

Assessing the development of labour productivity in the EU countries

Hodnocení vývoje produktivity práce v zemích EU

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Abstract: The paper is aimed at assessing the development of labour productivity in GDP (in PPS) per an employed person (EU15 = 100%). There were evaluated the countries of the EU and for comparison the USA and Japan in the reference period 1994 to 2003. Methods of regression and correlation analysis and development trends were used for the mathematical-statistical analysis. A strong increasing development trend is to observe in Ireland. The strongest decrease is in Italy and Germany. The development trend in the Czech Republic is slightly increasing.

Key words: labour productivity, analysis of development, European Union, mathematical and statistical methods

Abstrakt: Příspěvek je zaměřen na posouzení vývoje produktivity práce v HDP (v standardu kupní síly) na zaměstnanou osobu (EU15 = 100 %). V referenčním období let 1994 až 2003 byly vyhodnoceny země EU a pro srovnání USA a Japonsko. Pro matematicko-statistickou analýzu byly použity metody regresní a korelační analýzy a vývojové trendy. Rostoucí trend vývoje je nejsilnější v Irsku. Největší pokles můžeme naopak sledovat v Itálii a Německu. Vývojový trend v České republice je mírně rostoucí.

Klíčová slova: produktivita práce, analýza vývoje, Evropská unie, matematické a statistické metody

INTRODUCTION

Generally, term productivity means an output per the unit of input. Higher productivity can be reached through the increase of the capital or labour effectiveness which is closely related to the technical progress requiring investments also into education and equipment of scientific and research institutions. Thus, technical progress is a result of the capital accumulation. Capital accumulation changes the ratio between production factors. The proportion of capital in relation to work increases and thus the product per worker increases and so labour productivity increases. Gradual increasing of the productivity of labour in all sectors of the national economy of every country is of extraordinary importance because labour productivity and its growth rank among important factors of the growth of wealth of the whole society. Countries with the high productivity of labour show also better competitive capacities in the field of international trade.

This paper describes and exactly documents the development of labour productivity in GDP (in PPS = Purchasing Power Standard) per one employed person in the EU.

MATERIAL AND METHODS

The data on the productivity of labour are calculated as the GDP level in PPS per person employed (EU15 = 100%). There were evaluated the countries of the EU and for comparison the USA and Japan in the reference period 1994 to 2003. All data were obtained from literature sources of the EUROSTAT for the reference period 1994 to 2003. In the Czech Republic, data on the productivity of labour per an employed working person are available since 2000. In Malta, Poland and Romania, data on the productivity of labour per employed person are available since 1999 and in Slovenia since 1995. The problem of labour productivity is solved in Dornbusch, Fischer

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(1990), Holman (1999), Jílek et al. (2001), Klíma, Palát (2003), Mankiw, (1999), Synek et al. (1996). The mathematical-statistical processing of the presented data is based on methodical procedures given in papers of Minařík (2000) and Seger et al. (1998).

RESULTS AND DISCUSSION

Development of labour productivity in GDP (in PPS) per employed person in the Eurozone, new member countries, of labour productivity USA and Japan in the reference period 1994 to 2003

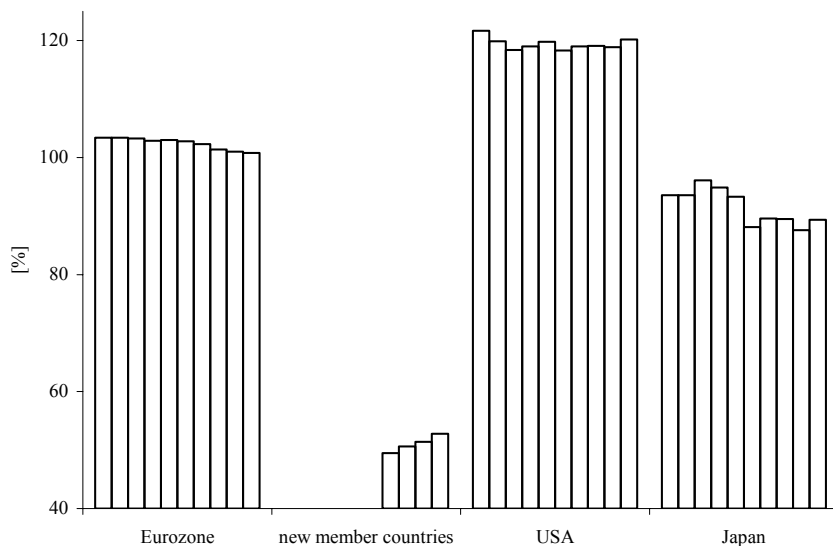


Figure 1. Development of labour productivity in GDP (in PPS) per an employed person (EU15 = 100%) in the Eurozone, new member countries, USA and Japan in the reference period 1994 to 2003

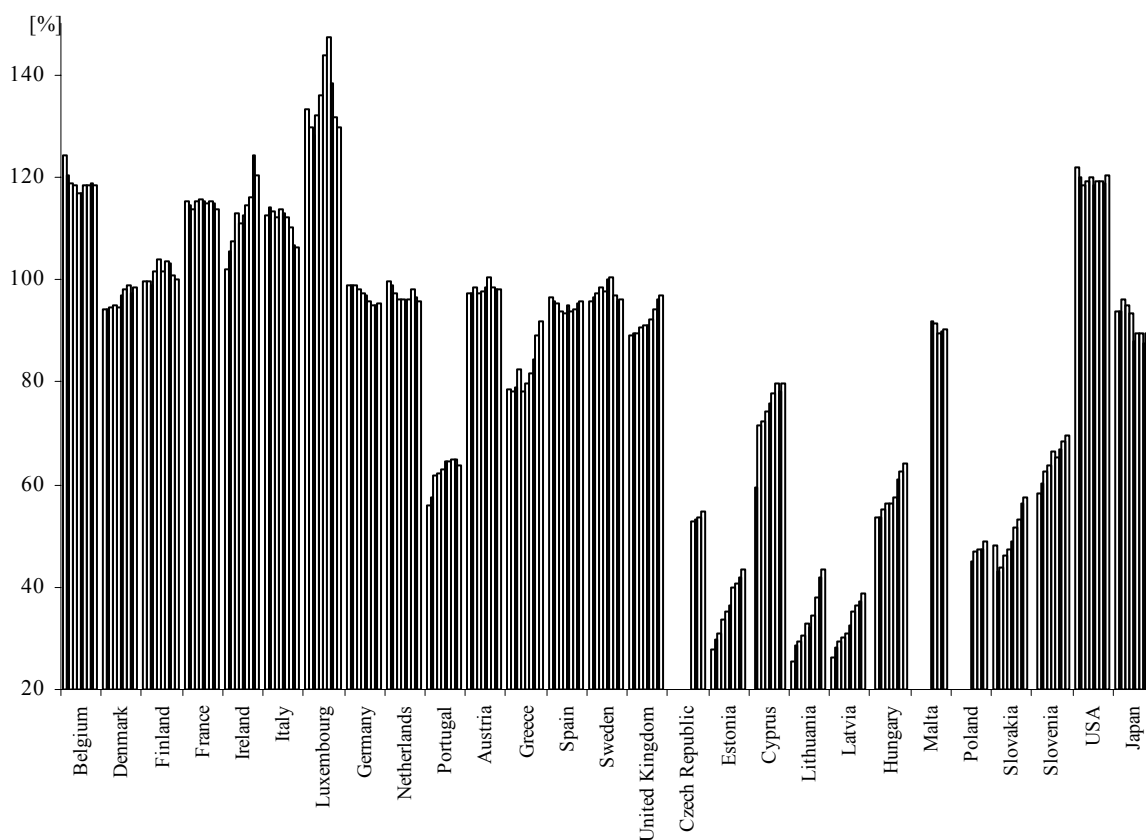


Figure 2. Development of labour productivity in GDP (in PPS) per employed person (EU15 = 100%) in all member countries of the EU, USA and Japan in the reference period 1994 to 2003

the reference periods 1994 to 2003 are given in Figure 1. The development in GDP (in PPS) per employed person in all member countries of the EU is given in Figure 2. The highest labour productivity in GDP (in PPS) per an employed person in comparison with the EU15 is in the USA. Labour productivity in Japan is lower than in Eurozone.

Parameters of models of labour productivity development trends in GDP (in PPS) per an employed person in the reference periods are given in Table I. An equation for the linear model is $y_t = a_{yt} + b_{yt}t$. An equation for the quadratic model is $y_t = a_{yt} + b_{yt}t + c_{yt}t^2$. Most of correlation indices I_{yt} are significant on the level of $\alpha = 0.01$.

Linear trends of labour productivity in GDP (in PPS) per employed person are slightly decreasing in the Eurozone as a whole. Development trends of the selected countries are described below. There is a strong decreasing trend in these selected members of the EU: Belgium, Italy and Germany. Other linear trends are increasing – see negative or positive regres-

sion coefficients b_{yt} in Table 1. A strong increasing trend is in Ireland. There is an increasing trend in Greece, Slovenia, United Kingdom, Denmark and Slovakia too. The development trend in the Czech Republic is slightly increasing.

The quadratic models show nonlinear in the reference period. Selected developmental trends in the reference period are given in graphical form in Figures 3. Labour productivity in GDP (in PPS) per employed person in all fifteen states of the EU is in the reference period higher than labour productivity in GDP (in PPS) per an employed person in the new member countries. None of the new member countries have already reached the EU15 level but some of them will soon reach the level of less developed countries of the EU15.

Cluster analysis was used for evaluation labour productivity in GDP (in PPS) per employed person in twenty five countries of the EU. In dendrogram from labour productivity in GDP (in PPS) per employed person in twenty five countries of the EU for

Table 1. Models of development trends of labour productivity per an employed person in the selected countries of the EU in the reference period 1994–2003

Labour productivity in GDP (in PPS) per employed person	Model type	Model parameters			I_{yt}	
		a_{yt}	b_{yt}	c_{ytt}		
Belgium	(y_1)	1	907.4691	−0.3945	−	0.5640
		2	807 270.651	−807.3646	0.2019	0.9227 ⁺⁺
Denmark	(y_2)	1	−1 026.5636	0.5618	−	0.8893 ⁺⁺
		2	−22 206.834	21.7580	−0.0053	0.8893 ⁺⁺
Ireland	(y_3)	1	−4 096.2921	2.1061	−	0.9517 ⁺⁺
		2	−102 433.26	100.5170	−0.0246	0.9521 ⁺⁺
Italy	(y_4)	1	1 641.1309	−0.7655	−	0.8126 ⁺⁺
		2	−769 925.89	771.3823	−0.1932	0.9641 ⁺⁺
Germany	(y_5)	1	1 116.8806	−0.5103	−	0.9572 ⁺⁺
		2	22 297.1518	−21.7065	0.0053	0.9576 ⁺⁺
Greece	(y_6)	1	−2 634.4588	1.3594	−	0.8489 ⁺⁺
		2	1 057 891.97	−1059.9652	0.2655	0.9469 ⁺⁺
United Kingdom	(y_7)	1	−1 709.0624	0.9012	−	0.9507 ⁺⁺
		2	397 690.337	−398.7988	0.1000	0.9874 ⁺⁺
Czech Republic	(y_8)	1	−1 287.4800	0.6700	−	0.9736 ⁺
		2	699 762.695	−699.8550	0.1750	0.9998 ⁺
Slovakia	(y_9)	1	−2 892.4642	1.4721	−	0.8947 ⁺⁺
		2	868 524.408	−870.6006	0.2182	0.9555 ⁺⁺
Slovenia	(y_{10})	1	−2 584.1083	1.3250	−	0.9701 ⁺⁺
		2	−348 990.11	347.9049	−0.0867	0.9807 ⁺⁺

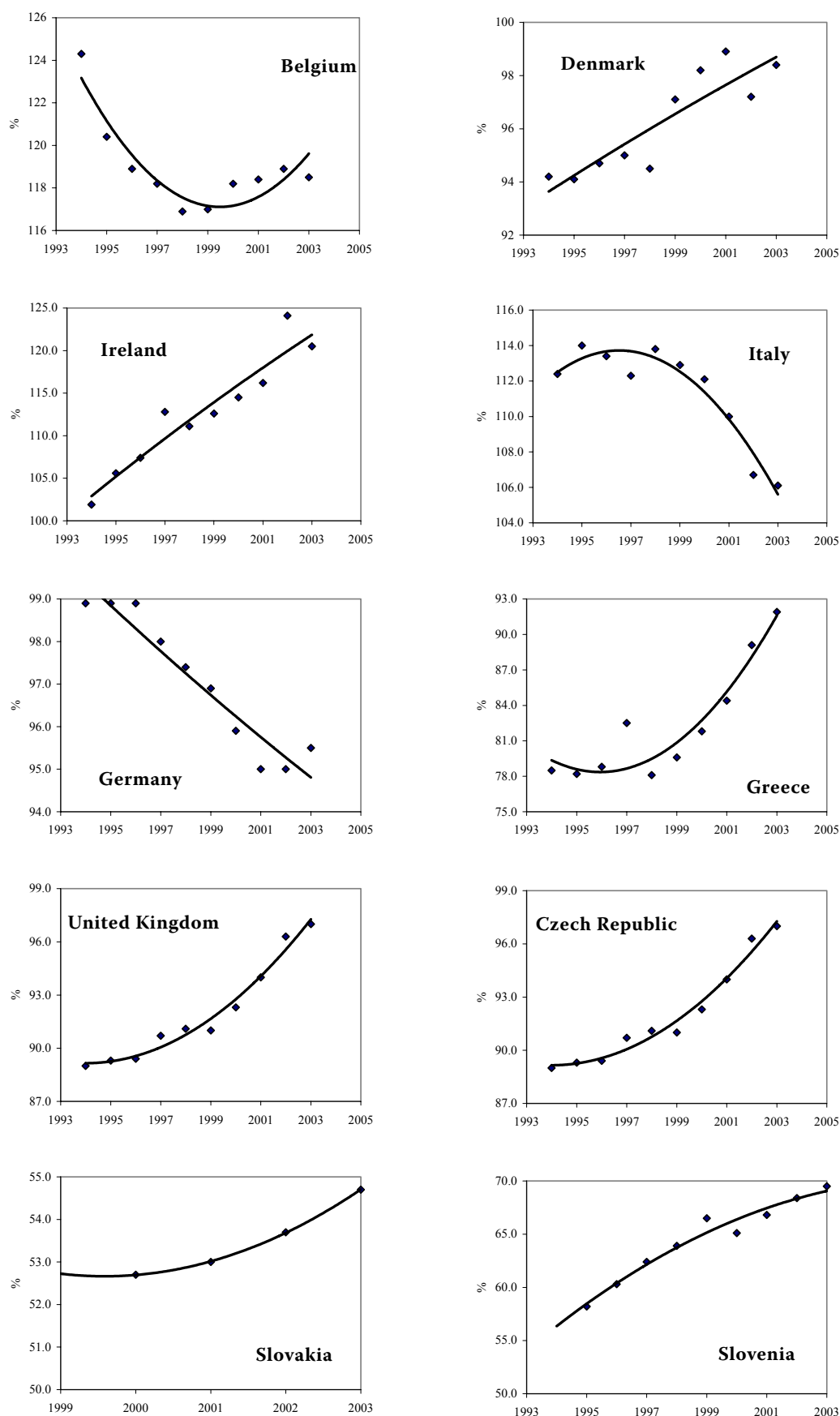


Figure 3. Development of labour productivity per an employed person in Belgium, Denmark, Ireland, Italy, Germany, Greece, United Kingdom, the Czech Republic, Slovakia and Slovenia in the reference period 1994 to 2003

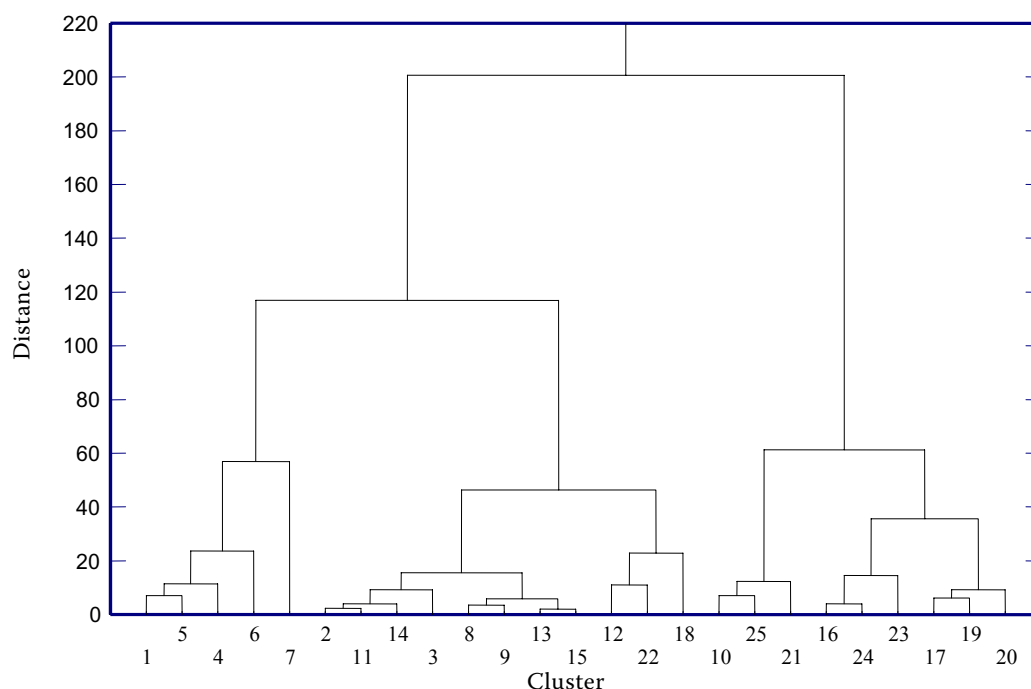


Figure 4. Dendrogram of labour productivity per employed person in twenty five countries of the EU for 2000–2003 (1 – Belgium, 2 – Denmark, 3 – Finland, 4 – France, 5 – Ireland, 6 – Italy, 7 – Luxemburg, 8 – Germany, 9 – Netherlands, 10 – Portugal, 11 – Austria, 12 – Greece, 13 – Spain, 14 – Sweden, 15 – United Kingdom, 16 – Czech Republic, 17 – Estonia, 18 – Cyprus, 19 – Lithuania, 20 – Latvia, 21 – Hungary, 22 – Malta, 23 – Poland, 24 – Slovakia, 25 – Slovenia)

2004–2003 (Figure 4) we can find three main clusters: (1) – Belgium, Ireland, France, Italy, Luxembourg; (2) – Denmark, Austria, Sweden, Finland, Germany, Netherlands, Spain, United Kingdom, Greece, Malta, Cyprus; (3) – Portugal, Slovenia, Hungary, the Czech Republic, Slovakia, Poland, Estonia, Lithuania, Latvia. It is possible to notice that labour productivity in GDP (in PPS) per an employed person in all new member countries of the EU except of Malta and Cyprus is markedly lower then in the countries of the EU15, but it has a stronger increasing trend.

CONCLUSION

The paper is focused on assessing the development of labour productivity in GDP (in PPS) per an employed person (EU15 = 100%). There were evaluated the countries of the EU and for comparison the USA and Japan in the reference period 1994 to 2003. Methods of regression and correlation analysis, development trends and cluster analysis were applied for the mathematical-statistical analysis. The highest labour productivity in GDP (in PPS) per an employed person in comparison with the EU15 is in the USA. Labour productivity in Japan

is lower than in the Eurozone. Cluster analysis used for evaluation of the labour productivity in GDP (in PPS) per an employed person in twenty five countries of the EU shows that labour productivity in all new member countries of the EU except of Malta and Cyprus is markedly lower then in the countries of the EU15, but it has a stronger increasing trend. None of the new member countries have already reached the EU15 level but some of them will reach the level of the less developed countries of the EU15 in the near future. A strong increasing development trend is in Ireland, the strongest decrease is to observe in Italy and Germany. The development trend in the Czech Republic is slightly increasing.

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