

# LABOUR PRODUCTIVITY OF THE EU MEMBER STATES IN SELECTED SECTIONS OF ECONOMY

Anna Rozkošová – Silvia Megyesiová

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## Abstract

There are many options of factors influencing the economic growth. One of them is labour productivity and many authors consider it as the most significant factor. There are many factors influencing the labour productivity. We can analyse labour productivity for example on business level, on sectorial level, on regional level or level of economies of states and integrated countries, but there still be disparities and space for increasing the labour productivity. The main aim of presented article was to analysed labour productivity of the twenty-eight EU member states in selected sections of economy. Analysis was focused on identification the development and differences of labour productivity during time period 2005-2016 on level of EU member states. We analysed Czech Republic and Slovakia, as V4 member states and also EU member states, on regional level by NUTS2 classification in selected section of economy in which were found out the high and low labour productivity.

**Key words:** labour productivity, sections of economy, regional disparities

**JEL Code:** J24, E24

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## Introduction

In general understanding the productivity means the efficiency of something, for example machines, people, sources or system. Productivity is one of the most significant and important factors of efficiency of economy. Productivity measures ratio of output and input. There are many factors affecting the productivity. Factors such as natural resources, human resources, capital formation and technological advances affect the productivity growth of the economy. Two most important variants are labour productivity and total factor productivity. According authors Samuelson and Nordhaus (1995) many economists believe that labour quality, abilities and knowledge are the most important components of economic growth.

Labour productivity in selected sections of economy is basic search area for many analyses. For example authors El-Gohary, Aziz and Abdel-Khalek (2017) consider labour

productivity as a fundamental information for planning a construction project and estimating a budgeting all items in it. They recognized a lack of systematic approach to measuring or predicting and suggested the productivity system should be integrated into database or construction company's information system for making the investment economically feasible.

There are many factors affecting the labour productivity such as human capital, education and qualification level, technological level of equipment and devices, technological changes and innovation, geographical and natural conditions or business and manager skills, etc. Based on these particularities and specifics of each country and each section of economy, there certainly exist differences in labour productivity not only among section of one economy, but also among countries. There were recorded a large declines of labour productivity especially in manufacturing and services in United Kingdom after global financial crisis (Harris, Moffat, 2016). Oosterhaven and Broersma (2007) analysed regional labour productivity in Netherlands. Regional differences were decomposed into a sector structure, a cluster economies and a residual regional component. All these sectors have large impact on the labour productivity growth.

This article is focused on labour productivity in EU countries especially in Visegrad group countries on regional level. The main contribution of article of authors Azorin and Vega (2015) was to investigate the contribution of human capital and agglomeration economies to the differences in labour productivity in EU regions by NUTS2 classification. They identified the dispersion in the labour productivity levels of the EU regions done 12.5%. Their empirical results show weak importance of human capital and agglomerations economies in determining the labour productivity in EU regions and they suggest taking into account the spatial dependence in designing the development regional policy in EU. Relation between productivity growth in manufacturing sectors in Poland as a member of Visegrad countries group investigated Parteka and Wolszczak-Derlacz (2013) and they pointed out the domestic sectors' openness and expansion in relative size of sectors have a positive effect on domestic labour productivity growth in Poland.

The main objective of this article was to identify selected sections of the economy according the level of labour productivity in EU member countries and analyse labour productivity in V4 countries on regional level.

## **1 Data and methodology**

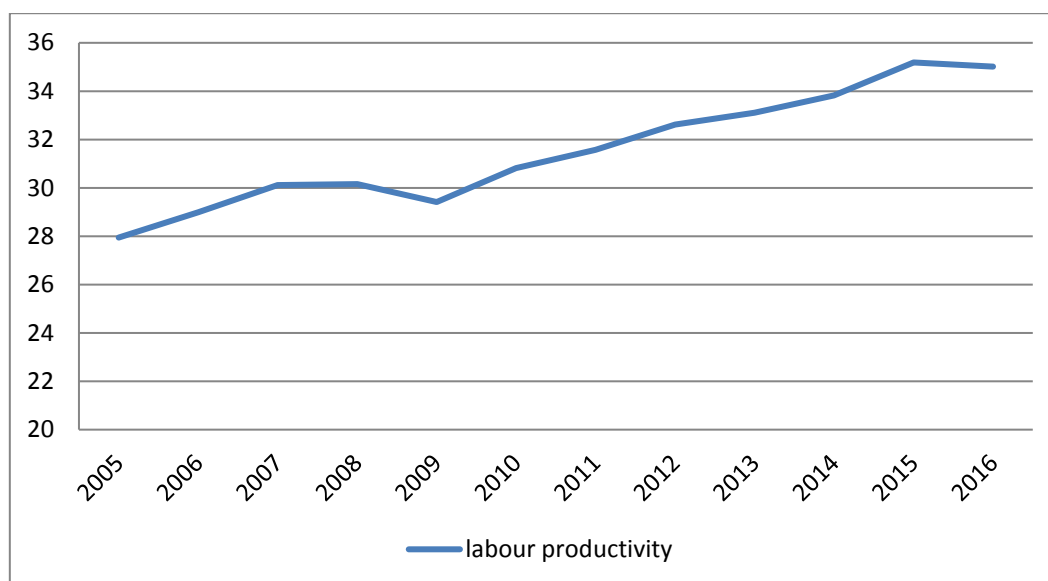
In this article, we focused on labour productivity that means amount of output or product per unit of labour in 28 EU member states and then especially in four countries of V4. The basis source of data about all countries was Eurostat. All data used for calculation of labour productivity were based on The European System of National and Regional Accounts (ESA 2010), which is accounting framework described economies in details. According ESA 2010 definition, productivity is measured such as value added per hour worked. That means the input will be indicator worked hours and output will be indicator gross value added. We also used chain and base indices for more accurate interpretation of the results.

Eurostat defines Gross Value Added (GVA) according to ESA 2010 as output value expressed at basic prices less intermediate consumption valued expressed at purchasers' prices. We used gross value added in current prices in million euros for all NACE activities. Regulation of the European Parliament established in 2006 the statistical classification of economic activities NACE Revision 2. One of the corresponding aggregation for the ESA Transmission Programme is A\*10 classifications, which divides industry activities into ten NACE Rev. 2 sections as follow: A – Agriculture, forestry and fishing; B, C, D and E – Mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water supply; sewerage, waste management and remediation activities; F – Construction; G, H and I – Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities; J – Information and communication; K – Financial and insurance activities; L – Real estate activities; M and N – Professional, scientific and technical activities; administrative and support service activities; O, P and Q – Public administration and defence; compulsory social security; education; human health and social work activities; R, S, T and U – Arts, entertainment and recreation; other service activities; activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; activities of extraterritorial organisations and bodies. The input for calculating the labour productivity we used total employment domestic concept for all NACE activities divided by A\*10 industry breakdowns expressed in million hours worked. Under the term section of economy we understand the NACE Rev. 2 classification and we evaluate labour productivity in EU countries according these economic sectors.

## **2 Analysis of labour productivity in EU28**

For analysis of labour productivity of the EU 28 countries we use all data from Eurostat database and calculated labour productivity as ratio between gross value added and hours worked for total activities and particularly for each section of NACE Rev. 2 classification by A\*10 for period 2005 – 2016. Labour productivity for all NACE activities in EU28 is shown below.

**Fig. 1: Development of labour productivity of NACE activities in EU28 countries in time period 2005-2016 in EUR by hour worked.**



Source: Own calculation according data of Eurostat database.

The development of labour productivity of NACE activities in EU28 countries has rising tendency during the whole analysed period of years 2005 to 2016. The labour productivity increased from a level of 27.95 EUR to 35.01 EUR per hour worked. There is also a noticeable moderate decrease in development of labour productivity in 2009 as a consequence of previous global financial crisis which influence economies of all EU countries and affected deceleration or decrease in their economic growth and also in growth of labour productivity.

For better interpreting the development of labour productivity in EU28 countries we calculated chain index for all years of selected time period. Tab. 1 confirm that all year to year changes were positive besides the year 2009 as a results of financial crisis and also last actual year 2016 signalled decrease of labour productivity. This fact can be connected with another economic crisis in Europe caused by refugee crisis and political tension.

**Tab. 1: Chain index of labour productivity in EU28 countries in time period 2005-2016 in EUR per hour worked.**

	EU28	Chain index		EU28	Chain index
<b>2005</b>	27.95	X	<b>2011</b>	31.57	1.02
<b>2006</b>	28.99	1.04	<b>2012</b>	32.62	1.03
<b>2007</b>	30.11	1.04	<b>2013</b>	33.11	1.02
<b>2008</b>	30.15	1.00	<b>2014</b>	33.83	1.02
<b>2009</b>	29.42	0.98	<b>2015</b>	35.19	1.04
<b>2010</b>	30.82	1.05	<b>2016</b>	35.02	1.00

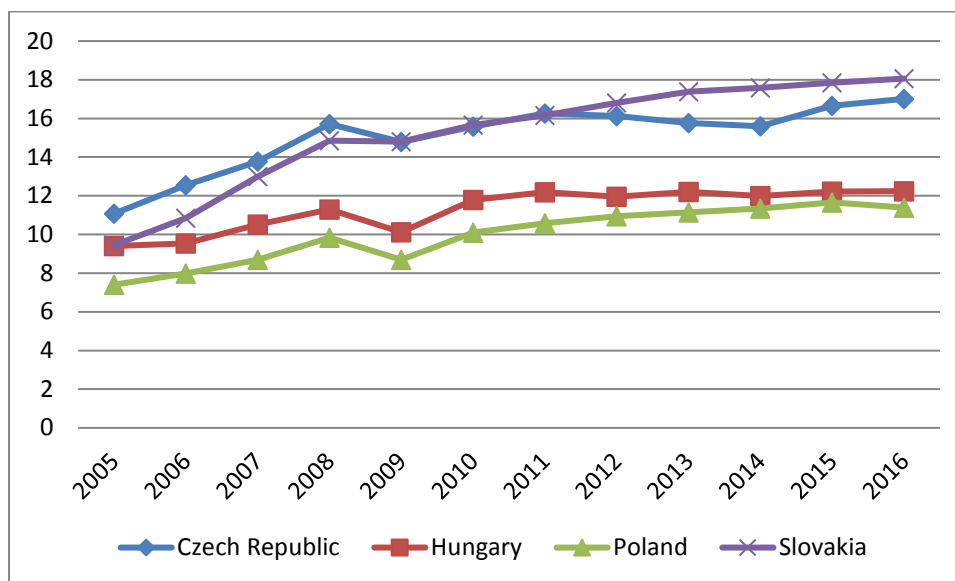
Source: Own calculation according data of Eurostat database.

Analyses of labour productivity in particular section of economy based on NACE activities classification for all EU28 countries together indicated the highest and the lowest labour productivity in economy sections during all period in similar sequence. The highest labour productivity was signified in section L – real estate activities with value 330.75 EUR per hour worked in average. Than the second highest labour productivity achieved the section K – financial and insurance activities with average value 62.52 EUR per hour worked. And the third highest labour productivity was in section J – information and communication with value 54.17 EUR per hour worked in average. On the opposite side the lowest labour productivity was identified in A – agriculture, forestry and fishing with value 8.47 EUR per hour worked in average, a little better labour productivity achieved sections R-U – arts, entertainment and recreation and other service activities with value 20.70 EUR per hour worked in average and F – construction with value 23.44 EUR per hour worked in average. These results indicates that the worst labour productivity is indicated in sections of economy which are based on physical human resources and in general achieved low wage evaluation of employees what can be the one of the reason of low labour productivity. On the other side sections with the high labour productivity especially financial and information sections dispose high technology facilities, which help people in production process and wages in general are the highest in these sections. These two aspects can be components for achieving high labour productivity.

### **3 Analysis of labour productivity in V4 countries**

Based on defined aim of the article we analysed not only labour productivity of all EU28 countries and identified the sections of economy with the highest and the lowest labour productivity, but we also analysed a special group of four countries named Visegrad four, which are geographically and economically connected and cooperated.

**Fig. 2: Development of labour productivity of all NACE activities in V4 countries in time period 2005-2016 in EUR per hour worked.**



Source: Own calculation according data of Eurostat database.

Fig. 2 describes development of labour productivity of all NACE in V4 countries. We can see similar progress then in all EU28. During selected time period the labour productivity in this region increased within range 7.4 to 18.06. Here is also significant change in development in 2009 because of financial crisis in three of four countries of this group. Only Slovakia didn't outlined such a comparable fall as other countries in 2009. Development and values of labour productivity of all NACE activities were very close in pair of countries Slovakia and Czech Republic and second pair Hungary and Poland.

Chain indices in Tab. 2 confirm decrease of labour productivity in 2009 for all countries, but the highest 11.55% in Poland and the lowest decrease 0.004% in Slovakia. There is also another decrease in 2012-2014 in Czech Republic, in 2012 and 2014 in Hungary and in 2016 in Poland. Slovakia achieved expect 2009 the highest increase of labour productivity by 19.84% in 2007.

According to results of labour productivity of NACE activities A\*10 for EU28 countries, we analysed three best and three worst sections in V4 region in three years – 2005 as a first year after entry into EU of all V4 countries, 2009 as the year when the crisis was strongest in most EU countries with significant changes in labour productivity development and the last actual year 2016. The highest labour productivity was during three selected years in all V4 countries found in same sections L, K and J as in EU28 countries. On the contrary there are

other economic sections with low labour productivity than in EU28. Hungary achieved low labour productivity in G-I, Poland achieved low productivity in O-Q section and Slovakia achieved low productivity in M-N and G-I section. Only Czech Republic achieved totally same results of three lowest labour productivity sections than EU28, so it has similar development curve as a rest of EU economies.

**Tab. 2: Labour productivity in V4 countries in time period 2005-2016 in EUR per hour worked.**

	<b>Czech Republic</b>	<i>Chain index</i>	<b>Hungary</b>	<i>Chain index</i>	<b>Poland</b>	<i>Chain index</i>	<b>Slovakia</b>	<i>Chain index</i>
<b>2005</b>	11.08	X	9.40	X	7.40	X	9.45	X
<b>2006</b>	12.55	1.13	9.54	1.01	7.98	1.08	10.84	1.15
<b>2007</b>	13.78	1.10	10.52	1.10	8.70	1.09	13.00	1.20
<b>2008</b>	15.71	1.14	11.30	1.07	9.83	1.13	14.85	1.14
<b>2009</b>	14.79	0.94	10.11	0.90	8.69	0.88	14.80	1.00
<b>2010</b>	15.57	1.05	11.79	1.17	10.11	1.16	15.67	1.06
<b>2011</b>	16.26	1.04	12.19	1.03	10.58	1.05	16.16	1.03
<b>2012</b>	16.13	0.99	11.96	0.98	10.94	1.03	16.80	1.04
<b>2013</b>	15.76	0.98	12.20	1.02	11.14	1.02	17.39	1.03
<b>2014</b>	15.60	0.99	11.98	0.98	11.35	1.02	17.58	1.01
<b>2015</b>	16.66	1.07	12.22	1.02	11.66	1.03	17.85	1.02
<b>2016</b>	17.01	1.02	12.24	1.00	11.40	0.98	18.06	1.01

Source: Own calculation according data of Eurostat database.

**Tab. 3: Three sections with the highest and three sections with lowest labour productivity in V4 countries in 2005, 2009 and 2016 in EUR per hour worked.**

	<b>2005</b>	<b>2009</b>	<b>2016</b>
<b>Czech Republic</b>	L,J,K/RU,F,A	L,K,J/RU,F,A	L,K,J/A,F,RU
<b>Hungary</b>	L,J,K/RU,GI,A	L,J,K/GI,F,A	L,K,J/A,RU,F
<b>Poland</b>	L,J,K/RU,OQ,A	L,J,K/RU,OQ,A	L,J,K/OQ,RU,A
<b>Slovakia</b>	L,K,J/A,MN,OQ	L,K,J/MN,OQ,GI	L,K,J/GI,MN,OQ

Source: Own calculation according data of Eurostat database.

### 3.1 Comparison between labour productivity in selected section of economy in Slovakia and Czech Republic

Under the results above mentioned we found out three sections with high labour productivity such as J, K and L not only in EU28, but in V4 countries, too. The last part of the article is devoted to the regional analysis of labour productivity of these selected sections in Czech Republic and Slovakia by NUTS2 classification in three years – 2005, 2009 and last actual year 2014.

The highest labour productivity was achieved in section L – real estate activities. Regional unit Central Bohemia achieved in all three analysed years the highest labour productivity in L section in Czech Republic, the top was 110.26 in 2014. The other regional units with high labour productivity after entry the EU, immediately after global crisis and in last analysed year were Southwest, Central Moravia and Northeast. Otherwise the lowest labour productivity achieved unit Prague, only 37.37 in 2015 and 46.24 in 2014, then Moravskoslezsko, Southeast and Northwest.

**Tab. 4: Labour productivity in sections J, K and L in Czech Republic by NUTS2 classification in 2005, 2009 and 2014 in EUR per hour worked.**

<b>Section J</b>	<b>2005</b>		<b>2009</b>		<b>2014</b>
<i>Northwest</i>	33.22	<i>Northwest</i>	47.33	<i>Prague</i>	37.40
<i>Moravskoslezsko</i>	28.41	<i>Northeast</i>	35.24	<i>Northwest</i>	29.77
<i>Prague</i>	28.10	<i>Central Bohemia</i>	32.89	<i>Northeast</i>	26.86
<i>Southwest</i>	25.68	<i>Southwest</i>	30.89	<i>Southwest</i>	25.10
<i>Northeast</i>	24.93	<i>Prague</i>	29.54	<i>Central Bohemia</i>	24.69
<i>Central Bohemia</i>	22.12	<i>Moravskoslezsko</i>	28.16	<i>Moravskoslezsko</i>	22.34
<i>Central Moravia</i>	17.96	<i>Southeast</i>	22.83	<i>Southeast</i>	20.63
<i>Southeast</i>	14.89	<i>Central Moravia</i>	21.41	<i>Central Moravia</i>	17.54
<b>Section K</b>					
<i>Prague</i>	43.63	<i>Prague</i>	51.11	<i>Central Bohemia</i>	57.62
<i>Southwest</i>	13.09	<i>Northeast</i>	28.23	<i>Prague</i>	48.13
<i>Northeast</i>	11.86	<i>Southwest</i>	26.12	<i>Southeast</i>	33.06
<i>Moravskoslezsko</i>	11.45	<i>Moravskoslezsko</i>	26.02	<i>Southwest</i>	32.19
<i>Southeast</i>	10.92	<i>Northwest</i>	25.56	<i>Northeast</i>	23.72
<i>Central Moravia</i>	10.9	<i>Southeast</i>	25.47	<i>Moravskoslezsko</i>	18.41
<i>Northwest</i>	10.57	<i>Central Bohemia</i>	24.12	<i>Central Moravia</i>	15.67
<i>Central Bohemia</i>	7.457	<i>Central Moravia</i>	22.71	<i>Northwest</i>	14.83
<b>Section L</b>					
<i>Central Bohemia</i>	80.85	<i>Central Bohemia</i>	98.29	<i>Central Bohemia</i>	110.30
<i>Southwest</i>	68.27	<i>Southwest</i>	70.99	<i>Northeast</i>	96.41
<i>Northeast</i>	61.21	<i>Central Moravia</i>	69.62	<i>Central Moravia</i>	92.18
<i>Central Moravia</i>	46.60	<i>Southeast</i>	69.62	<i>Southeast</i>	87.45
<i>Moravskoslezsko</i>	41.93	<i>Northeast</i>	67.72	<i>Southwest</i>	81.27
<i>Southeast</i>	41.87	<i>Prague</i>	52.03	<i>Moravskoslezsko</i>	64.60
<i>Northwest</i>	40.06	<i>Northwest</i>	49.97	<i>Northwest</i>	59.60
<i>Prague</i>	37.37	<i>Moravskoslezsko</i>	42.17	<i>Prague</i>	46.24

Source: Own calculation according data of Eurostat database.

Second analysed state of V4 group by NUTS2 classification was Slovakia, which achieved the highest labour productivity in section L in regional unit Eastern Slovakia, the value



148.93 in 2014, what is the highest result of all three analysed years in both countries. High labour productivity was also in Central Slovakia in 2009 and 2005. Region with the lowest labour productivity was Bratislava Region during all selected period, for example in 2005 achieved only 50.87, what is still higher than Prague in 2005 and 2014.

**Tab. 5: Labour productivity in sections J, K and L in Slovakia by NUTS2 classification in 2005, 2009 and 2014 in EUR per hour worked.**

<b>Section J</b>	<b>2005</b>		<b>2009</b>		<b>2014</b>
<i>Bratislava Region</i>	18.69	<i>Bratislava Region</i>	33.22	<i>Bratislava Region</i>	28.06
<i>Eastern Slovakia</i>	18.59	<i>Central Slovakia</i>	31.95	<i>Eastern Slovakia</i>	25.83
<i>Central Slovakia</i>	17.08	<i>Eastern Slovakia</i>	27.00	<i>Western Slovakia</i>	23.67
<i>Western Slovakia</i>	14.50	<i>Western Slovakia</i>	22.26	<i>Central Slovakia</i>	22.40
<b>Section K</b>					
<i>Bratislava Region</i>	30.61	<i>Bratislava Region</i>	37.39	<i>Bratislava Region</i>	51.54
<i>Central Slovakia</i>	20.42	<i>Central Slovakia</i>	33.32	<i>Western Slovakia</i>	32.94
<i>Western Slovakia</i>	20.38	<i>Western Slovakia</i>	24.64	<i>Central Slovakia</i>	30.86
<i>Eastern Slovakia</i>	18.28	<i>Eastern Slovakia</i>	19.35	<i>Eastern Slovakia</i>	19.31
<b>Section L</b>					
<i>Central Slovakia</i>	78.92	<i>Central Slovakia</i>	142.68	<i>Eastern Slovakia</i>	148.93
<i>Western Slovakia</i>	77.07	<i>Eastern Slovakia</i>	126.97	<i>Central Slovakia</i>	134.02
<i>Eastern Slovakia</i>	75.72	<i>Western Slovakia</i>	115.43	<i>Western Slovakia</i>	126.63
<i>Bratislava Region</i>	50.87	<i>Bratislava Region</i>	107.65	<i>Bratislava Region</i>	100.01

Source: Own calculation according data of Eurostat database.

Labour productivity in sections K – financial and insurance activities and J – information and communication had similar outcomes in Slovakia. The highest labour productivity in section J achieved region Bratislava Region 2009 on value 33.22, a little lower productivity 28.05 in 2014 and 18.69 in 2005. Bratislava Region achieved the highest labour productivity in section K 51.54 in 2014, 37.39 in 2009 and 30.61 in 2005. There are some changes in other regions in Slovakia, but the lowest labour productivity in J section achieved Western Slovakia in 2005 and Eastern Slovakia in K section. Both regions improve their labour productivity in both sections. According the last analysed year 2014 in section J Central Slovakia achieved the lowest value, but labour productivity in all four regional units in 2014 was very similar. There were a big gap between labour productivity in Eastern Slovakia, only 19.31 and the other three units, which achieved more than 30 in K section.

The results of labour productivity in sections K and J in Czech Republic indicated marked changes in region score. There is a space for improving labour productivity in J section in regional units Southeast and Central Moravia and in K section in Central Moravia and Central

Bohemia. Region Central Bohemia reached the highest growth of labour productivity from 7.45 to 57.62 in K section. High results in K section in three analyses years achieved regions Prague and Northeast. There were a huge gap between labour productivity in 2005 in region Prague 43.63 and the others regions, but this big difference gradually diminished in next years. Labour productivity in J sections didn't note such huge differences among regions in Czech Republic.

## Conclusion

This article deals with labour productivity as a ratio of grow value added and hours worked in short NACE Rev. 2 classification by A\*10 in EU member states. Labour productivity in all NACE activities in EU28 increased during the time period 2005-2016, but the highest labour productivity was achieved in sections of economy real estate activities, financial and insurance activities and information and communication. Analyses of labour productivity in V4 countries achieved the same high results in these three section during same period. For comparison we analysed labour productivity in selected section of economy only selected states Czech Republic and Slovakia in period after entry to EU, at the end of financial crisis and actual data. The highest productivity in Slovakia was achieved in L section in 2014 in region Eastern Slovakia and in Czech Republic also in L section in Central Bohemia. These results confirmed the expectation of regional and sectorial disparities.

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### **Contact**

Ing. Anna Rozkošová

Faculty of Business Economics of the University of Economics in Bratislava with seat in Košice

Tajovského 13, 041 30 Košice

anna.rozkosova@student.euke.sk

doc. Ing. Silvia Megyesiová, PhD.

Faculty of Business Economics of the University of Economics in Bratislava with seat in Košice

Tajovského 13, 041 30 Košice

silvia.megyesiova@euke.sk