



IMPACT OF SUSTAINABLE DEVELOPMENT INDICATORS ON ECONOMIC GROWTH: BALTIC COUNTRIES IN THE CONTEXT OF DEVELOPED EUROPE

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Abstract. The paper aims to analyse sustainable development indicators taken from the Eurostat database and to determine a rational relationship between the sustainable development indicators and the economic growth of the country. The suggested hypothesis implies that the process of the country's development differs depending on the stage of the development. In order to establish the relationship between the sustainable development and the economic growth, the correlation analysis was used. Lithuania, Latvia and Estonia were taken as the research objects and the results obtained were compared with those describing the developed countries (Austria, Belgium, Denmark, Netherlands, France, Germany). The results obtained outline the main economic trends as well as determining their variation depending on the development stage of the country.

Keywords: sustainable development, indicators, Lithuania.

DARNAUS VYSTYMOŠI RODIKLIŲ POVEIKIS EKONOMINIAM AUGIMUI: BALTIJOS ŠALYS IŠSIVYSČIUSIOS EUROPOS KONTEKSTE

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Santrauka. Darbo tikslas – atskleisti ekonomiškai pagrįstus ryšius tarp darnaus vystymosi, remiantis Eurostat duomenų baze, ir šalies ekonomikos augimo rodiklių. Iškelta hipotezė – šalies išsivystymo procesas kinta priklausomai nuo ekonominio išsivystymo lygio. Statistinei rodiklių analizei atlikti taikytas koreliacijos metodas. Tyrimo objektas yra Lietuva, Latvija, Estija, gauti rezultatai lyginami su išsivysčiusiomis valstybėmis (Austrija, Belgija, Danija, Nyderlandų Karalystė, Prancūzija, Vokietija). Gauti rezultatai nusako ekonomines tendencijas ir jų skirtumus skirtingo išsivystymo lygio šalyse.

Reikšminiai žodžiai: darnus vystymasis, rodikliai, Lietuva.

1. Introduction. A theoretical review

Sustainable development is a leading concept of nowadays. It started to be considered as urgent issue since 1972 Stockholm Conference on the Human Environment, where the conflicts between environment and development had been acknowledged the first time (Kates *et al.* 2005). A lot of studies have been devoted to the new philosophy. However, there are various definitions of this phenomenon. The widely known definition states that it is the “ability of humanity to ensure that it meets the needs of the present generation without compromising the ability of future generation to meet their own needs” (Brundtland 1987). Germination of the concept of sustainable development at institutional level has been analysed by Grybaitė and Tvaronavičienė (2008). The concept of sustainable development contains three dimensions of welfare, comprising economic, environmental, social aspects and their interrelations.

The aim of the paper is to analyse the relationship between the economic growth and sustainable development in different countries, juxtaposing the Baltic states with developed European countries. The assumption is made that economic processes of a particular country differ depending on the stage of its development. It might be the case that, at the lower level of economic development, there is a stronger relationship between the economic growth of the country and social-economic variables, while at the higher level, the environmental indicators are very important.

The modern study of economic growth was started by Adam Smith and David Ricardo. Since then, many theories have been defining the major factors of economic growth, but three basic factors, such as capital formation, population growth, technological changes and their interactions were mainly emphasized. The role of capital formation, reflected in saving and investment has been a crucial factor in many works of economics thinkers for centuries, and it remains important even today (Tvaronavičienė 2006; Tvaronavičienė, Tvaronavičius 2008). During the past fifty years the term “economic growth” was being transformed to a new notion - economic development, emphasizing not only the growth of the quantity of material goods and services, but also a higher level of welfare of the country. It was suggested (Theobald 1961) to divide the process of economic development into five stages, which every nation can pass regardless of its social and political structure. Notably, this approach is often presented as one of the leading theories of economic development (Parr 2001). In the middle of the 20th century social capital was made a focus in the analysis of factors, influencing the economic growth. T. W. Schultz was one of the first researchers who began to treat entrepreneurship as human capital, i.e. skills obtained by investing in a particular type of human resources (Huffman 2006). The social positions of development became even more

prominent with the adoption of Human Development Index (Ghosh 2008). Social factor has been widely explored and now social development is considered to be a prerequisite for economic growth, while economic and social systems are often presented as one.

Since the 1970s, when the Club of Rome put forth the theory of „limits to growth“, environment has been considered as a new prerequisite for economic growth. The world has recognized new challenges and responsibilities for changing climate and diminishing natural resources. The most effective theory based on the relationship between pollution and income level was developed (Bradford *et al.* 2005). Since then the economists have been analysing the question: “Do poor people care less about their health than rich people? If not, what makes the populations in poor countries, generally speaking, less healthy?” (Torras 2006). The later notion emphasizes that economic development and ecological services cannot be observed as one system, where the causality flows from both directions.

Hence, the concept of sustainable development is a vision of progress that links economic development, protection of the environment and social justice, and its values are recognised by democratic governments and political movements the world over (Grybaitė, Tvaronavičienė 2008). The evaluation of sustainable development is the basic approach to the assessment of the development level. This is the only way to find reasons and solutions to our position in many fields of sustainable development (Kovačič 2007).

Not going into the discussion about the need for new theories of inclusive development, the research is framed as follows. If sustainable development leads to higher and more stable economic growth, then the goal of the analysis is to find the most important sustainable development indicators for the Baltic region and compare them with those characteristic of developed countries in the European Union’s context.

2. The relationship between economic growth and sustainable development

In order to define the relevant variables, Eurostat sustainable development indicators, which are grouped in ten areas, were analysed. The groups were described in detail by Grybaitė and Tvaronavičienė (2008). All indicators from the Eurostat sustainable development database were reviewed and only those satisfying the conditions given below were chosen for analysis:

- Lithuanian data is available;
- The same data sets cover more than one country;
- The data gathered in the period from 1997 to 2006 without intervals;
- The variables are statistically measured.

A correlation analysis is used as a statistical method to define the relationship. Calculations were made using MS Excel and are presented in Appendix 1.

Based on the countries' classification provided by the World Economic Forum (Sala-i-Martin *et al.* 2008), several countries were chosen for comparison: the Baltic states as having the most similar economic situation. Austria, Denmark, Belgium, Netherlands were chosen as small but highly developed countries, while France and Germany were included as similarly developed big countries. As GDP growth is used as a basic indicator for this analysis it should be emphasized that it is different in the groups of the Baltic states and the developed countries. The growth of all three Baltic states is about four times that (except Russian crisis in 1999) of other countries analysed. This is graphically shown in Fig. 1.

Only the indicators with the statistically significant correlation are chosen and presented in Table 1. Correlation coefficients were calculated using the log change of sustainable development indicator and the log change of GDP (in constant prices) for the respective country. In many sources (Čekanavičius, Murauskas 2002) the correlation coefficient of 0.30 is described as a minimal level for the relationship to be valid, but this is only true for large data samples, more than 50 data points. For a small data sample (as in this work) the significance of the correlation coefficient can be determined by using standard distribution calculated by Student t test. Alternatively, a simple formula to determine the approximate critical value of the correlation coefficient at 0.05 level of significance was introduced (Walsh 2008):

$$\frac{2}{\sqrt{n}}; \text{ where } n \text{ is the number of data items.}$$

Accordingly, the calculated threshold for the correlation coefficient in the presented data sample is 0.63.

Hence, the indicators for further analysis were chosen based on the following criterion: at least one country in the group (the Baltic region – a transition stage versus the (developed countries) should have a coefficient of more than 0.63, while others should demonstrate similar trends.

Based on the use of the mentioned criteria, only social-economic and environmental variables presented in Table 1 were chosen. Other (social inclusion, demographic, health) indicators were excluded from the analysis as their correlation coefficients were insignificant.

Social-economic indicators make the largest subgroup, covering the topics such as investment, labour, exchange rate, energy intensity, sustainable consumption and production and good governance.

Total investment is divided into the areas of public and business investments. Public investment was eliminated from the analysis because the correlation coefficients were insignificant. Hence, the correlation coefficients established between investment and GDP are being higher than 0.50 (Lithuania – 0.67; Estonia – 0.79; Latvia – 0.75; Germany – 0.71; Belgium – 0.55). It confirms the statement of the classical theories of economic growth that investments, particularly those made in business, contribute to the growth. The investment as the most important driving force influencing the economic development of a country in transition was analysed by many scholars (Tvaronavičienė, Tvaronavičius 2008; Tvaronavičienė 2006).

The established significant relationship between labour market indicators and GDP confirms the importance of this variable in Europe. The total employment is the classical

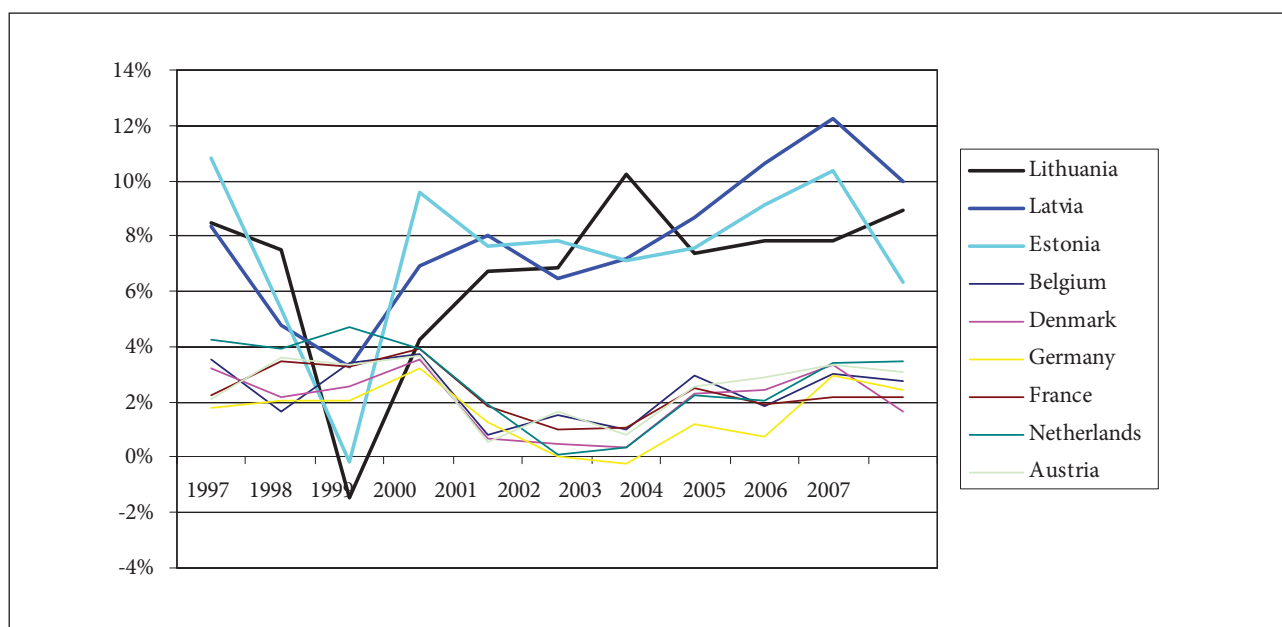


Fig. 1. Changes in GDP in the considered countries

Table 1. Relationships between the GDP growth and sustainable development

		Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Social-Economic indicators										
Economic	Total investment – % of GDP	0.67	0.79	0.75	0.20	0.55	0.56	0.60	0.57	0.71
	Business investment – % of GDP	0.70	0.79	-0.09	0.12	0.59	0.58	0.69	0.69	0.71
	Total employment rate – %	0.43	0.70	0.65	0.25	0.72	0.83	0.79	0.31	0.55
	Employment rate, by highest level of education attained – % of age group 25–64 years	0.17	0.40	0.62	0.13	0.82	0.79	0.46	0.00	0.37
	Unemployment rate	-0.41	-0.58	-0.70	-0.41	-0.61	-0.73	-0.72	-0.74	-0.92
	Growth rate of labour productivity per hour worked – % change over previous year	0.40	0.29	0.38	0.91	0.75	0.24	0.45	0.35	0.61
	Real effective exchange rate – index 1999 = 100	0.07	-0.05	0.52	-0.55	-0.73	-0.80	-0.71	-0.88	-0.75
	Energy intensity of the economy – kgoe per 1 000 euro	0.36	-0.31	-0.55	-0.88	-0.12	-0.64	-0.86	-0.26	-0.49
	Sustainable consumption and production	Municipal waste generated – kg per capita	0.70	0.06	0.52	0.41	0.47	0.43	0.33	0.43
Final energy consumption – 1 000 toe		0.80	0.62	0.62	-0.68	-0.24	-0.33	-0.20	0.17	0.14
Household expenditure per inhabitant – Volume index (1995=100)		0.69	0.91	0.85	0.77	0.66	0.12	0.83	0.79	0.79

End of Table 1

		Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Social-Economic indicators										
Good governance	Shares of labour taxes in total tax revenues - %	-0.71	-0.82	-0.55	0.11	-0.41	-0.02	-0.07	-0.27	0.01
	General government debt - General government consolidated gross debt as a percentage of GDP	-0.83	-0.50	-0.56	0.10	-0.48	-0.57	-0.77	-0.61	-0.78
Environmental indicators										
Climate change	Greenhouse gas emissions - index base year = 100	0.82	0.35	0.69	-0.84	-0.53	-0.38	-0.53	0.01	-0.12
	Gross inland energy consumption - 1 000 tonnes of oil equivalent	0.64	0.26	0.57	-0.81	0.06	-0.39	-0.49	0.17	0.10
Sustainable transport	Energy consumption of transport - 1 000 toe	0.77	0.44	0.54	-0.26	-0.08	-0.08	-0.03	0.71	0.52
	Greenhouse gas emissions from transport - 1 000 tonnes of CO ² equivalent	0.77	0.62	0.50	-0.21	-0.06	-0.25	0.20	0.20	0.30
	Emissions of particulate matter from transport - 1 000 tonnes	0.65	0.60	0.41	-0.09	0.58	-0.31	0.24	0.10	0.56

index of macroeconomy. It might lead to the growth of GDP at all development stages. Positive significant correlation has been found for the Baltic states (Lithuania – 0.43; Estonia – 0.70; Latvia – 0.65) and for the developed countries as well (Belgium – 0.72; Denmark – 0.83; Netherlands – 0.79; Germany – 0.55). A high correlation coefficient of the employment rate of people with the highest level of education is found in Latvia – 0.62; Belgium – 0.82; Denmark – 0.79. A relatively low correlation coefficient can be observed in Lithuania – 0.17. Lithuania is lagging behind in this respect. Unemployment rate negatively affects the GDP growth. Most values are less than – 0.50, which confirms that unemployment reduces the economic growth, acting in the opposite direction to employment. It is evident that the

higher rate of labour productivity per hour worked should result in GDP. The strong relationship between them can be observed in Austria – 0.91; Belgium – 0.75. Strong correlation between these indicators has not been found in the Baltic countries. In general, the relation between all labour indicators and GDP is lower in the Baltic states compared to that in the developed countries. This leads to the conclusion that the economic processes in this market of transitional countries are more volatile.

Real effective exchange rate can be used to assess the competitiveness of the state's currency. It should be noted that national currency in all Baltic states is historically pegged to base currency (USD, SDR, EUR), while all analysed developed countries have introduced Euro since 1999.

These historical differences in foreign exchange mode can be seen from the correlation results. There is a strong economically logic negative correlation, indicating that the increase in competitiveness causes the growth of GDP in the Euro zone countries. However in the Baltic region, the exchange rates have been fixed and the relationship is not so straightforward.

Energy intensity shows the amount of energy needed to produce one unit of economic output. A lower coefficient number indicates energy efficiency. The correlation obtained in the developed countries confirms that energy efficiency contributes to the GDP growth (negative correlation Austria – 0.88; Denmark – 0.64; Netherlands – 0.86; Italy – 0.85). In Lithuania, the coefficient (0.36) is statistically insignificant but surprisingly positive. It can be attributed to a lower technological level.

In economic terms, the sustainable consumption and production subgroup is based on life cycle approach to the use of resources, every day consumption and waste. In this chain, all levels embracing governments, citizens/consumers and business should be included. The importance of the indicator showing the waste generated by the industry has increased in recent years and this process is related to the increasing irresponsible production and consumption. Hence, it is evident that it is closely connected with GDP. The significant positive correlation coefficient was found only for Lithuania (0.70). In the developed countries, the relationship is weaker; it can be attributed to better management of waste in highly developed countries.

There are significant statistical correlation coefficients of household expenditure per inhabitant and GDP in all the countries analysed (except Denmark – 0.12). Therefore, it can be concluded that stimulation of this rate leads to a higher GDP. On the other hand, it is very important to have sustainable consumption.

Total energy consumption shows the use of energy in all areas, including industry, transport, household, agriculture, services and others. Energy is an important economic resource in all regions. High significant correlation is found for Lithuania (0.80), Estonia (0.62), Latvia (0.62). These results indicate that the economy of the Baltic region is highly dependent on energy. On the other hand, there is no significant relation in this area in the developed countries.

The concept of sustainable consumption and production is more widely known in the developed countries. The Baltic states have to use and sustain resources effectively. Good governance is a subgroup related to institutional work and some scholars suggest adding institutional work as the fourth dimension to a concept of sustainable development concept since it is very important for smooth development.

Shares of labour taxes in the total tax revenue are gen-

erally defined as all personal income taxes, payroll taxes and social contributions of employees and employers that are levied on labour income (both employed and non-employed). The higher rate of labour taxes in the total tax revenues leads to a lower GDP as taxes make a kind of business costs. Significant and negative correlation is found in the Baltic states (Lithuania – 0.71; Estonia – 0.82; Latvia – 0.55). The statistically significant relation is not found in the developed countries. The results might indicate that in the Baltic states, changes in labour taxes greatly affect GDP, and therefore, they should be implemented with care.

General government debt is the financial indicator showing the ability of the government to meet its future liabilities. The results show that in many countries a lower debt relates to a higher GDP (Lithuania – 0.83; Netherlands – 0.77; Germany – 0.78). This rate is one of the most important values at all stages of development.

The conclusion can be made that there are indicators, such as investment, government debt, household expenditure, employment rate and exchange rate, which influence GDP at all stages of development. There are areas which have to be monitored at particular stages in order to improve the welfare of the country. Sustainability is a popular philosophy in the developed world. The lower rates of waste and effective energy consumption in the developed countries encourage others to use resources in such a way to preserve the environment for future generations.

Many scientists and the growing number of Greenpeace activists warn us that every day of rough development is damaging our environment irreversibly. There is a paradox question associated with the nature of sustainable development: "Is it possible to reconcile sustainability with development?" Trying to ensure the welfare of human beings, at the same time, they are destroying the main surroundings of every creature. Therefore, not going into a painful theoretical discussion, let us define the group of environmental indicators.

Environmental indicators chosen as having a statistically significant correlation are climate change and sustainable transport. Climate change is linked with many areas of human activities. It requires taking some measures in many sectors from energy and transport to land use and urban development. All these measures, if successfully managed, result in sustainable development. Climate change is mostly caused by greenhouse gas emission. This indicator is strictly controlled by Kyoto protocol, however, despite this fact, it is increasing every year in most of the countries. The high rate of positive correlation between the total greenhouse gas emissions and GDP is found in the Baltic region (Lithuania – 0.82, Estonia – 0.35, Latvia – 0.69). The relation with GDP is negative or insignificant in the developed countries. The results show that the Baltic states produce GDP using energy associated

with high greenhouse gas emission. In the developed West European context the weak points of the Baltic states' sustainable development may be clearly seen. Climate change is closely related to energy consumption. Gross inland energy consumption shows the usage of various energy sources (fuel, gas, renewable energy sources, etc.). Positive significant correlation is found for Lithuania (0.64) and Latvia (0.57) with not so strong correlation observed in Estonia (0.26). Negative and significant correlation is found in Austria (−0.81), and negative but not strong correlation can be observed in Denmark (−0.39) and Netherlands (−0.49). Hence, higher consumption of fuel is closely related to the GDP growth in the Baltic states. In general, it can be seen that the Baltic region does not demonstrate the effective policy against the climate change. The results are different in the developed European countries. Only Estonia show positive trends to sustainability.

Vehicles make a large contribution to overall pollution and climate change. The chosen indices prove the importance of this factor. The indicator "Energy consumption in transport" has a significant high correlation with GDP in the Baltic region (Lithuania − 0.77; Latvia − 0.54; Estonia − 0.44), while in the developed countries similar results can be observed in France (0.71) and Germany (0.52). In other countries, this relationship is insignificant.

A significant and positive relation was found between the GDP growth and greenhouse gas emission by transport facilities as well as the emission of particulate matter by vehicles, exclusively in the Baltic region (among the developed countries only Belgium and Germany show the relationship between GDP and emission of particulate matter by transport facilities). Hence, the data obtained in the present work allow us to conclude that the Baltic region is lagging behind in creating a sustainable transport system.

Based on the results of the correlation analysis performed using the environmental indicators, the differences in their relationships in the Baltic states and those characterizing developed countries can be observed. This can be used as a proof that sustainable development policy is being implemented more effectively in the developed countries.

3. Conclusions

The philosophy of sustainable development has been built evolutionally, as the economic growth was supplemented with new social values and environmental protection challenges. Despite many attempts to frame this concept, it is still alive and changes in time. Recently, the scholars have been challenged to create a unified theory of many dimensions, including economic, social and environmental and other (institutional, religion, etc.) aspects in order to ensure prosperity in the world for the present and future generations.

After the collapse of the centrally planned and controlled systems in the Baltic states these countries demonstrate a rapid economic growth (despite some economic downturns). It should be noted that during the last decade the rate of GDP growth in the Baltic region has been much higher than in the developed European countries. Still, a large gap in the level of per capita income remains between the Baltic states and the developed European countries. The results of the analysis performed confirm the widely accepted notion that positive macroeconomic indicators impact on the prosperity of a country at every stage of its development. Investment, total employment, exchange rate, household expenditure, government debt have a statistically significant relationship with GDP.

To ensure the long-term economic growth, using the policy of sustainable development, environmental protection programs have to be implemented. Based on the results of the correlation analysis performed using the environmental indicators, the difference in the priorities in the Baltic states and those characterizing developed countries can be defined. The Baltic region has a highly significant correlation between environmental indicators and GDP and, unfortunately, the relationship is the strongest in Lithuania. It confirms the statements of the theories that at the lower stage of development, pollution is associated with a higher GDP. In the developed countries, the relationship is often negative: the lower level of pollution is related to a higher GDP. This is a proof that the policy of sustainable development is being implemented more effectively in the developed countries, and this does not contradict to the prospect of higher economic growth in the longer perspective.

References

- Bradford, D. F.; Shore, S. H.; Fender, R. A.; Wagner, M. 2005. *The Environmental Kuznets Curve: Exploring a Fresh Specification*. Available from Internet: <<http://www.bepress.com/bejeap/contributions/vol4/iss1/art5>>.
- Brundtland, G. (Ed.). 1987. *Our common future*. The World Commission on Environment and Development. Oxford: Oxford university Press. 416 p.
- Čekanavičius, V.; Murauskas, G. 2002. *Statistika ir jos taikymai*. Vilnius: TEV.
- Ghosh, N. 2008. *The Road from economic growth to sustainable development: How was it traversed?* MCX Academia of Economic Research. Available from Internet: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1082686>.
- Grybaitė, V.; Tvaronavičienė, M. 2008. Estimation of sustainable development: germination at institutional level, *Journal of Business Economics and Management* 9(4): 327–334.
- Huffman, W. E. 2006. Discussion: AAEA Session in Honor of T. W. Schultz, *Review of Agricultural Economics* 28(3): 351–353.

- Kates, R.; Parris, T.; Leiserowitz, A. 2005. What is sustainable development? *Environment: Science and Policy for Sustainable Development* 47(3): 8–21.
- Kovačič, A. 2007. Sustainable Development and the Problems of Measuring, *International Journal of Humanities and Social Sciences* 1(2): 83–91.
- Mason, R. D.; Lind, D. A.; Marchal, W. G. 1999. *Statistical Techniques in Business and Economics*. Tenth edition. Irwin McGraw-Hill.
- Parr, J. 2001. On the regional dimensions of Rostow's theory of growth, *Review of Urban and Regional Development Studies* 13(1): 2–19.
- Sala-i-Martin, X.; Blanke, J.; Hanouz, M. D.; Geiger, T.; Mia, I.; Paua, F. 2008. *The Global competitiveness index: prioritizing the economic policy agenda*. World Economic Forum 2008. The global competitiveness Report 2008-2009. Available from Internet: < <http://www.weforum.org/documents/GCR0809/index.html>>.
- Theobald, R. 1961. Toward a practical theory of economic growth, *American Journal of Economics & Sociology* 20(3): 327–331.
- Torras, M. 2006. The Impact of power equality, income, and the environment on human health: Some Inter-Country, *International Review of Applied Economics* 20(1): 1–20.
- Tvaronavičienė, M. 2006. Investment driving forces affecting Lithuanian economic growth, *Journal of Business Economics and Management* 7(2): 69–76.
- Tvaronavičienė, M.; Tvaronavičius, V. 2008. Role of fixed investments in economic growth of country: Lithuania in European context, *Journal of Business Economics and Management* 9(1): 57–64.
- Walsh, D. A. 2008. *Simple rule of thumb for statistically significant correlation*. Middle Tennessee State University. Available from Internet: <<http://frank.mtsu.edu/~dwalsh/436/CORRSIG.pdf>>.

Appendix 1. Correlation between changes in sustainable development indices and GDP change

	Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Labour productivity per person employed – GDP in Purchasing Power Standards (PPS) per person employed relative to EU-27 (EU-27 = 100)	0.44	-0.06	0.15	0.45	0.42	0.47	0.41	0.16	-0.68
Total investment – % of GDP	0.67	0.79	0.75	0.20	0.55	0.56	0.60	0.57	0.71
Public investment – % of GDP	0.13	0.29	0.36	0.28	0.25	0.16	-0.36	0.12	0.07
Business investment – % of GDP	0.70	0.79	-0.09	0.12	0.59	0.58	0.69	0.69	0.71
Dispersion of regional GDP per inhabitant – in % of the national GDP per inhabitant	-0.28	0.32	-0.52	-0.36	0.08	na*	-0.08	0.34	0.09
Net national income – % of GDP	0.26	-0.25	0.33	-0.06	0.66	-0.20	0.27	0.47	-0.12
Gross household saving – % of gross household disposable income	-0.26	0.05	-0.09	0.21	-0.22	-0.20	-0.23	-0.20	-0.69
Labour productivity per hour worked – % change over previous year	0.25	na	na	0.58	0.44	-0.29	na	0.05	0.32
Total R&D expenditure – % of GDP	0.36	-0.36	0.59	-0.26	0.30	-0.31	-0.05	-0.05	0.39
Energy intensity of the economy – kgoe per 1 000 euro	0.36	-0.31	-0.55	-0.88	-0.12	-0.64	-0.86	-0.26	-0.49
Total employment rate – %	0.43	0.70	0.65	0.25	0.72	0.83	0.79	0.31	0.55

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	Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Employment rate, by highest level of education attained – % of age group 25–64 years	0.17	0.40	0.62	0.13	0.82	0.79	0.46	0.00	0.37
Electricity consumption by households – 1 000 toe	0.05	-0.08	0.49	0.25	-0.34	-0.21	-0.15	0.01	-0.56
Electricity consumption by households – 1 000 toe	0.05	-0.08	0.49	0.25	-0.34	-0.21	-0.15	0.01	-0.56
Household expenditure per inhabitant, by category – Volume index (1995 = 100)	0.69	0.91	0.85	0.77	0.66	0.12	0.83	0.79	0.79
Total long-term unemployment rate – %	0.01	-0.48	-0.50	-0.21	-0.40	-0.80	-0.71	-0.55	-0.65
Lifelong learning – %	0.26	-0.23	na	-0.12	0.00	-0.25	0.34	-0.46	-0.55
Public expenditure on education – Percent of GDP	-0.16	-0.54	-0.16	0.07	na	-0.02	-0.61	-0.03	-0.39
Early school-leavers – %	-0.24	-0.42	na	0.25	-0.54	0.19	0.04	-0.18	-0.09
Employment rate of older workers	0.12	0.56	0.32	0.14	0.33	0.03	0.17	-0.56	-0.24
Net migration, including corrections – persons	0.41	0.02	0.28	-0.34	-0.40	0.12	0.29	-0.36	-0.30
Incidence of salmonellosis – new cases per 100 000 persons	0.37	0.22	-0.19	-0.31	0.15	0.27	-0.03	-0.20	0.43
Death rate due to chronic diseases – per 100 000 persons	0.00	0.48	0.55	-0.12	na	na	-0.02	-0.03	-0.44
Total greenhouse gas emissions – index base year = 100	0.82	0.35	0.69	-0.84	-0.53	-0.38	-0.53	0.01	-0.12
Renewables in gross inland energy consumption – %	-0.69	-0.05	-0.11	0.62	-0.52	0.12	0.07	0.55	-0.40
Energy dependency – %	-0.10	-0.21	-0.06	-0.10	-0.43	na	0.40	0.27	0.00
Implicit tax rate on energy – Ratio of energy tax revenues to final energy consumption, deflated	-0.33	0.10	-0.21	-0.23	-0.22	-0.07	0.67	-0.04	0.02
Electricity generated from renewable sources – % of gross energy consumption	-0.06	0.09	0.07	0.62	0.12	0.08	-0.09	0.28	0.08
Energy consumption of transport, by mode – 1 000 toe	0.77	0.44	0.54	-0.26	-0.08	-0.08	-0.03	0.71	0.52
Shares of environmental taxes in total tax revenues – %	-0.31	0.14	-0.28	-0.45	-0.29	0.17	-0.07	-0.40	-0.16
Shares of labour taxes in total tax revenues – %	-0.71	-0.82	-0.55	0.11	-0.41	-0.02	-0.07	-0.27	0.01

Continued next page

	Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Growth rate of labour productivity per hour worked – % change over previous year	0.40	0.29	0.38	0.91	0.75	0.24	0.45	0.35	0.61
Real effective exchange rate – index 1999 = 100	0.07	-0.05	0.52	-0.55	0.00	-0.80	-0.71	-0.88	-0.75
Employment rate, by gender – %	0.43	0.70	0.65	0.25	0.61	0.71	0.61	0.31	0.60
Unemployment rate, by gender – %	-0.41	-0.58	-0.70	-0.41	-0.61	-0.73	-0.72	-0.74	-0.92
Municipal waste generated – kg per capita	0.70	0.06	0.52	0.41	0.47	0.43	0.33	0.43	0.55
Municipal waste treatment, by type of treatment method – kg per capita	0.90	-0.01	0.41	-0.07	0.08	0.66	0.42	0.11	-0.35
Emissions of acidifying substances, by source sector – 1 000 tonnes acid equivalents	0.45	0.23	0.48	-0.58	-0.28	-0.42	-0.01	0.04	-0.38
Emissions of ozone precursors, by source sector – 1 000 tonnes ozone-forming potential	0.62	0.35	0.59	-0.71	0.44	-0.33	0.33	0.18	-0.02
Emissions of particulate matter by source sector – 1 000 tonnes particulate-forming potential	0.58	0.04	0.51	-0.47	0.33	-0.44	0.09	0.01	-0.23
Final energy consumption, by sector - 1 000 toe	0.80	0.62	0.62	-0.68	-0.24	-0.33	-0.20	0.17	0.14
Persons with low educational attainment, by age group – %	-0.06	0.31	0.20	0.28	-0.11	0.18	0.38	0.27	-0.18
Employment rate of older workers – %	0.12	0.56	0.32	0.14	0.33	0.03	0.17	-0.56	-0.24
Life expectancy at age 65, by gender – years	-0.25	-0.10	na	0.31	0.29	0.15	na	0.16	0.42
Total fertility rate – number – of children per woman	0.17	-0.06	-0.07	0.03	na	0.44	0.40	0.58	0.19
General government debtGeneral government consolidated gross debt as a percentage of GDP	-0.83	-0.50	-0.56	0.10	-0.48	-0.57	-0.77	-0.61	-0.78
Suicide death rate, by age group – Total – crude death rate per 100 000 persons	-0.60	-0.69	0.19	-0.02	na	na	0.26	0.33	0.06

End of Appendix

	Lithuania	Estonia	Latvia	Austria	Belgium	Denmark	Nether.	France	Germany
Greenhouse gas emissions – index base year = 100	0.82	0.35	0.69	-0.84	-0.53	-0.38	-0.53	0.01	-0.12
Greenhouse gas emissions by sector – million tonnes CO ² equivalent	0.84	0.35	0.68	-0.84	-0.54	-0.38	-0.54	0.01	-0.12
Greenhouse gas emissions intensity of energy consumption – index 2000 = 100	0.19	-0.03	0.12	-0.74	-0.58	-0.36	-0.29	-0.04	-0.34
Gross inland energy consumption, by fuel – 1 000 tonnes of oil equivalent	0.64	0.26	0.57	-0.81	0.06	-0.39	-0.49	0.17	0.10
Implicit tax rate on energy – Euros per tonne of oil equivalent	-0.33	0.10	-0.21	-0.23	-0.22	-0.07	0.67	-0.04	0.02
Modal split of freight transport – % in total inland freight tonne-km	0.51	-0.09	-0.45	0.21	-0.17	0.15	0.16	0.14	0.10
Volume of freight transport – Index 2000 = 100	-0.36	-0.53	-0.13	-0.07	0.28	-0.16	0.03	0.36	0.28
Greenhouse gas emissions from transport – 1 000 tonnes of CO ₂ equivalent	0.77	0.62	0.50	-0.21	-0.06	-0.25	0.20	0.20	0.30
People killed in road accidents – Number of killed people	0.61	0.47	-0.57	-0.27	0.18	0.01	0.03	0.49	0.05
Emissions of ozone precursors from transport – 1 000 tonnes of ozone-forming potential	0.60	0.29	-0.51	-0.05	-0.27	-0.13	0.32	0.10	0.60
Emissions of particulate matter from transport – 1 000 tonnes	0.65	0.60	0.41	-0.09	0.58	-0.31	0.24	0.10	0.56
Forest trees damaged by defoliation – %	0.76	-0.04	0.10	-0.26	-0.23	-0.15	-0.34	-0.67	-0.05
Shares of environmental and labour taxes in total tax revenues – %	-0.31	0.14	-0.28	-0.45	-0.29	0.17	-0.07	-0.40	-0.16

*na – data not available

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