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The features of economic growth in the case of Latvia and Lithuania

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Abstract

Innovation based growth and development is a hot topic in all economies of the world. Openness of mind, openness of businesses and openness of innovation are the key characteristics and success factors of the global world today. Growth and development strategies are becoming smarter transforming economy towards creation of higher added-value products, services and more effective use of resources. Such a high-priority aim may be achieved by R&D activities, which raise the innovation growth and, positively influence productivity, thus providing a platform for sustainable growth and development. Productivity is perceived as the ability to properly use the production factors to create value-added, implement innovations and to maintain the country's competitiveness. In the macroeconomic researches of different scholars (Solow, Saliola, Seker, Kathuria, Puharts etc.) special attention is given to the quantitative measurement of the various factors of growth and development. These researches have shown that one of the more accurate methods of the productivity measurement is a calculation of total factor productivity (TFP). TFP notion is closely related to the innovation concept as proved by many empirical researches. Industry and firm-level studies concluded that R&D investments to a great extent determine TFP growth. The aim of this research is to calculate the total factor productivity by industry both in Latvia and Lithuania for better understanding of economic growth and development perspectives in those countries.

Keywords: Economic growth and development, Gross domestic product, Productivity, Innovations, Total factor productivity

Background

Economic development is perceived as a complex phenomenon, which essence is to adapt to the constantly changing environment and thus promote the economic development of the country. The key factor of the economic development is the productivity and purposeful use of the labour and capital resources. Productivity is often understood as the ability to use the available factors of the production to create value-added – product. Proper use of this two essential factors of production leads to the country's value creation and thus to stimulate economic growth. Therefore, a proper assessment of the results of productivity analysis is an essential prerequisite for fostering the efficiency of the competitiveness and economic systems (country's, company's).

In the developed countries, economic growth is depended on the country's human capital and its efficient use. On the other hand, it is essential to properly assess and purposefully use the available capital and using it, to foster the objectives of the welfare

state. In the article the statements of Solow, Saliola, Seker, Kathuria, Puharts etc. are analysed and showed that calculating the total factor productivity (further – TFP) it is necessary to assess the influence of labour and capital factors on gross domestic product (further – GDP). TFP is strongly related to the human capital, innovation, infrastructure, taxation and regulatory framework (Cardarelli, Lusinyan 2015). These studies help to perceive, which industry has the greatest impact on GDP growth and which branch is considered as less significant.

The aim of this research is to calculate the total factor productivity by industry both in Latvia and in Lithuania for better understanding of economic growth and development perspectives in those countries. The authors used company data on public and private firms extracted from Amadeus database. Criterion for the company inclusion was data availability for the period from 2005 to 2015. The methods chosen for conducting a research are mainly quantitative.

Theoretical features of the productivity

The scientists are constantly exploring the factors that influence economic development, so the productivity analysis is one of the main tasks of economists and the objectives of economic science. Latruffe (2010) productivity defines as the ability to create value-added – product, using the available factors of production. In this context, productivity is described in several ways (Kim, Law 2012; Bergeaud et al. 2015; Nowak et al. 2015), such as:

- the assumption of economic growth and development;
- the ratio between the costs (resource utilization) and the resultant effect (the end result) and efficient management;
- one of the most important determinants of living standards.

In the broadest sense, the productivity is understood as the ratio between the results (output) and resources (input) (Rutkauskas, Paulavičienė 2005):

$$Productivity = \frac{Output}{Input} \tag{1}$$

In this context, the productivity is related to the use of the resources to the value creation. The high productivity is achieved by the efficient use of the resources. Productivity changes may result the composition of employment. These changes are affecting the measurement of the workers' contribution and therefore have an impact on the wage setting (Eckstein et al. 2011; Peluffo 2015). It follows that a proper use of labour, mainly human, resources is an essential prerequisite for ensuring economic development. Rising productivity means that the improved management tools are applied and staff are acquired the useful knowledge.

In the broadest sense, the economic development should be understood as the degree to which the economy includes the efficient economic resources and distribute them (Roemer 2014). The development requires a transformation of the structural production and consumption (Fig. 1).

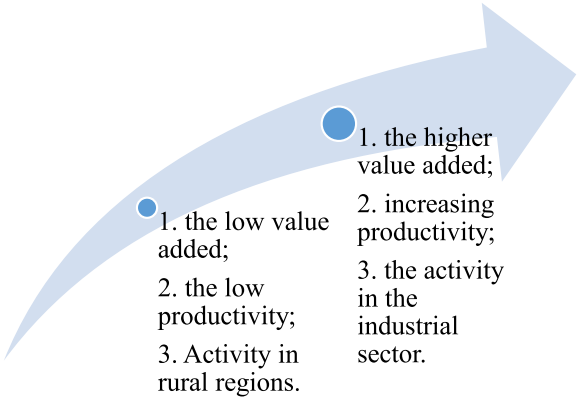

Fig. 1 The graphical view of the structural transformation of production and consumption (Source: compiled by authors based on Baležentis 2013)

The graphical view of the structural transformation of production and consumption explains that the transformation from low value-added, low productivity and activity in rural regions to more productive, higher value-added and the activities in the industrial sectors are preconditions to promote the production and export of the more complex products.

In particular, the concept of productivity explains the productivity as an important measure, which interpret invisible trends in the market and in decision-making process (Baležentis 2013). The analysis of productivity is a fundamental problem in order to improve competitiveness and creates a useful management tools for the fostering of economic growth and development (Domańska et al. 2014). Therefore, it is proposed to measure the country's competitiveness in a various ways and one of an appropriate method is the calculation of total factor productivity as an example of the analytical method.

Total factor productivity as the method of economic growth assessment

Nowadays the country's political, economic, social and technological environment influence on economic progress is analysed. The authors highlight the idea that social, historical and cultural, institutional and political factors and administrative context has an important influence on the development process in the national and regional growth and companies' productivity perspective (Kim, Law 2012). The macroeconomical factors (institutional quality, openness to the international trade, geographical conditions) are fundamental determinants of the long-term productivity and growth. Here are various methods that can be used for the assessment of the country's economic situation. The special attention of scientists (Hulten 2001; Калюжный 2003; Bernanke et al. 2008; Van Beveren 2010; Del Gatto 2011; Chansarn 2014; Lasagni et al. 2015; Puharts, Kloks 2015; Dhehibi et al. 2016; Selçuk, Köktas 2016) in macroeconomic researches is paid to the calculation/use of the total factor productivity. It is the measure of efficiency (productivity) and the most important engine of the economic growth (Puharts, Kloks 2015). Total factor productivity is the method that determines the capital, labour and general productivity factors contribution to the gross domestic product growth (Калюжный 2003; Kathuria et al. 2013). TFP also can be understand as technical progress in its broadest sense (Fassio et al. 2015). TFP has a strong relation with human capital, innovation, infrastructure, taxation and regulatory framework (Cardarelli,

Lusinyan 2015). If GDP growth is high, the labour transformation from the low to high productivity level can lead to the development and growth. The obtained results demonstrate how to split the investments between the main components (capital and labour) in order to increase productivity.

The growth of total factor productivity is a broader measure of innovation. Generally, innovation is an idea, technique or object that becomes acceptable as innovation from an individual or other unit of adoption (Karafillis, Papanagiotou 2008). It shows the importance of innovation dynamic in the productive processes. Innovation is a multifaceted phenomenon and it is difficult to measure it. The innovation dynamics are strongly technology-specific and differ across sectors, so here is the possibility to use the new knowledge for the growth of the productivity. As a result, here is the possibility to produce new products in a new ways and apply a technological novelty (Fassio et al. 2015). Technical difference, resulting by different innovation apply TFP difference, which is from innovation to productivity, is explained (Karafillis, Papanagiotou 2008).

In 1942 Tinbergen defined the production function, which in 1957 was developed by Solow (1957) (Hulten 2001). TFP is the production function of Cobb-Douglas (Baležentis, 2013) modification (Ferrante, Freo 2012; Filatovaitė, Bratčikovienė 2015).

$$Q = AL_aK_b \tag{2}$$

where:

Q- quantity of the production;

A – productivity factor;

$L$and K- the factors of production (labour and capital);

a and b – coefficients.

The production function shows what the quantity of production can be obtain by using the available resources. Depending on the type of production, resources (so called production factors) can be various. In most cases, there are distinguished three groups of production factors: labour, capital and land. Since the land fund practically does not change, then this factor usually are not included to the production function.

Solow (1957) defined the total factor productivity as the efficiency with which the companies makes the available resources to the appropriate outputs and have appropriate results. In the company level, production function is detailed in this way (Bergeaud et al., 2015) (Van Beveren 2010; Biddle 2012; Lasagni et al. 2015).

$$Y_{it} = A_{it}K_{it}^{\alpha_k}L_{it}^{\alpha_l}M_{it}^{\alpha_m} \tag{3}$$

where:

Y_{it}- the firm‘s revenue;

A_{it} - firm specific time-variant term;

$K_{it}^{\alpha_k}$ - our measure of physical capital, namely the value of tangible fixed assets as reported in the balance sheet;

$L_{it}^{\alpha_l}$- our measure of employment level;

$M_{it}^{\alpha_m}$- raw materials expenditures.

It follows, that the calculations include three factors – capital, labour and intermediate goods. The scientists (Saliola, Seker 2011; Von Arnim, Rada 2011) offers use the

machine value, technological resources and equipment value as the capital measurement tools. A total compensation of employees (wages, salaries) are perceived as a labour, and as intermediate goods are described by the prices of raw and materials. These factors lead to the explanations of the production factors that may be employed and create higher value-added and increase the technical efficiency (Baležentis 2015; Carlsson et al. 2015). Analysing these determinants here can be find the appropriate ways to increase their productivity (Chansarn 2014).

In this article, the methodology of total factor productivity calculation (Калюжный 2003) is used. Using the (Bernanke et al., 2008) formula (using the analytical method) the productivity of analysed factors is assessed in the context of the gross domestic product.

$$\Delta Y_{TFP} = \Delta Y_{TFP/L} + \Delta Y_{TFP/K} \tag{4}$$

TFP growth is explained as the paying of fixed costs of innovation in a perfectly competitive economy with constant returns to scale in capital and labour (Comin 2006). By linking the TFP grow rate to innovation it is necessary to apply the attention to the main components of TFP growth – capital and labour rates, so firstly the growth of GDP by growing the use of labour (Biddle, 2012) and capital (Cardarelli & Lusinyan, 2015) is calculated:

$$\Delta Y_L = (L_{2015}/L_{2005} - 1) \times (Y_{2005} - A_{2005}) \tag{5}$$

where:

L_{2015}/L_{2005} - index of growth of use of the labour;

Y_{2005} - GDP in 2005 (at current prices);

A_{2005}- the use of capital in 2005.

$$\Delta Y_K = (K_{2015}/K_{2005} - 1) \times A_{2005} \tag{6}$$

where:

K_{2015}/K_{2005} - index of growth of use of the capital;

Secondly, it is necessary to calculate the growth of GDP by using the labour and capital (Carlsson et al., 2015).

$$\Delta Y_{TFP} = \Delta Y - (\Delta Y_L + \Delta Y_K) \tag{7}$$

Where:

ΔY - the change in GDP.

Further, it is necessary to calculate $\Delta Y_{TFP/L}$ and $\Delta Y_{TFP/K}$ ((8) and (Del Gatto et al., 2011)).

$$\Delta Y_{TFP/L} = (p_{L2015} - p_{L2005}) \times L_{2015} \tag{8}$$

where:

$p_{L2015}$and p_{L2005} - the productivity of labour;

L_{2015} - the use of labour in 2015.

$$\Delta Y_{TFP/K} = (a_{2015} - a_{2005}) \times K_{2015} \tag{9}$$

where:

a_{2015} and a_{2005} - the productivity of capital;

K_{2015} - the use of capital in 2015.

Then we have all necessary components for the total factor productivity calculation (Bernanke et al., 2008). Maximizing the benefit the combination of labour and capital, which reduces costs and increase the expected profit is chosen (Zamparelli 2015). The calculation of the index requires three factors: GDP, labour and capital. In further calculations, the information about GDP, the average annual fixed capital, fixed capital use and the average annual number of the employed in Lithuania and Latvia are used. The total factor productivity is calculated for each industry. Further, the productivity of labour and capital and part of fixed capital in GDP (%) are calculated.

The assessment of economic growth in Latvia and Lithuania

For the calculation of the total factor productivity, the industry data are used. Here are marked the classification of the industries:

A. – agriculture, forestry and fishing;
B. – mining and quarrying;
C. – manufacturing;
D. – electricity, gas, steam and air conditioning supply;
E. – water supply, sewerage, waste management and remediation activities;
F. – construction;
G. – wholesale and retail trade, repair of motor vehicles and motorcycles;
H. – transportation and storage;
I. – information and communication;
J. – information and communication;
K. – financial and insurance activities;
L. – real estate activities; accommodation and food service activities
M.– professional, scientific and technical activities;
N. – administrative and support service activities;
O. – public administration and defence, compulsory social security;
P. – education;
Q. – human health and social work activities;
R. – arts, entertainment and recreation;
S. – other service activities.

In this article the modification of the production function – an analytical method is used. This method is used for the calculation of the factors influence on the growth in GDP. Using (Bernanke et al., 2008) formula the total factor productivity for the period 2006–2015 years in Lithuania and Latvia is calculated. The results are shown in Table 1.

Table 1 shows that the greatest impact on Lithuania's GDP dynamic has such industries as information and communication (J) and financial and insurance activities (K), where during the analysed period the productivity grow respectively by 405,65% and 302,59%. The greatest negative impact (productivity decline) is observed in such industries as transportation and storage (H) and wholesale and retail trade, repair of motor vehicles and motorcycles (G), where during the analysed period productivity decline by

Table 1 The results of the total factor productivity calculation (Source: compiled by authors based on author's calculations)

Lithuania				Latvia			
Industry	$\Delta Y_{TFP/L}$	$\Delta Y_{TFP/K}$	ΔY_{TFP}	Industry	$\Delta Y_{TFP/L}$	$\Delta Y_{TFP/K}$	ΔY_{TFP}
A	101,11	−8,44	92,67	A	130,84	−51,04	79,81
B	120,13	−25,23	94,90	B	120,13	−25,23	94,90
C	108,12	−21,16	86,96	C	143,14	−48,81	94,32
D	122,80	−21,54	101,26	D	152,51	7,97	160,48
E	−51,39	166,87	115,48	E	87,92	−24,17	63,75
F	164,76	−53,12	111,64	F	114,97	−97,16	17,81
G	−0,07	−21,15	−21,22	G	103,00	79,57	182,57
H	−62,83	1,84	−60,98	H	86,60	−7,95	78,65
I	49,98	−3,00	46,98	I	−184,65	−19,01	−203,66
J	315,35	90,30	405,65	J	12,55	−438,08	−425,53
K	−390,40	692,98	302,59	K	−5,22	259,03	253,81
L	113,08	12,95	126,03	L	102,37	14,11	116,48
M	103,24	−1,24	102,00	M	73,64	1,77	75,41
N	65,98	−44,07	21,91	N	144,36	−114,58	29,78
O	n/a	n/a	n/a	O	98,92	−13,54	85,38
P	n/a	n/a	n/a	P	−56,12	312,98	256,87
Q	46,89	4,60	51,49	Q	88,29	5,44	93,73
R	88,96	−0,89	88,07	R	153,18	113,58	266,76
S	n/a	n/a	n/a	S	98,69	−10,64	88,05

−60,98% and −21,22%. In Latvia, the situation is quite different. Here the greatest impact on GDP dynamic has arts, entertainment and recreation (R) and education (P), where the productivity grows by 266,76 and 256,87%. The negative impact (productivity decline) was in such industries as information and communication (J) (−425,53%) and information and communication (I) (−203,66%). For the further analysis results of two main sectors - electricity, gas, steam and air conditioning supply (D) and financial and insurance activities (K) - are given. Fig. 2 shows the graphical view of this situation.

It follows that it is necessary to invest in industries that have the greatest impact on the GDP changes – to improve agriculture, forestry and fishing industry and properly organize the financial activity. Here both countries have a great potential and the possibility to improve the entire economy of the country. However, special attention should be paid for the manufacturing and construction industries. They are the sectors with the most employed people and sectors that have the ability to raise productivity.

Figure 2 shows that both in Lithuania and Latvia electricity, gas, steam and air conditioning supply (D) sector's productivity is very similar. In 2010 year was a great recession, when this sector productivity was negative. However, in 2011 situation changes and results were quite better. Until 2015, productivity in this sector was very low, so it can be said, that it is non-productive. The industry with great dynamic results is the financial and insurance activities (K). Here are quite different situation. In Latvia results of this industry, productivity was highest in 2010 but in 2011 here was a great decline. In Lithuania during the analysed period, the productivity of this sector is very similar during the analysed period.

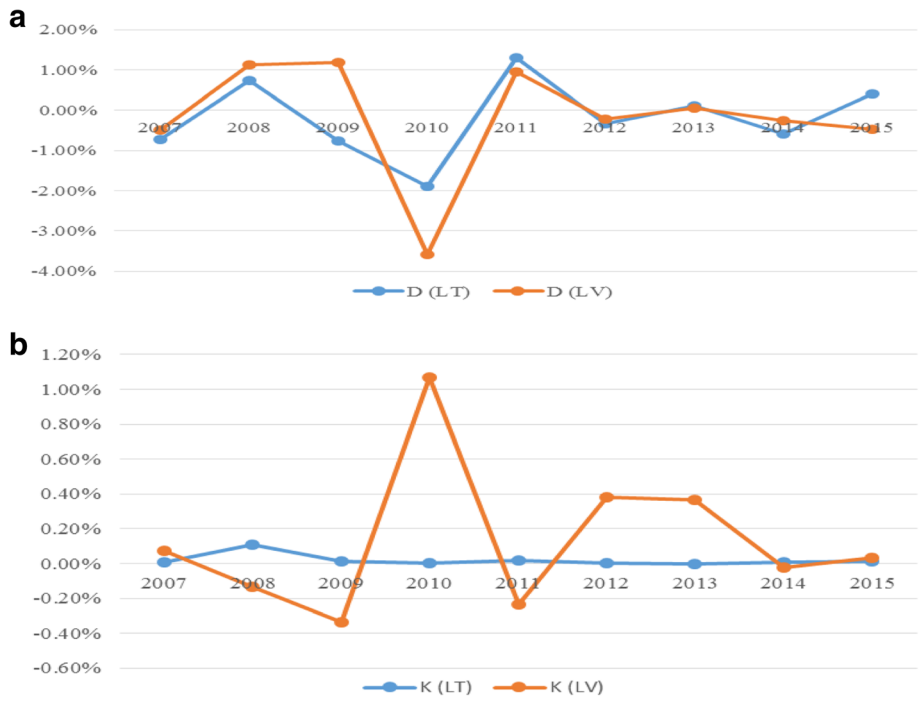

Fig. 2 TFP dynamic in (**a**) electricity, gas, steam and air conditioning supply (D) and (**b**) financial and insurance activities (K) in 2006–2015 y. y. (Source: compiled by authors based on author's calculations)

In summary, the identified main industries in which it is necessary to invest in order to recoup the investment and to improve the economic situation of the country. However, also the industries with lower productivity impact on the GDP dynamic should be improved. Here are several ways how to improve the productivity – by investing in new technologies, attraction of the most skilled and talented people.

Conclusions

Productivity is an important measure of the economic growth and development. The transformation of structural production and consumption from low value-added activity with low productivity and rural activity to more productive, higher value-added activity in the industrial sector creates preconditions to promote the production and export of the more complex products. The main source of productivity growth is the technological progress.

The study results show, that the most productive and the greatest impact on GDP growth in Lithuania has such industries as financial and insurance activities (K) and agriculture, forestry and fishing (A), where during the analysed period the productivity grow respectively by 0,06 and 0,03%. The greatest negative impact (productivity decline) is observed in such industries as electricity, gas, steam and air conditioning supply (D) and manufacturing (C), where during the analysed period productivity decline by −2,03 and −1,07%. In Latvia, the situation is quite different. Here the greatest impact on GDP dynamic have construction (F) and electricity, gas, steam and air conditioning supply (D), where the productivity grow by 0,55 and 0,53%. The negative impact (productivity decline) was in such industries as public administration and defence, compulsory social security (O) (−0,57%) and other activities (S) (−0,08%).

Authors offer to identify the main industries in which it is necessary to invest in order to recoup the investment and to improve the economic situation of the country. The productivity can be improved in several ways – by investing in new technologies, attraction of the most skilled and talented people.

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Authors' contributions
ID wrote all the paper and NL made all the research framework and develope the research. Both authors read and approved the final manuscript.

Competing interests
We have read SpringerOpen's guidance on competing interests and included a statement of all financial and non-financial competing interests.

Publisher's Note

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