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**Labour Contribution and Productivity in the European Union: Cluster Analysis**

**Abstract: t**he paper dealt with the analysis of dynamics and differentiation of basic features that characterize the employment of the European Union’s countries. Conducted research considered such characteristics of labour force like share of total labour compensation in GDP, the number of worked hours and labour productivity. According to the economic theory, this last variable plays the crucial role in the formation of the long-term economic growth. There was examined also the influence of the economic crisis on the behaviour of indicated variables. A main statistical data source was the Total Economy Database published by The Conference Board. The author showed that there exists growing international differences of basic characteristics of labour force utilization and productivity. The conclusions were drawn on the ground of the cluster analysis, which allowed to derive homogenous groups of countries according to its specificity of labour utilization and efficiency.

**Introduction**

Labour force resources and quality play crucial role in economic growth as well as in economic transition of countries. Relevance of labour depends on its main characteristics, including: share of labour in national income, labour productivity and number of hours worked. Since 1960 in major industrial countries we can observe a very large and systematic negative link between labour force growth and labour productivity (Beaudry, Collard, 2002). This relation is probably the main reason of decreasing number of hours worked and reduction of the labour share in gross domestic product. We can also assume that pattern of labour force use and efficiency is strongly related to the level of economic development. The main goals of the undertaken research was an identification of similarities of the European Union members according to chosen features of labour force. The results were obtained by means of cluster analysis.

**Past and recent trends in the European Union’s labour force**

Share of labour in national income has been one of the most important issue in economics and remains the focal point of modern economic theories. However, we can observe a serious disconnect between the use of this share in theoretical models and actual estimates of this share in empirical investigations. A. Izyumov and J. Vahaly found in their study carried for 1990’s and 2000’s that labour shares in low developed and transition countries are respectively lower than in high developed ones. Their data confirmed also the existence of a long-term downward trend for labour shares in the majority of countries (Izyumov, Vahaly, 2014, p. 697)[[1]](#footnote-1). Though, we will be able to see that this tendency was suppressed by the latest world economic crisis. Probably the main reasons of this phenomenon were lower profits and less investment possibilities. The drivers of decline of the labour share represented by wages, salaries and benefits in national income in almost all OECD countries were examined in (OECD, 2012). Authors stressed the role played by factors such as increased productivity and capital-deepening, increased domestic and international competition, the reduction of workers’ bargaining power, the evolution of collective bargaining institutions and reducing public ownership. The latest, probably through the impact of privatisation on incentives for profit maximisation. According to their opinion, the decline of the labour share can result in greater income inequality, which might endanger social cohesion and slow down the current recovery. One ot the key question formulated in this study was: whether the decline of the aggregate labour share has been the result of a structural shift away from labour-intensive activities or whether instead it has been the result of a decline in the labour share within each industry? The results obtained using shift-share method[[2]](#footnote-2) confirmed that within-industry falls in the labour share, i.e. divergence of industry-level productivities, explain an overwhelming proportion of its aggregate decrease between 1990 and 2007. Despite similar levels of *per capita* income, education and technology, the development of labour income shares in OECD countries has displayed different patterns since 1960[[3]](#footnote-3). One of main reason of this occurence can be demography change which can affect the labour share, either by altering the domestic capital intensity, by causing factor-biased technological change or in a small open economy framework by creating a gap between domestic savings and investments. Empirical estimations with use of a panel error correction model, provide also evidence that an increases in the expected retirement durations and old-age dependency ratios as well as declines in labour force growth rates have indeed been major forces behind the decline in labour shares that took place in many countries, especially in open economies (Schmidt, Vosen, 2013, p. 357-361).

The findings of J. Hutchinson and D. Persyn suggest that lower trade costs and factors often associated with economic integration such as international low-wage competition and industry concentration have contributed to the decline in the labour share (Hutchinson, Persyn, 2012, p. 17). One of the recent study conducted by A. Bassanini and T. Manfredi for 25 OECD countries, 20 business-sector industries and covering up to 28 years, indicated that total factor productivity growth and capital deepening jointly account for as much as 80% of the within-industry contraction of the labour share. They also foud that other important factors are privatisation of stateowned enterprises and the increase in international competition as well as off-shoring of intermediate stages of the production proces (Bassanini, Manfredi, 2012, p. 32-34). According to P. Sweeney the decline in labour’s share in GDP has contributed to increased inequality in the distribution of national income. He also pointed out main reasons of this phenomenon: technology and policy changes, globalization, increased domestic and international competition, growing financialisation and sectoral shifts in employment (Sweeney, 2012-13). Other authors underline the impact of labour regulation (Deakin, Malmberg, Sarkar, 2014) or ageing (Schmidt, Vosen, 2013, p. 376) on the labour share in national income.

In the European Union we observed a decline in the share of total labour compensation in GDP since 1994 untill 2007[[4]](#footnote-4) (from 62% to almost 60%). Due to economic crisis there was a turning point in 2008-2009 (increase till 63.6%) and redirect reduction in next four years up to the level of 1994. The highest level of this share was indicated for Slovenia (84.0% in 1994 and 71.8% in 2014), while the lowest was noticed for Slovakia (37.4% in 1994 and 39.4% in 2014). There were also strong differences in changes of labour shares among European countries (see Figure 1).

Fig. 1. Share of total labour compensation in GDP in the EU in 1994-2014 (in %)

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

Although, the proportion of labour in national income is quite significant for the economic dynamics, the crucial role in economic development is played by labour productivity. Slowdown in productivity growth caused mainly by supply shocks, leads to the rise in labour shares, while the recovery of profit shares is by many authors interpreted as a result of the reaction of firms who increased profit shares by reducing labour demand and through a shift to more capital-intensive production techniques (Schmidt, Vosen, 2013, p. 358). There is a strong literature concerning basic factors that influence labour productivity[[5]](#footnote-5). Some authors suggest that policies that promote investment, economic integration and international competitiveness improve short-run labour productivity, while in the long run, fixed capital accumulation is the dominant source of productivity improvements (Madden, Savage, 1998). Other researchers underline that in countries with high level of labour costs and labour protection we can observe economic growth driven by labour productivity than rise in the level of employment (Czyżewski, Łapińska-Sobczak, 2001, p. 530; Batóg, Batóg, 2007).

In 1994-2007 labour productivity in the European Union was rising in a very stable way, but this development path was stopped slightly by last economic slowdown (see Figure 2). At the begining as well as at the end of this period the higest level of labour productivity per person employed was observed for Luxembourg, while the lowest characterized Romania.

Fig. 2. Labour productivity per person employed in the EU in 1994-2014 (2014 US$ converted to 2014 price level with updated 2011 PPPs)

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

For all countries we have noticed rise of productivity, but similarily like for labour contribution, strong international differences in dynamics of labour productivity were visible. For instance for Luxembourg and Italy productivity rose accordingly by 1.16% and 1.20%, whereas for Lithuania and Estonia this growth was equal respectively to 103.36% and 75.60%.

We can find some evidence that total weekly hours worked are positively correlated with the annual growth in GDP. The Monetary Policy Committee at the Bank of England pay close attention to the number of hours worked when considering monetary policy decisions as these may be more closely related to changes in demand and output than the level of employment (Stam, Coleman, 2010, p. 50). The growing negative correlation between labour productivity and annual hours worked per worker in EU countries means that, we can not expect significant positive tendencies in the level of employment in the near future. Almost all European countries demonstrated the same decreasing evidence in annual hours worked per worker since 2001 (see Figure 3). The biggest reductions were observed for Luxembourg (-16.22%) and Ireland (-12.43%). There was only one essential exception – Lithuania – with growth equal to 5.38% (see Figure 4).

Fig. 3. Annual hours worked per worker in the EU in 1994-2014

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

The higest levels of annual hours worked per worker in 2014 were noticed for Greece (2042) and Poland (2039), whereas the lowest was observed for Germany (1371). It means that German workers spent approximately 33% hours less in work in comparison with these two countries (see Figure 4).

Fig. 4. Change in annual hours worked per worker in the EU countries in 1994-2014

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

**Classification of EU countries according to chosen features of labour market**

Comparisons of labour characteristics such like productivity levels and share of labour compensation in GDP face several problems related to the measurement of labour input. Some countries integrate the measurement of labour input in the national accounts. In most countries, however, employment data are derived from labour force surveys, which are not entirely consistent with the national accounts. Second limitation is a consequence of the necessity of international comparisons of labour output which require price ratios to convert output expressed in a national currency into a common unit. One of the best database that we can use in such curcumstances is probably The Conference Board 2015, The Conference Board Total Economy Database™[[6]](#footnote-6).

All European Union countries, apart from Croatia because of some data lacks, were classified into homogenous groups according to all three variables described in the previous section. Cluster analysis (Ward’s method) was applied to discover the path of creation of two labour force profiles for EU countries in 1994-2014[[7]](#footnote-7). Results were presented in Figures 5-7. First profile containing less developed countries (in 2014 new members of EU, Greece, Portugal and Spain) is characterized by low share of labour compenasation in GDP, low labour productivity and high annual worked hours per worker. The second includes high developed European Union members with high share of labour compenasation in GDP, high labour productivity and low annual worked hours per worker (see Table 1).



Fig. 5. Results of cluster analysis for 1994

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.



Fig. 6. Results of cluster analysis for 2004

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.



Fig. 7. Results of cluster analysis for 2014

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

Table 1. Labour force profiles for EU countries

|  |  |
| --- | --- |
| **PROFILE 1**  Low GDP *per capita* | Low share of labour compenasation in GDP (1994 mean 56.9; 2014 mean 57.7%) |
| Low labour productivity per person (1994 mean 38 508; 2014 mean 63 039) |
| High annual worked hours per worker (1994 mean 1 920; 2014 mean 1 852) |
| **PROFILE 2**  High GDP *per capita* | High share of labour compenasation in GDP (1994 mean 67.6; 2014 mean 66.9%) |
| High level of labour productivity per person (1994 mean 77 553; 2014 mean 94 515) |
| Low annual worked hours per worker (1994 mean 1 676; 2014 mean 1 565) |

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

In the analysed period both profiles were characterized by decreasing dispersion assessed by the measure of differentiation *Q*:

, (1)

where:

*r* – group number (*r* = 1, 2, …, *k*),

*n*r – size of group *r*,

*i* – object number,

 – distance between object *i* and centroid of group *r*.

Table 2. Differentiation of profiles (*Q* value) in 1994, 2004 and 2014

|  |  |  |  |
| --- | --- | --- | --- |
| PROFILE / Year | 1994 | 2004 | 2014 |
| PROFILE 1 | 1,362 | 1,258 | 1,136 |
| PROFILE 2 | 1,068 | 1,005 | 0,973 |
| Total | 2,430 | 2,263 | 2,109 |

Source: own calculations based on data from The Conference Board Total Economy Database™, May 2015.

It means that countries within both groups become more similar to other group members.

**Conclusions**

During last several years we were witnessess of growing labour productivity, decreasing worked hours and decreasing share of labour compensation in GDP in the European Union countries. Especially this latter tendency should be consider as a key indicator by European governments. The main reason is that the shrinking importance of labour, may cause growing income inequalities. It could be visible first of all in ageing countries. Although, there are indications that the decline in the labour share not necessarilly is associated with lower unemployment but it can help put the recovery from the global economic crisis on a more sustainable path, without extended fiscal deficits. Received results confirmed also growing similarities of basic characteristics of labour force of European countries. It is an additional argument, besides of observed income convergence, that European Union members demonstrate tendency towards the same structure of the economy and similar level of economic development.

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1. See also (Kristal, 2010). [↑](#footnote-ref-1)
2. Other application of shift-share method in an analysis of labour market can be found in (Batóg, Batóg, 2010). [↑](#footnote-ref-2)
3. See also (Hogrefe, Kappler, 2013, p. 303). [↑](#footnote-ref-3)
4. See (OECD, 2012, p. 113; Hogrefe, Kappler, 2013, p. 305; Hutchinson, Persyn, 2012, p. 18; Bassanini, Manfredi, 2012, p. 8). [↑](#footnote-ref-4)
5. See for instance (The Quality of Growth**,** 2000), (Mućk, 2015). [↑](#footnote-ref-5)
6. http://www.conference-board.org/data/economydatabase. [↑](#footnote-ref-6)
7. Exactly the same results were obtained by use of k-means method. [↑](#footnote-ref-7)