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Classical and Dynamic Shift-Share Cost Analysis for the Construction Sector in the European Union

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Abstract:

Purpose: *The aim of this study is to parametrize and assess the situation which companies dealing in the building industry in the European Union found themselves in. The situation is analyzed from the point of view of the costs borne by the enterprises in the years 2011-2017.*
Design/Methodology/Approach: *For the purpose of the calculations the shift-share analysis was used in both its classical and dynamic approach.*
Findings: *The results of the research point to the fact that the dynamics of changes in the construction sector in the EU member states is not equal and depends on the accepted analytical approach. The factor which is deciding about a change in the growth rate or a decrease in the costs borne by enterprises is the high level of competitiveness between the associated states. In the majority of cases, a rise in the costs positively correlates with an increase in the operating surplus.*
Practical Implications: *The information obtained on the basis of the conducted empirical research can be of use to individual EU member states and also to the whole Commonwealth, primarily as a tool in creating the policy of development. The study allows selecting states which are characterized by a high investment potential.*
Originality/value*: So far the problem of enterprises dealing in construction industry, which are based in the EU member states, has not been addressed by the literature on the subject from the point of view of the structural-geographical analysis or with reference to operating profit.*

Keywords: *Shift-share, construction industry, the European Union.*
JEL classification: *C10, L74, R11.*
Paper Type: *Research study.*

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1. Introduction

Construction industry is one of the fundamental sectors of national economies throughout the world. Proper functioning of construction industry makes a key part of the economic and housing policies of many states (De Boeck *et al.*, 2019). Thus, it is not without a reason that this sector is particularly monitored by state[5] and international[6] institutions, as well as by central banks.[7] Highly developed building industry favors general tendencies in the remaining sections of economy by means of a network of strong links and influences. At the same time, the situation of construction industry finds its reflection in the general condition of a state and displays a similar direction of changes (Myers, 2005). According to Eurostat[8] nomenclature, by construction sector one should understand a set of all its components (Table 1).

Table 1. *Components of construction industry according to the division accepted by Eurostat*

SECTION F - CONSTRUCTION			
41	Construction of buildings	43.11	Demolition
41.1	Development of building projects	43.12	Site preparation
41.2	Construction of residential and non-residential buildings	43.13	Test drilling and boring
42	Civil engineering	43.2	Electrical, plumbing and other construction installation activities
42.1	Construction of roads and railways	43.21	Electrical installation
42.11	Construction of roads and motorways	43.22	Plumbing, heat and air conditioning installation
42.12	Construction of railways and underground railways	43.29	Other construction installation
42.13	Construction of bridges and tunnels	43.3	Building completion and finishing
42.2	Construction of utility projects	43.31	Plastering
42.21	Construction of utility projects for fluids	43.32	Joinery installation
42.22	Construction of utility projects for electricity and telecommunications	43.33	Floor and wall covering
42.9	Construction of other civil engineering projects	43.34	Painting and glazing
	Construction of water projects		Other building completion and finishing

[5]*Statistics and research conducted by a relevant statistical office in each state.*
[6]*The following organizations, among others, can be listed as examples: Organisation for Economic Co-operation and Development (OECD), Eurostat.*
[7]*One of the forms of monitoring the market is the analysis of dynamics of changes in the construction industry, found on the website of the European Central Bank: https://sdw.ecb.europa.eu/browse.do?node=9691217, accessed: 20.07.2020.*
[8]*European Statistical Office – a Directorate-General of the European Commission, with its seat in Luxemburg, established in 1972.*

42.91		43.39	
43	Specialised construction activities	43.9	Other specialised construction activities
43.1	Demolition and site preparation	43.91	Roofing activities

Source: *Authors' own elaboration on the basis of (European Commission, 2008)*

The most vital component of the section, from the point of view of meeting basic needs of citizens is the sub-section related to construction of residential and non-residential buildings (41.2). A residential building is one which is used for housing needs in at least one half of its capacity. If a building does not fulfil this requirement (housing occupies a smaller part of it), then it is classified into the sub-sector of non-residential buildings. A non-residential building, in principle, is designed for other purposes than housing.

Companies that deal in the sphere of construction industry must function in the environment of a strong pressure of competition, both in the regional and global scales, depending on the extent of enterprises that are run (Dupire and M'Zali, 2018; Hayward, 2012). Through indirect and direct interactions with other branches of national economy and transformations on the global scale, companies are exposed to, among others, domestic fluctuations in business cycles (seasonal demand) (Fernández-Villaverde and Guerrón-Quintana, 2020), collapses in global economy (Mach, 2019), or information gaps in decision-making processes (Ben-Haim *et al.*, 2013).

Controlling the height of financial outlays made by companies can be deciding about market advantage over competition not only on the local scale, but also regarding the global one (Kádárová *et al.*, 2015; Lee and Sohn, 2016). Optimization of expenses borne on goods and services as well as costs connected with maintaining personnel, which jointly belong to the main costs borne by companies (Felipe and Kumar, 2014), stimulates development and also limits the risk of business activity which is run. Systematic verification of the cost structure in relation to profits offers valuable feedback concerning current financial condition of the company. It also makes the basis of attaining and strengthening the market position (Sadkowski, 2017).

This publication aims to parametrize and evaluate the situation of companies that deal in the branch of construction (Sector 'F') in the EU, taking into account the expenses borne on goods and services, as well as costs related to their personnel. Simultaneously, an assessment was made of the formation of the sum of the above-mentioned costs in dependence of the number of employed workers. The values of the costs for each of the states was correlated with the operating profit, reflecting the quality of operating activity in construction industry (Rutkowski, 2016).

Identification as well as assessment of companies' costs was carried out on two planes, with simultaneous taking into account of two components, that is those of time and space. The spatial dimension was analyzed with reference to individual EU

member states, whereas changes regarding time were correlated with the analysis of changes in the cost structure of construction companies, which followed in the years 2011-2017. The geographical-temporal analysis of the cost structure of those enterprises will allow evaluating them, taking into consideration the potential of the sector and that of competitors.

The information obtained on the basis of the conducted empirical research can be of use to individual EU member states and also to the whole Commonwealth, primarily as a tool in creating the policy of development.

2. Research Methodology

In the first place, the costs of companies dealing in the construction sector as qualified according to Eurostat nomenclature, were made subject of the research analysis. These costs were divided into two components: the sum of costs borne on total purchases of goods and services, and costs connected with employing the personnel (personnel costs). The former group covers the value of all goods and services purchased in the accounting period with the aim to re-sell or use them in the production process, with the exclusion of investment goods. Regarding personnel-related costs, Eurostat counts into them costs of remuneration (in cash or in kind) paid by the employer to permanent workers, temporal employees or employees working from home. The personnel-related costs include also employers' social-security contributions, costs of professional training and those connected with recruitment and employees' work (e.g. expenses borne on workwear), as well as taxes on remuneration treated as work costs and reduced by all kinds of obtained subsidies (Grzesiak, 2018).

The second part of the study analyzes the formation of the sum of the above-described costs in companies divided into classification categories according to the number of people employed. By employed persons one needs to understand the total number of working people, including working owners and partners, as well as working family relatives who are not paid wages. The structure of the number of the employed was divided into five sub-sectors, that is up to 9 people employed, from 10 to 19, from 20 to 49, from 50 to 249 and over 250 workers, respectively.

A complement to the conducted research is the directional analysis of changes in the sum of costs in relation to the operating profit executed with the use of Pearson correlation matrix (Afyouni *et al.,* 2019). Making use of the correlation will allow determining the force of influence of the changes on the side of costs on that of operating profit.

The assessment of the cost situation in construction companies was carried out in the static framework and that of the dynamics of changes, delineating individual and average change rates for the states as well as for the cost sector. Also, complete, structural and geographical effects of changes were determined (Mach, 2017).

Calculations of the complete, structural and geographical effects of changes were made with the use of shift-share analysis which was introduced for the first time into empirical studies of economic growth with division into regions by Dunn (Dunn, 1960), the method being widely described in works of other authors using the static (classical) or dynamic approaches (Adão *et al.*, 2019; Mach, 2016; Malik, 2011; Tłuczak, 2018).

The structural-geographical analysis allows examining and assessing the level of formation of costs in the construction sector in the states of the European Commonwealth against the background of dynamics of changes in the reference area which is that of the European Union. In shift-share studies, the development of quantified variable TX is assessed in the complex form of: dynamics of changes or absolute accretion. The input data are values txri of variable TX9. Due to different sizes of the regions and sectors in relation to the reference area, there are three types of weighs that are calculated, with the aim to level the differences (Suchecki and Antczak, 2010):

- regional weighs - $w_{r\bullet(i)} = \frac{x_{ri}}{x_{r\bullet}}$ where $x_{r\bullet} = \sum_i x_{ri}\ (r = 1,2,3, \dots, R)$, (1)

- sector weighs - $w_{\bullet i(r)} = \frac{x_{ri}}{x_{\bullet i}}$ where $x_{\bullet i} = \sum_r x_{ri}\ (i = 1,2,3, \dots, S)$, (2)

- individual weighs - $w_{ri} = \frac{x_{ri}}{x_{\bullet\bullet}}$ where $x_{\bullet\bullet} = \sum_r \sum_i x_{ri}$ (3)

Beside the individual growth rate, in structural-geographical analyses there are applied also dynamics of growth for regions, sectors and for that in the global framework (Suchecki & Antczak, 2010).

- mean dynamics of growth in the *r*-th region - $tx_{r\bullet} = \sum_i w_{r\bullet(i)} tx_{ri,}$ (4)

- mean dynamics of growth in the *i*-th sector - $tx_{\bullet i} = \sum_r w_{\bullet i(r)} tx_{ri,}$ (5)

- global factor of regional growth - $tx_{\bullet\bullet} = \frac{\sum_r \sum_i (x^*_{ri} - x_{ri})}{\sum_r \sum_i x_{ri}}$ (6)

The shift-share analysis is based on decomposition of the complete change in variable *X* into three parts which are reflected in the following: a) the global part of regional growth (M_{ri}); b) the part of changes in the sector structure (E_{ri}); c) the geographical part of regional development (U_{ri}). In the classical framework, the shift-share equation takes on the form (Jackson and Haynes, 2020):

$$\Delta x_{ri} = M_{ri+} E_{ri+} U_{ri} \quad (7)$$

$$x^*_{ri} - x_{ri} = x_{ri} tx_{\bullet\bullet} + x_{ri}(tx_{\bullet i} - tx_{\bullet\bullet}) + x_{ri}(tx_{ri} - tx_{\bullet i}) \quad (8)$$

[9]*Where: r is the index corresponding to the r-th region, while subscript i is an index of the i-th group according to structural division.*

$$tx_{ri} = tx_{\bullet\bullet} + (tx_{\bullet i} - tx_{\bullet\bullet}) + (tx_{ri} - tx_{\bullet i}) \Rightarrow tx_{ri} = m + e_i + u_{ri} \quad (9)$$

where: $m = tx_{\bullet\bullet}$ - global growth rate of regional growth,

$e_i = tx_{\bullet i} - tx_{\bullet\bullet}$ - structural factor of regional growth,

$u_{ri} = tx_{ri} - tx_{\bullet i}$ – competitive (geographical) growth factor of a successive sector in a successive region.

Transformation of formula (9), through differentiation between the regional and global growth rates, allows separating the structural and competitive parts:

$$tx_{ri} - tx_{\bullet\bullet} = (tx_{\bullet i} - tx_{\bullet\bullet}) + (tx_{ri} - tx_{\bullet i}) \quad (10)$$

Executing calculations of the regional means, we obtain the following dependence for the equation given above:

$$tx_{r\bullet} - tx_{\bullet\bullet} = \sum_i w_{r\bullet(i)} (tx_{\bullet i} - tx_{\bullet\bullet}) + \sum_i w_{r\bullet(i)} (tx_{ri} - tx_{\bullet i}), \quad (11)$$

$$tx_{rnetto} = s_r + g_r \quad (12)$$

As a result of the calculations, there is determined the relative change in the phenomenon in a region, diminished by the constant global change, the so-called net effect (Antczak and Lewandowska-Gwarda, 2019). This effect is the sum of structural and geographical changes in the region, whereas the very equation itself is known as the structural-geographical (shift-share) equality (Suchecki and Antczak, 2010).

The classical shift-share method is characterized by a static approach towards the temporal series and subjects to analysis two (edge) periods, neglecting data of the inter-period. In this way it does not take into account phenomena and dependences which influenced the subsequent periods. Accepting, in the classical shift-share method, the initial or final values as the reference variable, the researcher runs the risk of attributing weighs to variables that do not fit the reality. In consequence of this, there occurs either underestimation or overestimation of the coefficients. Determining the mean value for the periods does not solve the problem. Richard Barff and Prentice Knight (Barff & Knight, 1988; Knudsen & Barff, 1991) transformed the classical shift-share method, accepting the assumption of variability of weighs and recursive execution of calculations. The results for individual periods are then summed:

$$\sum_j (tx_{r\bullet} - tx_{\bullet\bullet}) = \sum_j \sum_i w_{r\bullet(i)} (tx_{\bullet i} - tx_{\bullet\bullet}) + \sum_j \sum_i w_{r\bullet(i)} (tx_{ri} - tx_{\bullet i}) \quad (11)$$

3. Research Results

The research includes the existing data (Rechciński *et al.*, 2017) on the side of costs and gross operating surplus of the EU member states in the years 2011-2017. In

view of the lack of certain data, the analysis was not carried out with regard to Cyprus and Malta in Point 3.2. On the other hand, the calculations take into account Croatia despite the fact that the country accessed the EU in 2013. Still, this is a result of the availability of the relevant data for Croatia for the years 2011-2012. The data provided by Eurostat served as the source of information.[10] The analysis of structural-geographic changes was conducted year-over-year and for the edge years (2011-2017). In each table and figure, the member states are indicated by individual codes[11] which are presented in Table 2. The values given in the tables were rounded to the decimal place.

Table 1. *Identification codes of the EU member states*

BE - Belgium	EL - Greece	LT - Lithuania	PT - Portugal
BG - Bulgaria	ES - Spain	LU - Luxembourg	RO - Romania
CZ - Czechia	FR - France	HU - Hungary	SI - Slovenia
DK - Denmark	HR - Croatia	MT - Malta	SK - Slovakia
DE - Germany	IT - Italy	NL - Netherlands	FI - Finland
EE - Estonia	CY - Cyprus	AT - Austria	SE - Sweden
IE - Ireland	LV - Latvia	PL - Poland	UK - United Kingdom

Source: *Authors' own elaboration*

3.1 Static and Dynamic Structural-Geographical Costs Analysis

The analysis of the dynamics of changes revealed that the fastest rate of increase in costs in the construction sector in the EU member states occurred in the years 2014-1015 and 2016-2017, when the dynamics of growth exceeded 5% (Table 3). However, in the former period we came to deal with a much higher rise in costs of goods and services in relation to the outlays on personnel than between 2016 and 2017.

Table 2*. Average rate of rises in costs according to the type of costs*

Analyzed period	Total purchases of goods and services	Personnel-related costs	Average growth rate
2011-2012	-2.4%	0.2%	-1.8%
2012-2013	-3.6%	-3.0%	-3.5%
2013-2014	4.1%	4.4%	4.1%
2014-2015	6.2%	1.6%	5.1%
2015-2016	-1.4%	1.5%	-0.7%
2016-2017	5.8%	4.8%	5.5%
2011-2017	8.4%	9.6%	8.7%

Source: *Authors' own elaboration.*

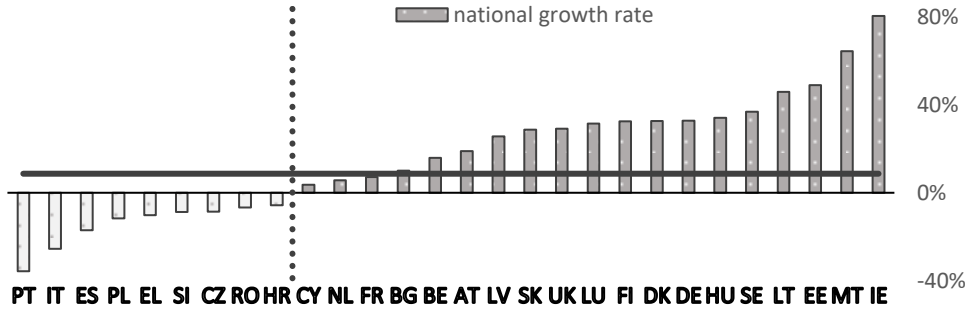
[10]*The source of computational engineering data are the following tables: [sbs_na_con_r2] oraz [sbs_sc_con_r2] accessed: 22.07.2020.*

[11]*In compliance with ISO 3166.*

The greatest decrease in the costs, i.e. one on the level of 3.5%, occurred in the years 2012-2013, the result being largely influenced by its components, with the dynamics of changes of -3.6% and -3.0%, respectively with reference to goods/services and personnel. The static calculations for the years 2011-2017 indicated that in that period the average growth rate of costs amounted to 8.7%. Calculating the sum of the dynamics from individual periods (the dynamic approach) we obtain the value of change on the level of 8.8%, the value remaining close to the calculations done with the use of the static method.

The highest total rise in the costs between 2011 and 2017, as far as the dynamic framework is concerned, was observed in Ireland, amounting there to over 80%, while in the static framework the value reached slightly over 53%. The large difference in the dynamics of changes results from not including in the latter approach the inter-periods, when Ireland recorded a drop in the costs by as much as 60%. The low base value (rendered in absolute terms) in the year 2012 caused high relative rises in the subsequent periods until as late as 2017 (Figure 1). Very high percent changes took place also in Malta (over 50%), the main reason for which being a rapid percent rise in the costs (by as much as 63.7%) in the years 2015-2016. In the case of 19 states, an increase in the costs was found, including the fact that in 16 of the states it was greater than the average growth in the reference area. In 9 of the states, the average costs borne decreased, including the greatest drop by 35.6% in Portugal, then Italy – by 25.4%, Spain – 17.0%, Poland – 11.7% and Greece – 10.1%. The remaining decreases were lower than 10%.

Figure 1. *Average dynamic growth rate in the costs in the EU member states in the years 2011-2017*



Source: *Authors' own elaboration*

While undertaking to conduct a more detailed analysis of the changes which companies belonging to Sector 'F' recorded as regards the changes in the total effect achieved, structural as well as geographical effects were additionally calculated. The total values presented for each of the countries were corrected by the average growth rate within the reference area. The considerable differences in the accretions in individual states regarding the classical and dynamic methods, testify to the justifiability of advancing the inter-period analysis, whose results offer the most

reliable picture of the occurring changes. In particular, the big differences appearing between the classical and dynamic methods can be noticed in the case of Ireland (-27.3%), Cyprus (-12.0%) and Bulgaria (-10.7%). In all the states, the structural changes in the business activity did not influence the height of the total effects to a considerable degree. This testifies to a small variability of the relation of costs borne on goods/services and personnel over the successive years. The total changes in all of the states – to the major extent – were caused by internal changes connected with competitiveness from other states (the geographical effect). The greatest drop in the costs took place in Portugal, whereas the biggest one – in Ireland.

Table 3. *Static and dynamic shift-share analysis of the sum of costs (2011-2017)*

	Classical method			Dynamic method			Difference in accretions		
Country	T	S	G	T	S	G	T	S	G
PT	-42.3%	0.0%	-42.2%	-44.4%	-0.1%	-44.3%	2.1%	0.1%	2.0%
IT	-32.1%	-0.1%	-32.0%	-34.2%	0.0%	-34.1%	2.1%	0.0%	2.1%
ES	-28.7%	0.0%	-28.8%	-25.8%	0.0%	-25.8%	-3.0%	0.0%	-3.0%
PL	-20.4%	-0.1%	-20.3%	-20.4%	-0.1%	-20.4%	0.1%	-0.1%	0.1%
EL	-19.7%	-0.1%	-19.7%	-18.9%	0.1%	-19.0%	-0.9%	-0.2%	-0.7%
SI	-18.7%	0.0%	-18.7%	-17.5%	0.0%	-17.5%	-1.2%	-0.1%	-1.2%
CZ	-18.5%	-0.1%	-18.4%	-17.3%	-0.1%	-17.2%	-1.2%	-0.1%	-1.1%
RO	-17.9%	-0.1%	-17.8%	-15.4%	-0.1%	-15.2%	-2.6%	0.0%	-2.6%
HR	-15.6%	-0.1%	-15.5%	-14.4%	-0.1%	-14.4%	-1.2%	0.0%	-1.1%
CY	-17.1%	0.0%	-17.2%	-5.1%	0.2%	-5.2%	-12.0%	-0.1%	-11.9%
NL	-3.9%	0.0%	-3.9%	-3.0%	0.0%	-3.0%	-0.9%	0.0%	-0.9%
FR	-1.6%	0.1%	-1.6%	-1.6%	0.1%	-1.6%	0.0%	0.0%	0.0%
BG	-9.4%	-0.2%	-9.2%	1.4%	-0.1%	1.5%	-10.7%	0.0%	-10.7%
BE	7.8%	-0.1%	7.9%	7.2%	0.0%	7.3%	0.6%	0.0%	0.6%
AT	11.8%	0.0%	11.7%	10.2%	0.0%	10.2%	1.6%	0.0%	1.6%
LV	10.4%	-0.1%	10.5%	17.0%	-0.2%	17.2%	-6.6%	0.0%	-6.7%
SK	14.8%	-0.1%	14.9%	20.0%	0.0%	20.1%	-5.2%	-0.1%	-5.1%
UK	19.9%	0.0%	20.0%	20.5%	0.0%	20.5%	-0.6%	0.0%	-0.5%
LU	27.1%	0.1%	27.0%	22.8%	0.1%	22.7%	4.3%	0.0%	4.3%
FI	27.9%	0.0%	27.9%	23.8%	0.0%	23.8%	4.1%	0.0%	4.1%
DK	28.4%	0.1%	28.3%	24.0%	0.1%	23.9%	4.4%	0.0%	4.4%
DE	28.6%	0.1%	28.5%	24.1%	0.1%	24.0%	4.5%	0.0%	4.5%
HU	24.1%	-0.1%	24.2%	25.5%	0.0%	25.5%	-1.4%	-0.1%	-1.3%
SE	34.0%	0.0%	33.9%	28.2%	0.0%	28.2%	5.8%	0.0%	5.8%
LT	44.2%	-0.1%	44.3%	37.3%	0.0%	37.3%	6.9%	-0.1%	7.0%
EE	48.0%	-0.1%	48.1%	40.3%	0.0%	40.3%	7.7%	-0.1%	7.8%
MT	48.1%	0.0%	48.1%	55.8%	0.2%	55.7%	-7.7%	-0.2%	-7.5%
IE	44.5%	-0.1%	44.5%	71.8%	-0.2%	72.0%	-27.3%	0.1%	-27.4%

Note: *T – total effect, S – structural effect, G – geographical effect*
Source: *Authors' own elaboration.*

3.2 Static and Dynamic Structural-Geographical Analysis

Because of the lack of data for Malta and Cyprus, the average dynamics of the changes in the reference area in the years 2011-2017 changed only slightly (values in part-per-thousand). Throughout the examined period, the costs borne by the construction sector grew the fastest in companies employing 250 and more workers (Table 5). Regarding the largest firms, the costs rose the quickest in the years 2013-2014 and 2016-2017, i.e. by 8,3% and 12.7%, respectively. When it comes to the dynamic framework, the costs borne by companies of this category increased within 2011-2017 by 18.4%. The only category in which the costs did not rise – regarding the dynamic framework in the years 2011-2017 – is that of companies employing between 10 and 19 workers. A high dynamics of growth took place also in the smallest enterprises (employing up to 9 people), where the rate of changes in the costs, reaching the level of 10.6%, was mostly influenced by the years 2013-2016, when the total value of the change amounted to 13.6%.

Table 4. *Average growth rate of costs – division according to the size of employment*

Analyzed period	From 0 to 9	From 10 to 19	From 20 to 49	From 50 to 249	250 or more
2011-2012	0.9%	-2.7%	-4.4%	-4.6%	-1.0%
2012-2013	-2.8%	-3.7%	-4.0%	-3.0%	-4.2%
2013-2014	4.9%	4.4%	1.9%	-0.6%	8.3%
2014-2015	5.2%	7.2%	5.5%	6.8%	2.2%
2015-2016	3.5%	-4.5%	-2.4%	-6.3%	0.4%
2016-2017	-1.3%	6.2%	2.8%	10.9%	12.7%
2011-2017	10.6%	6.6%	-0.9%	2.9%	18.8%

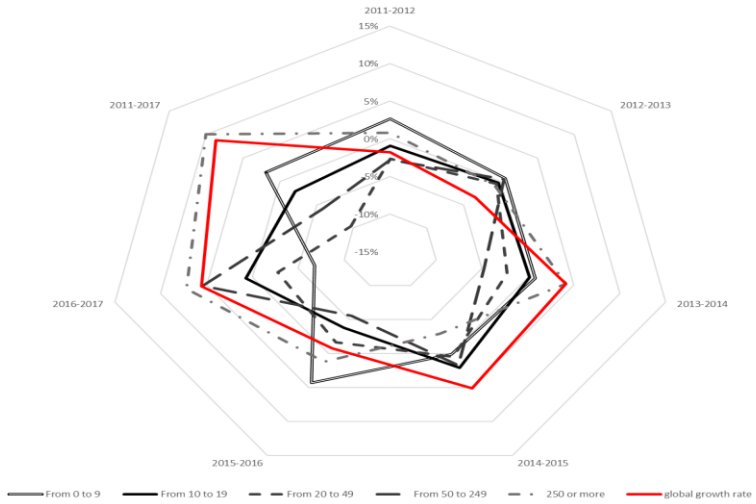
Source: *Authors' own elaboration.*

When interpreting the costs in the construction sector of the EU member states, it should be noticed that taking into account the growth rate in the reference area with regard to individual states, in part of them the direction of the structural growth factor will change. Despite the high level of growth in the years 2011-2017, as recorded in the group of enterprises employing between 10 and 19 workers, the values corrected by the global dynamics cause the average sum of the costs to decrease by 2.1% in this sector when juxtaposed against the EU countries. The height of the average growth rate level, diminished by the height of the global growth for all the subcategories and years is presented in Figure 2.

Only in the years 2014-2015 the growth rate of global costs reached a higher level than the average growth in costs in the largest enterprises. Companies employing from 20 to 49 workers recorded the total rise in the costs solely between 2014-2015; nevertheless, it still remained on a low level (below 1%). In all of the remaining

years, with regard to this sub-category of enterprises, the costs decreased in order to finally – in the dynamic treatment of the data for the years 2011-2017 – take the value (-9.6%), which makes the largest drop of all the structures.

Figure 2. *Dynamics of the structural growth factor with reference to the global growth*



Source: *Authors' own elaboration.*

Table 5. *Average domestic dynamic growth rate (2011-2017)*

Country code	From 0 to 9	From 10 to 19	From 20 to 49	From 50 to 249	250 or more
BE	7.2%	0.7%	0.6%	6.3%	1.6%
BG	3.9%	2.0%	-1.0%	1.3%	-6.8%
CZ	0.9%	-0.9%	-1.6%	-2.7%	-5.5%
DK	9.1%	2.2%	9.0%	12.7%	4.0%
DE	12.7%	9.6%	4.0%	5.9%	5.1%
EE	24.9%	12.3%	12.4%	8.4%	-1.3%
IE	16.6%	8.5%	9.3%	9.9%	8.9%
EL	-7.4%	-4.2%	-2.0%	-7.6%	10.2%
ES	1.2%	-1.8%	-3.1%	-6.6%	-9.8%
FR	-2.6%	-2.2%	-2.2%	-1.3%	15.4%
HR	-2.0%	1.4%	2.5%	-0.7%	-8.1%
IT	-10.1%	-2.8%	-4.9%	-3.2%	-2.4%
LV	-1.3%	3.9%	6.0%	6.0%	4.4%
LT	16.2%	6.6%	12.5%	10.1%	7.5%
LU	12.2%	3.9%	0.0%	11.3%	8.5%
HU	9.0%	8.6%	7.4%	6.4%	1.4%
NL	3.3%	0.2%	-0.2%	1.0%	0.5%
AT	6.0%	0.9%	4.4%	5.0%	4.2%
PL	-1.2%	-0.4%	-1.1%	-2.0%	-7.0%

PT	-7.2%	-2.3%	-1.7%	-8.0%	-14.4%
RO	0.0%	1.6%	3.0%	-5.5%	-8.3%
SI	1.5%	0.2%	-1.9%	-8.2%	-1.5%
SK	33.7%	-1.2%	-2.8%	-4.2%	-2.0%
FI	4.5%	4.9%	7.2%	11.7%	8.3%
SE	8.8%	5.9%	7.2%	15.8%	4.8%
UK	15.2%	0.2%	-0.9%	-1.3%	15.4%

Source: *Authors' own elaboration.*

Table 6 presents average dynamic growth rates of the costs in particular countries in the years 2011-2017. In the states such as Italy, Greece, Portugal, France, Croatia, Latvia and Poland, the expenses borne on goods/services and personnel dropped in the case of the smallest enterprises, with Italy recording the biggest decrease (-10.1%), while the highest rise (as far as this group of enterprises is concerned) occurred in Slovakia (33.7%).

Among the enterprises employing from 10 to 19 workers, in eight states the average costs went down, the biggest fall being recorded in Greece (by 4.2%) and the greatest increase occurring in Estonia (12.3%). As regards Estonia and Lithuania, in the group of enterprises employing between 20 and 49 workers, the costs of goods/services and personnel grew by over 10%, accounting for the highest values regarding the whole of the EU, where the average drop in this structure amounted to 0.9%.

In the group of companies employing from 50 to 249 workers, the largest growth in the costs occurred in the Scandinavian countries (Sweden, Denmark and Finland). On the other side of the juxtaposition there were found such states as Slovenia, Portugal and Greece.

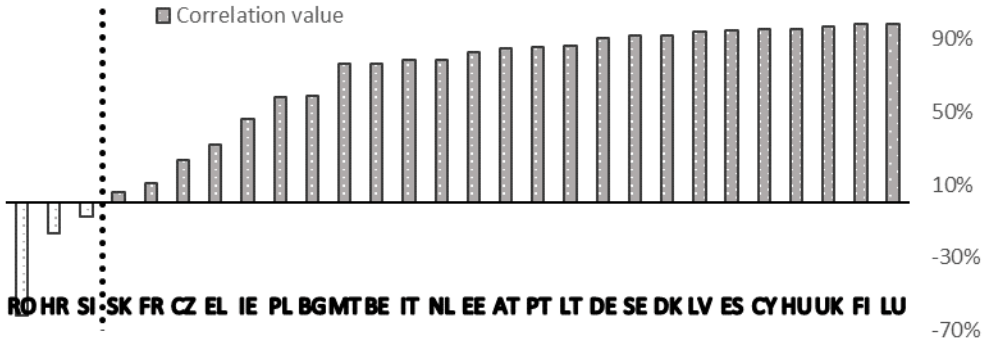
In the case of the largest enterprises (employment on the level of at least 250 workers) the sum of costs borne on goods/services and personnel decreased the most in Portugal (by as much as one third), then in Spain (by one fifth) and in Romania (by one tenth) in relation of the year 2017 to 2011. The rise in the costs was recorded in France, Great Britain and Greece.

3.3 Interdependence of Costs and Gross Operating Surplus

An appropriate assessment of the costs in companies dealing in the construction sector, either as stimulants or inhibitors, should take into account parallel changes going on in the structure of the generated operating profit. A rise in the costs borne on goods and services as well as in those related to personnel, in a well-developing market should be a derivative augmented by the number of investments which are characterized by a high rate of return. A rise in the costs with a simultaneous decrease in the profit testifies to the lack of investment potential on the market.

Figure 3 presents, in ascending order, the values of correlation matrix between the sum of costs and gross operating surplus of enterprises in the construction sector over the period between 2011 and 2017.

Figure 3. *Coefficient of correlation of costs and operating surplus in the EU states in 2011-2017*



Source: *Authors' own elaboration.*

Of all the EU states, only in three of them the rise in the costs borne was not linked to an increase in the profit, which meant that investments in these markets were characterized by a very high risk. The lowest potential occurred in Romania, where the value of correlation of costs and surplus amounted to (-62.1%). Also, in Croatia and Slovenia, the growing costs of business activity were accompanied by a drop in the profit (correlations of -16.6% and -7.6%, respectively).

In the case of Slovakia, France, Czechia and Greece, this interdependence was low in the years 2011-2017 and did not exceed 33%. It can be inferred that in the years under analysis, in these markets, there dominated investments, whose profitability was low or negative.

Such states as Ireland, Poland and Bulgaria were characterized by a moderate influence of the rise in the costs on the operating surplus. Investments on these markets were relatively safe and probably dependent on individual circumstances of the business activity which was run.

Lastly, the remaining states displayed a high coefficient of costs to profit correlation, all of them exceeding 76%. The highest value of the coefficient was found for Luxemburg and Finland (over 98%), only a slightly lower one in the case of Great Britain (97%), Hungary and Cyprus (96%). The value of correlation over 90% was also reached by the following countries: Spain and Lithuania (94%), Denmark and Sweden (93%) and Germany (91%). From the point of view of the relation of costs borne to profits obtained, they are markets which appear to be the most attractive to potential investors, since they are characterized by a strong demand for building activity and a high rate of return.

4. Conclusion

The aim of the study was to parametrize and assess the costs of enterprises based in the EU member states, dealing in the construction sector, over the years 2011-2017. The costs were divided into structural expenses on goods and services as well as those connected with maintenance of personnel. Accordingly, it was checked how the costs which are borne look in enterprises categorized according to the size of employment and also what the type of dependence between a rise in the costs and the operating profit is like.

In order to achieve the goal, the properties of the classical and dynamic *shift-share* method and the dynamics of changes were made use of. The empirical research revealed that in the period under analysis, as regards the static and dynamic frameworks, the costs rose the fastest in Ireland, whereas they decreased the most in the case of Portugal. At the same time great differences were observed in the dynamics of changes, depending on the calculation method, in such states as Ireland, Cyprus and Bulgaria, which confirmed the justifiability of taking inter-periods into account in the calculations.

In all of the analyzed states, the greatness of the total effect was decided by the geographical effect, that is competitiveness against other EU states. Changes in the domestic structure reached very low values. In the analyzed period, the average personnel-related expenses grew faster than the expenses borne on goods and services, while the sum of these costs rose in the dynamic framework by 8.8% at that time.

The analysis of the sum of costs according to the size of employment proved that in the period under examination the costs increased the fastest in the group of companies employing at least 250 workers, whereas the only group in which the average expenses decreased was that of enterprises with between 20 and 49 people. For all the categories the differences between static and dynamic calculations were low and did not exceed 0.5%.

Regarding the structure of enterprises employing up to 9 workers, the highest average dynamic rate of changes occurred in the case of Slovakia and the lowest – in Italy. In the next category (between 10 and 19 workers) the costs grew the fastest in Estonia and the slowest – in Greece. In the medium-sized enterprises (from 20 to 49 workers), the average expenses on goods and services as well as the personnel-related ones decreased the most in Italy, whereas the highest rise was recorded in Lithuania. Swedish companies of the construction sector, which employed between 50 and 249 people, entered the highest costs in their books in the studied period, in contrast to Slovenian firms, whose average costs fell the lowest in the whole of the EU. Enterprises employing more than 250 workers recorded the highest growth in the costs in France, Great Britain, while the greatest drop occurred in Portugal.

It was checked by means of the correlation matrix whether along with a rise in the dynamics of costs in enterprises there grows the operating profit as well. Research proved that in the case of Romania, Croatia and Slovenia the rise in the costs did not generate profit from the business activity run, which results from the fact that these markets are characterized by a relatively high risk and a small investment potential. The opposite market-related situation was found in such states as Luxemburg, Finland, Great Britain, Hungary, Cyprus, Spain. Lithuania, Denmark, Sweden, as well as Germany, in which countries the correlation coefficient between the cost and the profit is very high, and whose markets are attractive to potential investors.

The conducted research encourage the authors of this publication to further analyze the construction sectors not only in the EU states, but also in other geographical regions.

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