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APPLICATION OF THE GROWTH ACCOUNTING METHOD FOR THE CONSTRUCTION INDUSTRY

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Abstract. As the growth accounting method can suggest research benefits, this paper is dedicated to the application of the method in the construction industry. The lack of methodologies for the application of the method in the less developed countries has necessitated the design of the methodology presented in the paper. Once the methodology is composed, comparable results can be obtained on the fulfilment of international academic standards. The paper presents the main methodological problems faced by the author while working on the problem. In addition, it enables the identification of the proximate sources of growth as well as the performance of economic analysis from a comparative perspective of countries at different stages of development. The scientific merit of the paper – the entire group of intangible capital rather than only software will correspond to knowledge based capital. The results suggest that Lithuania is in a rather strong position in terms of productivity growth, but the same could not be said when considering the structure of its main determinants compared with the more developed countries.

Keywords: economic growth determinants, value-added growth, productivity growth, growth rate, growth accounting, construction industry.

JEL Classification: O47, E22, E01.

Introduction

Inadequate attention paid by Lithuanian scientists to the method of growth accounting compared with the attention given to it by scientists of the more developed economies (Mas 2005; Mas, Quesada 2005; Haskel *et al.* 2015; Haskel *et al.* 2014a; Dal Borgo *et al.* 2012; Dal Borgo 2013), and also the lack of comparable results arising from the fulfilment of international academic standards (see EU KLEMS) in Lithuania and other less developed countries has necessitated the application of the method to the case of Lithuania. The scientific problem of the present paper is the lack of methodologies for the application of the growth accounting method, which would allow results to be obtained on the fulfilment of international academic standards of the EU KLEMS (EU KLEMS) project in the construction industry of the less developed countries (including the case of Lithuania). The aim of the present paper is to compose a methodology that uses the growth accounting method in the construction industry of a less developed country and then approve the methodology for the case of Lithuania. This would enable comparable proximate sources of growth of differently developed economies to be ascertained.

The period of the research is 1995–2009. This period of research was selected because the latest data are not available due to their wide scope in the selected databases, which are only updated infrequently (the EU KLEMS and the WIOD). Moreover, the latest publications by well-known scientists of works referring to the growth accounting method refer the same period of research (Haskel 2015; Haskel *et al*. 2014b, 2012a; Dal Borgo *et al.* 2013; Haskel, Wallis 2013; Greenhalgh *et al.* 2013). Because the main purpose of the present paper is to solve an existing contemporary economic problem defined above and to compose a methodology enabling comparable results to be derived for a less developed country, this will be indicated as a limitation of the current research.

1. General framework

The following objectives for the present paper have been raised. Firstly, to overview the relevant scientific literature on the growth accounting model, and define the relevant questions under discussion. Secondly, to build a relationship between the theoretical perspectives and the practical application of the model. Thirdly, to review the possible sources of scientific datasets for the successful application of the method in the case of Lithuania. Fourthly, to compose a new methodology to obtain relevant comparable results. The calculations had to be carried out following certain methodological recommendations and certain consistency checks. Lastly, to perform a comparative economic analysis of the results obtained for the Lithuanian case in the context of the construction industry of the more developed countries.

The paper has a novel perspective at the national level, i.e. the application of capital services instead of capital stock. At the international level, the perspective is that the entire group of intangibles is considered to belong to the group of knowledge-based capital rather than just software.

The relevant theoretical and empirical implementation questions for the growth accounting model were clarified during a 2-month scientific internship under Professor Matilde Mas (University of Valencia, IVIE Institute of Economic Research, Spain). It should be noted that IVIE institute provides the calculations for Spain to the developers of the EU KLEMS project.

2. Method

The analysis of economic growth relies on capital, labour and productivity measures, and the growth accounting approach is approved by the common consensus of respected scientists (Jorgenson 1963; Haskel *et al.* 2012a; Haskel, Pesole 2011; Mas, Fernandez 2014; Timmer *et al.* 2013; Oulton 2012a; Oulton 2012b).

There are many versions of the growth accounting method and forms of its application (Mas, Fernandez 2013; Haskel *et al.* 2014b; Haskel *et al.* 2014c; Corado *et al.* 2001;

Haskel *et al.* 2013; Haskel *et al.* 2009; Brynjolfson, Lorin 2000; Caroli, Reenen 2001; Oulton 2002; KPMG 2009). The roots of the method date back to the representative of the neo-classical economics Scientist Robert Solow (1956). In 1987, professors Jorgenson, Gollop and Fraumeni (Harvard University) presented their work to the society and outlined the growth accounting approach based on the KLEMS methodology (Jorgenson *et al.* 1987). In this particular research, the EU KLEMS methodology of growth accounting will be followed basically (Timmer *et al.* 2007a; Timmer *et al.* 2007b).

With the help of the model, the growth rate of value added can be broken down into contributions of hours worked and productivity within a consistent framework. Productivity is further broken down into detailed labour, capital and multifactor productivity (MFP) contributions. Following the assumptions of neo-classical economies, MFP growth identifies the improvements in technology. MFP growth is expressed as the difference between the volume growth of the output and the volume growth of the inputs. Hence, it evaluates the increases in the amount of the value added that can be created by a given certain quantity of inputs.

Growth accounting is founded on production possibility frontiers and industry gross output is a function of capital, labour, intermediate inputs, and technology, which is indexed by time (Timmer *et al.* 2007a). The value added consists of capital, labour inputs and the nominal value is expressed by Formula 7 (Timmer *et al.* 2007a: 16). Following the neoclassical assumptions, the growth of the industry value added can be broken down into the contributions of capital, labour, and MFP, which is expressed by Formula 8 (Timmer *et al.* 2007a: 16). The weight of each input is expressed by Formula 9 (Timmer *et al.* 2007a: 16).

Capital input is expressed in terms of capital services. To derive capital services, the detailed capital stock indicators are needed as well as the shares of its remuneration in the total output value. Capital services are calculated according to Formula 3 (Timmer *et al.* 2007a: 33) and are expressed as the Tornqvist quantity index. The weights indicate the average value shares of each detailed asset in the value of capital compensation (CAP) (Timmer *et al.* 2007a). The compensation is expressed as the user cost and is calculated according to Formula 4a (Timmer *et al.* 2007a: 33). The rate of return is calculated following the endogenous approach (Timmer *et al.* 2007a; Oulton 2007).

Labour input is expressed in terms of labour services. Labour input is calculated according to educational attainment, as this approach is the most relevant from a productivity perspective. Labour services are calculated with reference to Formula 5.1 (Timmer *et al.* 2007a: 24) and are expressed as the Tornqvist quantity index. The weights indicate the average shares of labour types according to the educational attainment in the value of labour compensation (LAB) (Timmer *et al.* 2007a).

In order to derive weights for capital and labour, two indicators from the national accounts (national statistics) are needed: compensation of employees (COMP) and gross operating surplus (GOS). The GOS indicator is adjusted to self-employed income (which is added to the COMP indicator). Thus, the main figures for capital and labour weights are derived for the calculations of growth accounting (Timmer *et al.* 2007b).

Growth accounting needs the following variables that capture the contributions of inputs and MFP to value added growth, Formula 1 (Timmer *et al.* 2007b: 5).

3. Data

The data come from the following sets: the WIOD, the EU KLEMS, and the Statistics Lithuania database. The WIOD provides data on the labour input for all of the selected countries, the EU KLEMS – for capital input for all of the more developed countries, and the Statistics Lithuania database – for capital input of Lithuania. It should be noted, that the particular methodology described in the present paper is suitable for all of the less developed countries. Capital determinants that could be found in the EU KLEMS database were selected as well as the detail capital input set (EU KLEMS): computing equipment (IT), communications equipment (CT), software (SF), transport equipment (TR); other machinery and equipment (OM); non-residential structures (NR); residential structures (R), other intangibles (OI). It is important to indicate the novel perspective of the present paper, i.e. adding software (SF) to other intangibles (OI) and, therefore, all intangibles (IN) are derived and accounted. The labour input is taken according to the educational attainment – labour composition (LC), as this is the most relevant approach from the productivity perspective. The novelty that has to be indicated is reflected in the idea that the group of knowledge-based capital compounds not only the following indicators: labour composition (LC), computing equipment (IT), communications equipment (CT), and software (SF) (as in original growth accounting method). Software (SF) is added to other intangibles (OI) and, therefore, intangibles (IN) have been derived and attributed to the group of knowledge-based capital. Hence, knowledge-based capital includes: labour composition (LC), computing equipment (IT), communications equipment (CT), intangibles (IN), multifactor productivity (MFP).

4. Methodology

The following sequence of steps had to be accomplished: capital accounts, labour accounts, and productivity accounts. The period of the research was 1995–2009. Microsoft Office Excel was used for the calculations. The more developed countries are those with the gross value added (GVA) greater than that of Lithuania.

The newly composed methodology will consist of the following three parts:

1. The methodology for Australia, Czech Republic, Denmark Sweden, and the USA.
2. The methodology for Austria, Finland, Germany, Italy, Japan, the Netherlands, Spain, and the UK.
3. The methodology for Lithuania.

The methodologies for each group of countries above are used because certain methodological steps are required in case of these countries in order to obtain comparable results. For the first group of countries, the data on capital came from the EU KLEMS ISIC rev. 3 database (EU KLEMS). For the second group of countries, the capital input data was taken from the EU KLEMS ISIC rev. 4 database (EU KLEMS). For the third case, the case of Lithuania, the data came from the Statistics Lithuania database (national accounts). For the labour accounts, the data was taken from the WIOD database (WIOD). An economic structure template had to be composed in order to obtain comparable results (Table 3, Annex).

4.1. Methodology for the first group of countries

For Australia, Czech Republic, Sweden, Denmark, and the USA, detail data on capital were found in capital accounts of the EU KLEMS ISIC Rev. 3 database (EU KLEMS). Any country which lacked detail capital data for capital accounts was not selected for this particular research. Capital data were treated in the following manner: gross fixed capital formation (GFCF) and capital stocks (Stocks) of software (SF) were summed up with other intangibles (OI) for all the industries according to the economic structure template, provided in Table 3 (Annex). The novel perspective for the existing methodology was derived from this step – the group of intangible capital was attributed to knowledge-based capital for the period researched. The real and nominal GFCF and capital stock were taken for the construction industry. New price levels were calculated by dividing the nominal GFCF by the real GFCF for the economic structure template during the period researched. The new price levels were calculated for the construction industry using the year 1995 as the reference point. New industry rates of return were calculated according to Formula 5 (Timmer *et al.* 2007a: 34) for the economic template for the entire period. The capital compensation (CAP) indicator was taken from the WIOD database for the construction industry. Depreciation rates were taken from and aggregated according to the economic structure template (Timmer *et al.* 2007a: 36). Capital compensation (CAP) rates were calculated according to Formula 4a (Timmer *et al.* 2007a: 33) with new industry rates of return. The obligatory methodological recommendation at this stage concerned the sum of capital compensation, which had to be equal to the CAP that was used in the rates of return calculation. When the CAP for each detail capital was obtained, the next step was to calculate the part of each detail capital asset in all CAP. The sum of the inputs had to equal 1.

The next step was to prepare the labour accounts. It was decided to break down labour according to the educational attainment because this approach is the most relevant from the productivity perspective. Data were taken from the WIOD database – labour compensation (LAB) and hours worked by the high-skilled, medium-skilled and low-skilled workforce and adjusted to the economic structure template, provided in Annex during the period researched. It was imperative that those values equalled 1 when added together. The labour services volume had to be calculated because this is needed for the productivity growth accounting. The growth rate of labour composition had to be indicated and obtained as the Torqvist real growth rate. The index combines the percentage structure and growth rates of the volume index. The Tornqvist real growth rate for the total economy in an industry is calculated according to the following the formula:

$$[0.5*(A_t/T_t + A_{t-1}/T_{t-1})*\ln(A_t) - \ln(A_{t-1})] +$$
$$[0.5*(B_t/T_t + B_{t-1}/T_{t-1})*\ln(B_t) - \ln(B_{t-1})], \quad (1)$$

where the first part: $0.5*(At/Tt + At - 1/Tt - 1)$ or $0.5*(Bt/Tt + Bt - 1/Tt - 1)$ is the two periods nominal *VA* average share of each industry in the total economy (*T*), and the second part $\ln(A_t) - \ln(A_{t-1})$ or $\ln(B_t) - \ln(B_{t-1})$ is the real growth rate of each industry. The volume index (I) can be obtained as follows:

$$I_t = 100;\ I_{t+1} = I_t * Exp(GT_{t+1});\ I_{t+2} = I_{t+1} * Exp(GT_{t+2}), \tag{2}$$

where $Exp(x)$ is an excel function: returns e raised to the power of a number: e^x, i.e. *EXP* is the inverse of *LN*, the natural logarithm of the number.

With the help of Equation (1), the growth rate of labour composition was derived. The labour composition volume was derived using Equation (2). The annual growth rate of labour services includes the following facets and is the sum of the annual growth rate of the labour composition change and the annual growth rate of hours worked. The labour service volume was then calculated using Equation (2). The next step of the methodological sequence is to calculate the contribution of individual detailed capital types to the total capital growth rate. It is important to note that the growth rate for this asset is the difference between two periods of logarithms and is used on this occasion. For the growth accounting procedure, it is important to derive the real growth of each input and its nominal value added. The next step was to calculate the real growth rate of labour service. Different capital input volumes were calculated for different asset types and their real growth rates had to be obtained. Moreover, it was also necessary to make sure that the shares of LAB and CAP in the nominal value added equalled 1. Additionally, each detail capital input had to be multiplied by CAP in industrial value added. Thus, compensation shares of the detailed capital input in all the CAP were obtained. The next step was to calculate the real growth rates of the value added. The contribution of each detailed input was derived (Timmer *et al.* 2007a). The contribution of all the capital to the value added was derived as the sum of all contributions of each asset. And as the contribution of MFP is a residual, it is derived using Formula (Timmer *et al.* 2007a: 44). The growth rates of the variables are the real growth rates and the shares of the compensations are derived from the nominal value added.

4.2. Methodology for the second group of countries

For the following second group of countries, namely, Austria, Finland, Germany, Italy, Japan, the Netherlands, Spain, and the UK, detailed capital data was found in ISIC Rev. 4 updates for the period 1995–2009.

The main difference between the methodology of the first and the second group of countries provided here is that capital data for detailed inputs are expressed in terms of the volume indexes. The indexes of volume were adjusted to the economic structure template and the new growth rates were derived. Capital compensation (CAP) for all types of capital were adjusted to the economic structure template. Each part of the capital input in all CAP was derived by dividing each detailed capital input by the summation of CAP. The summation of CAP was used as CAP in growth accounting, and then the LAB was obtained by subtracting CAP from value added.

Labour input was derived using the same methodology, which was used for the first group of countries.

The same growth accounting calculations and consistency checks that were used in the methodology for the first group of countries were followed.

4.3. Methodology for Lithuania

The third methodology is for Lithuania. Lithuania's case had to be composed with especial accuracy as capital services were not provided in the EU KLEMS (EU KLEMS) and the Statistics Lithuania database did not provide the indicator, so they had to be properly derived.

The author started with the capital data. GFCF data for detailed capital assets according the Council Regulation (EC) No 2223/96 at nominal and chain linked volume (CLVL) prices and nominal stock estimates for the period 1995–2009 at NACE Rev. 2 was taken for 38 economy branches and the following detailed capital asset types with codes (IT (T111321), CT (T111322), TR (T11131), R (T1111), NR (T1112), In (T112)). OM was calculated by subtracting T11132, T111321, T111322, and T11131 from T11132, i.e. subtracting IT, CT and TR from all the transport equipment. The next step was to aggregate all the assets to the template. Price levels for detailed capital types were calculated by dividing the nominal values (Nom) by chain-linked volume (CLVL) estimates. The obtained price levels were used in the industry rates of return, capital compensation (CAP) calculations and real stock estimates to derive them from the nominal once. CAP data for each industry were used in the sequence provided below. The initial growth accounting statement is that value added is the sum of LAB and CAP. The LAB indicator comes from wages of employees and CAP comes from GOS, and adjusting GOS to the self-employed income. To obtain these estimates, the number of hours worked by the people engaged was divided by the total hours worked by the persons employed and this rate was multiplied by the compensation of employees. The indicators were taken from the Statistics Lithuania database. The CAP at the industrial level was then derived by subtracting LAB from value added. These values were adjusted to the economic structure template for the period researched. The calculations need to be consistent, so the derived values of CAP had to be used for the industry rates of return calculations. Formula 5 (Timmer *et al.* 2007a:34) was used for this purpose. Then, using Formula 4a (Timmer *et al.* 2007a:33), capital compensation data at the industrial level were derived. In addition, the detailed capital compensation shares as part of all CAP had to be calculated, as did the volumes for detailed assets. Labour data for hours worked by the engaged people were taken from national accounts and adjusted to the template. The shares of compensation according to the educational attainment were taken from the WIOD database and adjusted to the economic structure template during the period researched. The growth accounting calculations followed. The procedure followed the same steps as provided in the methodology for the first group of countries.

5. Results

After the empirical application of the methodologies for the selected countries, the comparable results were derived. The results derived by the application of the growth accounting method for the construction industry are presented in tables provided below. Table 1 provides the numerical values derived when the growth accounting method was applied to the construction industry, and Table 2 provides the ranking results of labour productivity contributors: the highest contributor had the value of 1, and the least contributor – the value of 9. The results indicate that Lithuania's growth rate of the value added is high compared with that of the more developed countries. During the researched period, Australia had the highest (0.06%) result, followed by Lithuania (0.05%), the USA (0.04%), Spain (0.03%), Sweden (0.02%), Finland (0.02%), Denmark (0.02%), the UK (0.01%), the Netherlands (0.01%), Italy (0.01%), Austria (0%). Negative values were obtained for the Czech Republic (–0.01%), Japan (–0.02%), and Germany (–0.03%). The results indicate quite a high growth rate of Lithuania's value added even when compared to the construction industry of the more developed countries. Author's special interest was in the labour productivity (LP) indicator. Its contribution to the growth rate of value added gave the following results: Lithuania's labour productivity (LP) was the highest when compared with that of the more developed countries selected for the research: during the researched period, Lithuania (0.04%) took the leading position, followed by Australia (0.03%), the USA (0.02%), Sweden (0.01%), Spain (0.01%), the UK (0%), Finland (0%), the Netherlands (0%), Austria (0%), Germany (0%), Denmark (0%), Japan (0%), the Czech Republic (0%), and Italy (–0.01%). The results are a good indication of Lithuania's strong productivity growth when compared with the construction industries of the more developed countries and prove the fact that Lithuania is an emerging economy. A particular target was to compare of the labour productivity growth determinants. Author compared the growth determinants of Lithuania's labour productivity (LP) with these more developed countries having the labour productivity growth higher than 0.00%. The results indicate that Lithuania (having the growth rate of LP 0.04%) should be compared with Australia (0.03%) and the USA (0.02%). Author interpreted the ranked contributors (Table 2). The three primary contributors to Lithuania's labour productivity growth were: other machinery (OM), transport equipment (TR) and MFP. In Australia, the primary three contributors were: MFP, other machinery (OM), and computing equipment (IT). In the USA – other machinery (OM), MFP, and intangibles (IN). Moreover, MFP ranked first for the more developed countries. It is the primary contributor to labour productivity growth in the construction industry. If Lithuania did not rank MFP in the third position, author would have indicated this as a negative point for the construction industry of Lithuania. Moreover, it should be stated that the two primary contributors of two of the more developed countries (Australia and the USA) were regarded to be from the group of knowledge-based capital. In contrast, from Lithuania's three primary contributors, only one corresponded to knowledge-based capital (only MFP). The results evidenced that even though Lithuania's LP growth rate was high when compared with the more developed countries (Australia and the USA), it lacked knowledge-based determinants. Moreover, in the long-term perspective, Lithuania's primary LP growth determinants should correspond to the group of knowledge-based capital.

Table 1. Contributors of value added (VA) and labour productivity (LP) growth in the construction industry during the research period of 1995–2009

	1 = 2 + 3	2	3 = 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12	4	5	6	7	8	9	10	11	12
Country	VA growth	Hours	LP growth	LC	IT	CT	TR	OM	NR	R	IN	MFP
Lithuania	0.05	0.01	0.04	–0.0003	0.0009	0.0010	0.0089	0.0135	0.0064	0.0000	0.0007	0.0067
Sweden	0.02	0.02	0.01	0.0014	0.0000	0.0000	0.0004	0.0032	0.0010	0.0000	0.0008	–0.0014
Australia	0.06	0.03	0.03	0.0009	0.0037	0.0011	0.0032	0.0042	0.0003	0.0000	0.0010	0.0172
UK	0.01	0.00	0.00	0.0031	0.0009	0.0000	0.0008	0.0021	0.0025	0.0000	0.0003	–0.0075
Finland	0.02	0.02	0.00	0.0000	0.0004	0.0002	0.0011	0.0031	0.0004	0.0000	0.0005	–0.0071
USA	0.04	0.03	0.02	0.0001	0.0011	0.0013	0.0008	0.0053	–0.0002	0.0000	0.0032	0.0040
Netherlands	0.01	0.01	0.00	0.0016	0.0015	0.0001	0.0010	0.0011	0.0009	0.0027	0.0009	–0.0106
Austria	0.00	0.00	0.00	0.0029	0.0002	0.0000	0.0000	–0.0015	–0.0003	0.0000	0.0003	0.0007
Germany	–0.03	–0.03	0.00	0.0019	0.0002	0.0000	–0.0004	–0.0003	0.0000	0.0000	0.0001	–0.0047
Spain	0.03	0.02	0.01	0.0020	0.0012	0.0000	0.0012	0.0077	0.0111	0.0020	0.0002	–0.0136
Denmark	0.02	0.02	0.00	–0.0009	0.0013	0.0000	0.0016	0.0011	0.0003	0.0000	0.0022	–0.0054
Japan	–0.02	–0.02	0.00	0.0017	0.0000	0.0000	–0.0007	0.0001	–0.0003	0.0000	–0.0004	–0.0039
Italy	0.01	0.01	–0.01	0.0003	0.0012	0.0001	0.0026	0.0029	0.0049	0.0000	0.0003	–0.0181
Czech Rep.	–0.01	–0.01	0.00	0.0009	0.0015	0.0000	0.0067	0.0048	0.0035	0.0016	0.0000	–0.0233

Notes: LC – labour composition, IT – computing equipment, CT – communications equipment, TR – transport equipment, OM – other machinery and equipment, NR – non-residential structures, R – residential structures, IN – intangibles, MFP – multifactor productivity; knowledge-based capital: labour composition (LC), computing equipment (IT), communications equipment (CT), intangibles (IN), multifactor productivity (MFP).

Table 2. Ranked labour productivity (LP) contributors for the construction industry during the research period of 1995–2009

Country	VA growth	Hours	LP growth	LC	IT	CT	TR	OM	NR	R	IN	MFP
Lithuania	0.05	0.01	0.04	8	6	5	2	1	4	0	7	3
Sweden	0.02	0.02	0.01	2	6	7	5	1	3	0	4	8
Australia	0.06	0.03	0.03	7	3	5	4	2	8	0	6	1
UK	0.01	0.00	0.00	1	4	7	5	3	2	0	6	8
Finland	0.02	0.02	0.00	2	4	3	7	8	5	0	6	1
USA	0.04	0.03	0.02	7	5	4	6	1	8	0	3	2
Netherlands	0.01	0.01	0.00	8	7	2	5	6	3	9	4	1
Austria	0.00	0.00	0.00	1	4	5	6	8	7	0	3	2
Germany	–0.03	–0.03	0.00	8	7	4	2	3	5	0	6	1
Spain	0.03	0.02	0.01	3	6	8	5	2	1	4	7	9
Denmark	0.02	0.02	0.00	7	3	6	2	4	5	0	1	8
Japan	–0.02	–0.02	0.00	8	6	5	2	7	4	0	3	1
Italy	0.01	0.01	–0.01	4	5	2	6	7	8	0	3	1
Czech Rep.	–0.01	–0.01	0.00	4	5	3	9	8	7	6	2	1

Notes: LC – labour composition, IT – computing equipment, CT – communications equipment, TR – transport equipment, OM – other machinery and equipment, NR – non-residential structures, R – residential structures, IN – intangibles, MFP – multifactor productivity; knowledge-based capital: labour composition (LC), computing equipment (IT), communications equipment (CT), intangibles (IN), multifactor productivity (MFP). The highest contributor obtained the value of 1, and the lowest – 9.

Discussion and conclusions

As the EU KLEMS project lacks detailed comparable industrial results for the less developed countries, a methodology to derive them for the construction industry has been presented. On the international level, the present paper has certain practical research implications: with the help of the developed methodology, growth and productivity accounts can be expanded and elaborated for the less developed countries, which also enables the performance of the economic analysis from a comparative perspective.

The application of the methodology to the case of Lithuania yielded the evidence that although Lithuania's LP growth rate is the highest, compared with the construction industries of the more developed countries, it lacks the primary contributors from the group of knowledge-based capital. The fact is that only one contributor is considered to be corresponding to the group of knowledge-based capital (MFP). It should be noted that in the cases of Australia and the USA, the two contributors (of the three available) came from the group of knowledge-based capital. It is likely, that the structure of Lithuania's main labour productivity (LP) contributors will change in the long-term perspective as Lithuania seeks to attain the development level already attained by the more developed countries, i.e. the primary contributors would have to correspond to the group of knowledge-based capital. Moreover, it is suggested that Lithuania should encompass the primary contributor of MFP (as did Australia and the USA), as MFP captures the increases in the amount of value added that can be created by a certain given quantity of inputs. Furthermore, despite the fact that the labour productivity growth rate is the highest among the more developed countries, the indicator itself is still low when compared with that of the more developed countries.

Because of the fact that the growth accounting model enables each economy to be reasonably structured into particular frames and the main growth determinants to be identified, this method is a particularly useful tool for economic analysis. Hence, there is a need for the growth accounting method to be applied to other industries and their results compared in the context of more advanced economies.

Other factors determine the industrial value added growth rate and its productivity (e.g. macroeconomic conditions, market structure, demand-led factors, etc.). But the proposed methodology focuses on the direct growth determinants (direct inputs to production) that could be captured in the national statistics (national accounts) (land is not included). Moreover, growth accounting method is merely accounting and says nothing about causality. The method provides a useful starting point for the identification of the contributions of the proximate sources of growth. The main aspect in productivity measurement is whether the data used in the analysis are good enough to support the conclusions drawn from them. Productivity and growth estimates will be biased if nominal outputs, prices, inputs or cost measures are not measured correctly. Also, the variables in the EU KLEMS database vary widely by country, period and data users should get familiarized with the principles of construction of the database. There are also unsolved problems in the national accounts, the data should be used with caution. Accurate productivity level estimates require industry-specific relative output and input prices and a thorough accounting for the heterogeneity of inputs.

The problems identified while applying the methodology were: a wide range of detailed indicators should be compiled; due to its wide scope, the latest data are not available; the calculations are long-lasting.

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APPENDIX

Table 3. Economic structure template

1.	Agriculture and forestry
2.	Mining and quarrying
3.	Manufacture of food products, beverages and tobacco products
4.	Manufacture of textiles, wearing and the leather products
5.	Manufacture of wood paper
6.	Manufacture of coke and petroleum
7.	Manufacture of chemicals Manufacture of pharmaceutical products
8.	Manufacture of rubber, plastic products and other non-metallic mineral products
9.	Manufacture of basic metals and fabricated products
10.	Manufacture of computer and electronic products
11.	Manufacture of machinery and equipment
12.	Manufacture of motor vehicles, trailers and other transport equipment
13.	Manufacture of furniture; jewels, musical instruments, toys; repair and installation of machinery
14.	Electricity, gas, steam, and air conditioning supply Water supply; sewage, waste management, and remediation activities
15.	Construction
16.	Wholesale and retail trade; repair of motor vehicles and motorcycles
17.	Transport an storage
18.	Accommodation and food service activities
19.	Publishing, motion picture, video, television program production Sound recording, programming and broadcasting activities Telecommunications Computer programming, consultancy and information service activities
20.	Financial and insurance activities
21.	Real estate activities
22.	Legal and accounting and head offices activities Management consultancy activities, architectural and engineering activities Scientific research and development Advertising and market research Scientific and technical activities, veterinary activities
23.	Public administration and defense; social security
24.	Education
25.	Human health activities Residential care activities and social work activities
26.	Arts, entertainment, and recreation

Source: designed by the author with reference to the ISIC Rev. 3, ISIC Rev. 4, and NACE Rev. 2 classifiers of the EU KLEMS, the WIOD and Statistics Lithuania.

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