig. 10) (Alcantara, Duarte 2004; Gopalakrishnan *et al.* 2002).

The data presented in Table 5 shows that there will be a tendency for use of the vast majority of energy inputs to increase their production if the industrial sector is based on high or medium-high level of energy intensity. Consequently, two approaches can

Table 5. Percentage change in the energy as factors of production use in Lithuanian industry during 1995–2008

	Change** in the energy consumption, 1995–2008 (%)	Change** in the energy productivity, 1995–2008 (%)	Change** in the energy intensity, 1995–2008 (%)	Change in the energy intensity, 1995–2008
Labour intensive industries:				
<i>Food, drink and tobacco industries*</i>	6%	191%	–44%	Medium-decreased
Textile, leather and clothing industries	–37%	308%	–55%	Medium-decreased
Paper and printing industries	–37%	338%	–67%	High-decreased
Construction, electricity, mining and other industries*	32%	167%	–38%	Medium-decreased
Capital intensive industries:				
<i>Chemical industry*</i>	81%	170%	–43%	Medium-decreased
<i>Iron, steel, engineering, metal and equipment industries*</i>	–56%	1278%	–90%	High-decreased
Non-metallic mineral products industry	–15%	413%	–74%	High-decreased
Total Industry	–3%	173%	–52%	Medium- decreased

Source: data from EUROSTAT, computed by authors

**export-oriented industrial sectors with increasing consumption of fixed capital and decreasing capital intensity (3 marked sectors comprised 75% of all industry export in the year 2009);*

***change index, % = calculated index in 2008 / calculated index in 1995;*

****energy intensity is measured as total energy consumption per gross value added generated in perspective industrial sector.*

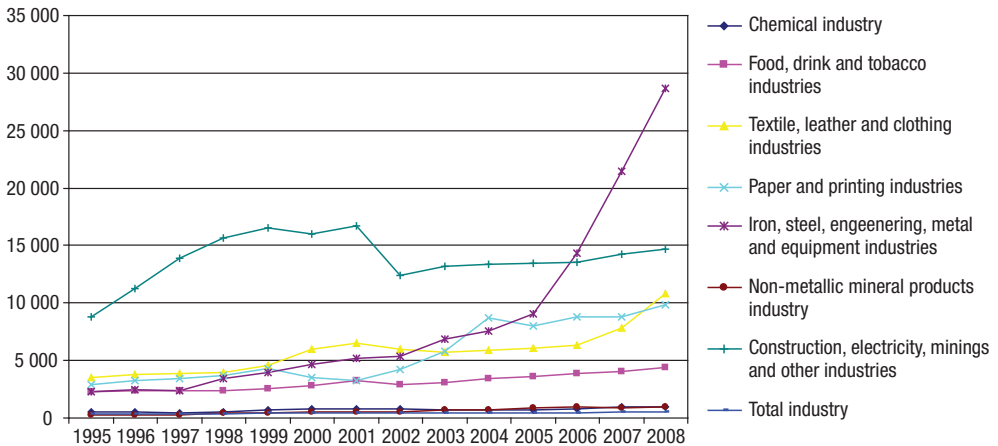


Fig. 10. Energy productivity of Lithuania's industrial sectors during 1995–2008
 Source: Data from EUROSTAT, index calculated by authors (energy productivity is as a ratio of output per energy consumption, an input; where $energy\ productivity = \frac{Gross\ Value\ Added,\ EUR}{Energy\ consumption,\ toe}$)

be suggested for data analysis: one approach focuses on export-oriented industrial sectors with high or medium-high level of energy intensity and energy productivity (as chemical industry and food, drink and tobacco industries), the other one focuses also on export-oriented industrial sectors with medium-low level of energy intensity, but with high energy productivity (construction, electricity, mining and other industries; iron, steel, engineering, metal and equipment industries). Both approaches have some steps in common, however their change in the energy consumption during the considered period is contrary: industries noticed as first approach has distinguished by positive change in energy use, the other – by negative. Notwithstanding, over the period of 1995–2008 all four Lithuania's export-oriented industries have generated cumulative returns and, concurrently, have reduced their energy intensity and increased their energy productivity (explanations of computing is given below Table 5).

4. Combining insights from input indicators

The competitiveness of industry, in general, can be improved by improving the efficiency of the main factors of production, namely, labour, capital (or technology) and energy. The model we shall use to illustrate our concept of main factors of production dependence on international trade and export competitiveness from a mezzo perspective is proposed in Fig. 11. It is an industrial sectors' model with three input indicators: labour, capital and energy. Within each industry, production functions display input proportions, so that no substitution is possible. However, industries differ in their factors' productivities/intensities, so that changes in relative factors' prices, accessibility or certain technical aspects, hence lead to changes in the consumption of relative inputs or on certain occasions to their substitution on the demand side and, eventuality, to increase or decrease in industry's export competitiveness and growth.

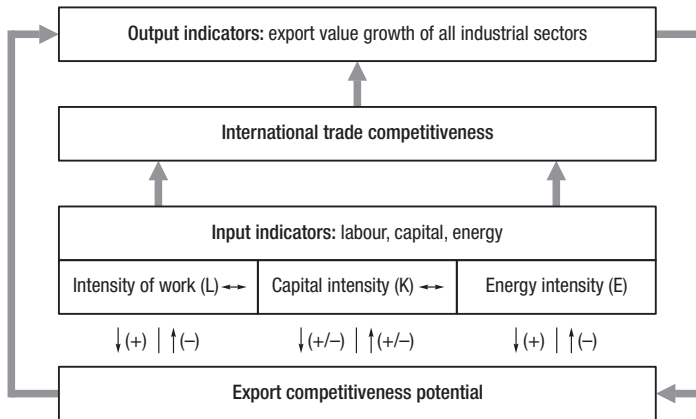


Fig. 11. Research hypothesis: less intensive use but more productive use leads to export competitiveness enhancement (resource intensity aspect)

To summarize, the model's variables are main factors of production denoting the responses of their changes to industrial sectors' export competitiveness and, finally, to export growth.

The model is a means to evaluate the possibility of change in work, capital and energy intensities for the formation of a competitive position and for its retention as well.

Fig. 5 shows vertical and horizontal relationships between intensity of work (L), capital intensity (K), energy intensity (E) and export competitiveness. The intuitive explanation of vertical relation is straightforward. A decrease in the intensity of work and energy intensity has a positive effect on the export competitiveness, and conversely, an increase is characterized by negative effect. A decrease in the capital intensity has two opposing effects on the competitive position of export – the positive effect of a decrease occurs frequently among labour-intensive industries, whereas undermining of competitiveness (negative effect) is noticed among capital-intensive industries.

The explanation of horizontal relation between main factors of production has not been investigated in this article. Intuition is, that there may be a variation from substitutability to complementarity among inputs as their intensities change. More research on this topic is needed.

On the basis of the suggested model (Fig. 11) we compared export-oriented industrial sectors through intensity changes of main factors of production that occurred at the start and the end of the considered period (Fig. 12). This comparative analysis for a wide array of industrial sectors identified that labour as an input factor is attributed to a higher level of intensity's decrease than energy or capital. The second insight contains a suggestion that the potential of export competitiveness is below the savings on energy costs and improving in capital intensity, although the situation in particular industrial sectors differ from this general perspective. Conditions, under which change of main factors' intensity impact on export development shows up, remain the object of further elaboration.

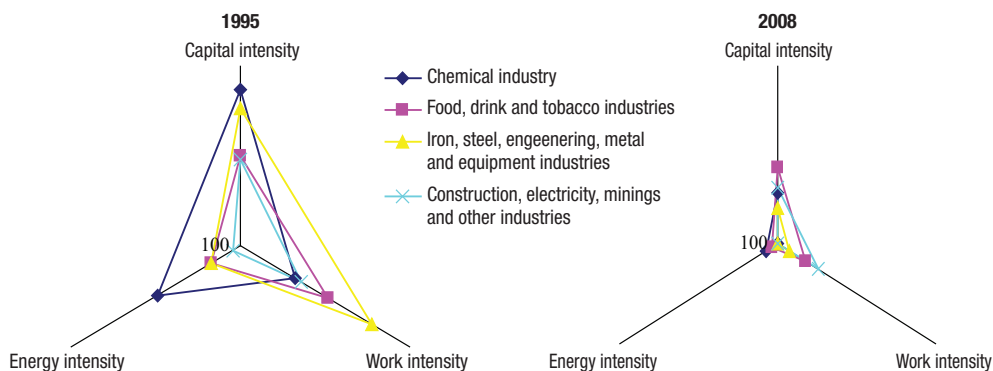


Fig. 12. Changes of export-oriented industrial sectors through industrial sectors in 1995 and 2008
Source: data from Tables 1, 2, 5, computed by authors

5. Conclusions

Export competitiveness cannot be completely defined by one or several economic indicators, thus complex measurement of input and output indicators reflecting competitiveness is required. The researches proved, that export-oriented industrial sector's competitiveness could be measured by such output indicators as export added value of growth. The second strand of literature advocates for export competitiveness measurement in relation to input indicators reflecting main factors of production as labour, capital and energy.

Case study of Lithuanian export specialization appeared as export specialization is rising in capital-intensive industrial sectors from 1999 till 2007 and is diminishing in labour-intensive sectors. The separate analysis of main factors of production proved, that rising in specialization is determined by increase of inputs' productivity indices, whereas diminishing in specialization is conditioned by increase of inputs' intensity indices.

The empirical application of export competitiveness measurement founded on input and output indicators let identify the main tendencies of enhancement in export competitiveness:

- This study shows that capital-intensive industries with medium-low energy intensity are essential for the export competitiveness and hence for international trade competitiveness. One key point raised in this paper is that these exporting sectors could be included in the encouraging sustainable development in Lithuania;
- We identified that potential for export competitiveness enhancement may result in increase of labour, capital and energy productivities and in decrease of energy inputs' intensity.

As sustainable export competitiveness relies upon efficient inputs consumption on the industrial sector's basis, it is the main focus of this study. Further improvement actions can be taken considering main factors of production price elasticity, and a more detailed analysis can be conducted by taking substitution between considered input indicators. The structure of export-oriented industries, their operating costs' structure, changes in inputs intensities/productivities and substitution within main factors of production can be further incorporated together into intense research.

References

- Alcantara, V.; Duarte, R. 2004. Comparison of energy intensities in European Union countries. Results of a Structural Decomposition Analysis, *Energy Policy* 32: 177–189. doi:10.1016/S0301-4215(02)00263-X
- Arbex, M.; Perobelli, F. S. 2010. Solow meets Leontief: Economic growth and energy consumption, *Energy Economics* 32: 43–53. doi:10.1016/j.eneco.2009.05.004
- Beine, M.; Coulombe, S. 2007. Economic integration and regional industrial specialization: evidence from the Canadian-us fta experience, *Journal of Economic Geography* 7(1): 93. doi:10.1093/jeg/lbl022
- Bernatonyte, D.; Normantiene, A. 2009. Estimation of Trade Specialization: the Case of the Baltic States, *Inžinerine Ekonomika – Engineering Economics* (2): 7–17.
- Bikker, J. A.; Haaf, K. 2002. Measures of competition and concentration in the banking industry: a review of the literature, *Research Series Supervision* (discontinued) 30, Netherlands Central Bank, Directorate Supervision.
- Chichilnisky, G.; Heal, G. 1983. *Energy-Capital Substitution: A General Equilibrium Analysis*. Working Paper, CP-83-6 International Institute for Applied Systems Analysis, 2361 Laxenburg, Austria, February 1983, Chapter 17.
- Crabbe, K.; Beine, M.; Vandenbussche, A. 2007. *Trade, institutions and export specialization*. Catholic University Leuven, March 6.
- Gardiner, B.; Martin, R.; Tyler, P. 2004. Competitiveness, Productivity and Economic Growth across the European Regions, *Regional Studies* 38(9): 1045–1067. doi:10.1080/0034340042000292638
- Gopalakrishnan, B.; Plummer, R. W.; Alkadi, N. M. 2002. Comparison of glass-manufacturing facilities based on energy consumption and plant characteristics, *Energy Dev*: 27(1): 101–15.
- European Commission 2009. *EU industrial structure 2009. Performance and competitiveness*. Luxembourg, European Communities. doi:10.3846/bm.2010.067
- European Commission 1999. *Sixth Periodic Report on the Social and Economic Situation of Regions in the EU*.
- EUROSTAT statistic database.
- EUROSTAT statistical books, 2009. *Panorama of energy*. Available from Internet: <http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-GH-09-001>.
- International Energy Agency (IEA), 2008. *Energy Technology Perspectives*. Available from Internet: <<http://www.iea.org/techno/etp/index.asp>>.
- Jain, T. R.; Trehan, M.; Trehan, R. 2009. *Business Environment*. Punjabi university, India. ISBN 978-81-88597-57-4.
- Janeliūnas, T. 2008. Lithuanian energy strategy and its implications on regional cooperation, in *Energy: Pulling the Baltic Sea Region together or apart?*, 190–222. Riga: Zinatne. ISBN 978-9984-808-58-1.
- Hausmann, R. L.; Pritchett, I.; Rodrik, D. 2005. Growth Accelerations, *Journal of Economic Growth* 10/4: 303–329. doi:10.1007/s10887-005-4712-0
- Klacek, J., et al. 2009. Total factor productivity in Czech manufacturing industry – KLEM framework, *Statistika* 5: 414–428.
- Krugman, P. 1994. Competitiveness: A Dangerous Obsession, *Foreign Affairs* 73(2): 28–44. doi:10.2307/20045917

Lithuanian academy of sciences, 2007. *Long-term economic development strategy of Lithuania until 2020*. Available from Internet: <<http://www.ukmin.lt/lt/strategija/VIRS/Galutinė%20strategija.2007.11.15.doc>>.

Ministry of Economy of the Republic of Lithuania, Lithuanian Academy of Sciences, 2003. *Long-term economic development strategy of Lithuania until 2015*. Available from Internet: <http://www.ukmin.lt/en/strat_prog/longtermstrategy/>.

Organisation for Economic Cooperation and Development (OECD), *Programme on Technology and the Economy*, 1992.

Porter, M. E.; Ketels, C. H. M. 2003. UK Competitiveness: Going to the Next Stage, *Economics Paper* 3. Department of Trade and Industry, London.

Rowthorn, R. E. 1999. *The political economy of full employment in modern Britain*. Kalecki Memorial Lecture, University of Oxford, Oxford.

Sapir, A. 1996. The effects of Europe's internal market program on production and trade: a first assessment, *Weltwirtschaftliches Archiv*, 132, 457. doi:10.1007/BF02707508

Solow, R. 1957. Technical Change and the Aggregate Production Function, *Reviewed- Econ. Stat.* Aug. 39(3): 312–20.

Subrahmanya, B. 2006. Labour productivity, energy intensity and economic performance in small enterprises: A study of brick enterprises cluster in India, *Energy Conversion and Management* 47: 763–777. doi:10.1016/j.enconman.2005.05.021

Taranco, M. A.; Pablo, R.; Albinana, F. C. 2010. Assessing the influence of manufacturing sectors on electricity demand. A cross-country input-output approach, *Energy Policy* 38(4): 1990–1908.

Thompson, H. 2006. The applied theory of energy substitution in production, *Energy Economics* 28: 410–425. doi:10.1016/j.eneco.2005.01.005

Travkina, I.; Dudzevičiūtė, G.; Maciukevičienė, L. 2009. Accession to the European Union: impact of legislation change on performance of Lithuanian companies, *Verslas: teorija ir praktika* [Business: Theory and Practice] 10(2): 142–149. doi:10.3846/1648-0627.2009.10.142-149

Travkina, I.; Tvaronavičienė, M. 2010. An Investigation into relative competitiveness of International Trade: the Case of Lithuania, in *6th International Scientific Conference "Business and Management–2010"*, VGTU, 2010.

Tvaronavičienė, M. 2006. Investment driving forces affecting Lithuanian economic growth, *Journal of Business Economics and Management* 7(2): 69–76. doi:10.3846/1611-1699.2006.7.69-76

LIETUVOS EKSPORTO KONKURENCINGUMAS IR ŠALIES PRODUKTYVUMO DĖMENYS

I. Travkina, M. Tvaronavičienė

Santrauka

Straipsnyje analizuojami eksporto konkurencingumą lemiantys atskiri gamybos veiksniai. Atlikus Lietuvos pramonės šakų pagrindinių gamybos veiksnių – darbo, kapitalo ir energijos produktyvumo/intensyvumo rodiklių lyginamąją analizę, padaryta prielaida, jog reikalingi sprendimai, kurie padėtų pramonės šakoms atrasti efektyvų kompleksišką minėtų gamybos išteklių naudojimo būdą bei prisidėtų prie pramonės eksporto konkurencingumo didinimo. Atlikto tyrimo praktinę vertę lemia kelios aplinkybės: pirma, pasiūlytos naujos išvalgos apie pramonės eksporto konkurencingumo vertinimą; antra, nustatytos tolesnių eksporto konkurencingumo teorijos tyrimų sritys.

Reikšminiai žodžiai: tarptautinė prekyba, eksporto konkurencingumas, produktyvumas, intensyvumas.

Irina TRAVKINA. PhD student in the Department of Economics and Management of Enterprises at Vilnius Gediminas Technical University. Research interests: international trade, competitiveness, economic growth.

Manuela TVARONAVIČIENĖ. Prof., Dr, Department of Enterprise Economics and Management, Vilnius Gediminas Technical University (Lithuania). Qualification raise: IESE Business School, Spain, Politecnico di Milano, Italy, Harvard Business School, USA. Research interests: economic development, foreign direct investment, business environment.