

## Structural Changes and Technological Progress as Factors of Labour Market Developments in the V4 Countries in 2004–2018

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In 2004–2018, Central European countries experienced significant structural changes that affected the labour market as well. These included an increase in the activity rate and a decrease in unemployment, a growing share of those employed in the services sector and increased flexibility of employment. The main focus of the paper is on the developments in the V4 countries' labour markets in comparison to more general trends in the European Union and global economy. The aim was to investigate the impact of two determinants of the changes: technological progress and structural transformations of the economy. The results of the analysis revealed that trends in the V4 countries were not always concurrent with the more widespread tendencies, e.g. the shift in the share of various sectors in total employment was consistent with the general trend, while in the case of under-employment or share of part-time employment, the V4 situation varied.

**Keywords:** EU, Visegrád countries, labour market, technology, structural change.

### Zmiany strukturalne i postęp technologiczny jako czynniki przemian na rynkach pracy krajów Europy Środkowej w latach 2004–2018

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Kraje Europy Środkowej w latach 2004–2018 doświadczyły istotnych zmian strukturalnych, które dotyczyły również rynku pracy. Polegały one na wzroście stopy aktywności zawodowej i spadku bezrobocia, wzroście udziału pracujących w sektorze usługowym i uelastycznieniu rynku pracy. Przedmiotem analizy są zmiany zachodzące na rynku pracy krajów Europy Środkowej w latach 2004–2018 na tle krajów Unii Europejskiej i gospodarki światowej. Zbadano również wpływ dwóch czynników, które w ostatnich

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latach miały kluczowe znaczenie w procesie zmian: przeobrażeń strukturalnych w gospodarce i postępu technologicznego. Przeprowadzona analiza pokazała, że zmiany zachodzące w krajach Europy Środkowej nie zawsze były zbieżne z bardziej powszechnymi tendencjami, np. zmiana udziału poszczególnych sektorów w zatrudnieniu ogółem była zgodna z ogólną tendencją, natomiast w przypadku niepełnego zatrudnienia lub pracy w niepełnym wymiarze godzin sytuacja krajów Europy Środkowej była odmienna.

**Słowa kluczowe:** UE, kraje Grupy Wyszehradzkiej, rynek pracy, technologia, zmiany strukturalne.

**JEL:** E24, F66, J01, J21

## 1. Introduction

Central European countries – Poland, Czechia, Slovakia, and Hungary – also known as the V4 countries (or Visegrád Four; the Visegrád Group) are a very particular group of economies that experienced substantial changes which included socio-economic transformation and a conversion into market economies as well as economic integration with the European Union. The changes also pertained to the labour markets. These included significant modifications to the sectoral composition of employment that consisted of a decline in the share of traditional sectors, such as agriculture and labour-intensive industry, and a concurrent increase in the share of services, but also increased labour market flexibility, improvement of workers' qualifications and emergence of new forms of employment.

A number of factors contributed to the labour market developments in the V4 countries which included: the aforementioned transformation and economic integration, but also the activities of international corporations, domestic and EU regulations, changes in the structure of demand and an increase in the prosperity of households. However, in recent years, the following determinants appear to play a crucial role. The first one is technological progress connected to the adoption of new methods of communication and data transfer as well as robotization and automation of the production process. The second factor stems from the structural changes in the economy, which in the V4 countries do not appear to be consistent with the tendencies in other EU countries.

The main goal of the paper is to analyse the influence of technological progress and structural changes in the economy in the labour markets of the V4 countries in 2004–2018. The analysis includes:

- 1) main trends in the labour markets of the V4 countries against the backdrop of the European Union, the United States, Japan and OECD countries;

- 2) structural changes in the economy and their impact on the inter-sectoral shifts of the labour force and the size of employment;
- 3) technological progress and its effects for the labour markets and the development of new forms of employment (flexible jobs).

The paper draws on data on Central European labour markets derived from OECD, IMF, the World Bank and Eurostat. The timeframe of the analysis is the period of 2004–2018. However, in some cases, due to the limited availability of data, the range was narrowed and included the last available statistics.

## **2. Labour Market of the EU in the Global Context**

The labour market in the European Union in the analysed period of 2004–2018 went through three stages of development: 1) the years 2004–2008, during economic prosperity the situation in the labour market was improving; 2) 2009–2013, in which the majority of indicators describing the market showed deterioration; and 3) the period after 2014, when, on the one hand, improvements in the labour market were felt but, on the other hand, factors related to technological progress and structural changes became more prominent.

The high degree of international economic interdependence means nowadays that the changes taking place in the EU labour market are to some extent correlated with the changes observed in the labour markets of the United States and Japan. The basic data describing the labour markets of the entities of the triad of international economic relations are presented in Table 1.

In the first sub-period (2004–2008), improvement of indicators describing the EU labour market can be observed. The unemployment rate was falling, the employment rate was increasing, and this was, among others, the consequence of the dynamic creation of new jobs (Pasierbiak, 2011). Positive changes resulted to a large extent from the favourable economic situation experienced by the European Union countries. In 2004–2008, the dynamics of economic growth was positive, with fluctuations from 2.6% (2004) through 3.6% (2006) to 0.7% (2008). The international comparison of indicators reported by the European Union regarding the employment rate, unemployment rate, and labour force participation was unfavourable. Both the United States and Japan showed lower unemployment rates as well as higher employment rates and labour force participation.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Real GDP growth														
EU28	2.6	2.3	3.6	3.3	0.7	-4.2	2.0	1.8	-0.3	0.3	1.9	2.4	2.0	2.7	2.2
US	3.8	3.5	2.9	1.9	-0.1	-2.5	2.6	1.6	2.3	1.8	2.5	2.9	1.6	2.2	2.9
Japan	2.2	1.7	1.4	1.7	-1.1	-5.4	4.2	-0.1	1.5	2.0	0.4	1.2	0.6	1.9	0.8
OECD	3.2	2.9	3.2	2.7	0.3	-3.4	3.0	2.0	1.4	1.6	2.2	2.5	1.8	2.6	2.3
	Employment rate (% of working-age population)														
EU28	n. a.	63.5	64.4	65.2	65.7	64.4	64.1	64.2	64.1	64.1	64.8	65.6	66.6	67.7	-
US	71.2	71.5	72.0	71.8	70.9	67.6	66.7	66.7	67.1	67.4	68.2	68.7	69.4	70.1	-
Japan	68.8	69.4	70.0	70.8	70.9	70.2	70.3	70.8	70.6	71.8	72.8	73.4	74.5	75.3	-
OECD	n. a.	65.2	65.9	66.4	66.3	64.6	64.4	64.7	65.0	65.2	65.7	66.3	67.0	67.7	-
	Unemployment (% of labour force)														
EU28	n. a.	8.9	8.2	7.2	7.0	8.9	9.6	9.6	10.4	10.8	10.2	9.4	8.5	7.6	6.8
US	5.5	5.1	4.6	4.6	5.8	9.3	9.6	9.0	8.1	7.4	6.2	5.3	4.9	4.4	3.9
Japan	4.7	4.4	4.1	3.8	4.0	5.1	5.1	4.6	4.4	4.0	3.6	3.4	3.1	2.8	2.4
OECD	n. a.	6.6	6.1	5.6	5.9	8.1	8.3	7.9	7.9	7.9	7.4	6.8	6.3	5.8	5.3
	Labour force participation rate (15-64 year-olds)														
EU28	69.5	69.9	70.3	70.5	70.9	71.0	71.2	71.3	71.9	72.2	72.6	72.8	73.2	73.6	-
US	75.5	75.4	75.5	75.3	75.3	74.6	73.9	73.3	73.1	72.8	72.7	72.6	73.0	73.3	-
Japan	72.3	72.6	73.1	73.6	73.8	73.9	74.0	73.8	73.9	74.9	75.5	76.0	76.9	77.5	-
OECD	70.0	70.2	70.5	70.6	70.8	70.7	70.6	70.6	70.8	71.0	71.1	71.3	71.7	72.1	-

Tab. 1. GDP growth and main labour market indicators of selected economies. Source: Own preparations based on (IMF, 2018; OECD, 2019b, 2019a, 2019d, 2019e).

The financial crisis arisen in 2007 in the United States turned into a full economic crisis in subsequent years, and its consequences were visible with some delay in the European Union labour market in 2009. Thus, the second period in the development of the labour market was initiated (2009–2013), which was characterized by a negative increase in the unemployment rate and a decrease in the employment rate. In comparison to the United States and Japan, the unemployment rate was the highest – in 2009 it was 8.9% and it increased to 10.8% by 2013. In the same years in the US, analogous ratios amounted to 9.3% and 7.4%, and in Japan, 5.1% and 4.0%. It should be emphasized that already in 2008, the European Union entered a phase of recession (European Commission, 2009), which, in the following year, led to a significant decrease in the GDP of the group (–4.2%). The economic situation in the US and Japan was also unfavourable. Both countries showed a decline in GDP in 2008 (of 0.1 and 1.1% respectively), but in 2009 the crisis deepened further and GDP fell by additional 2.5% in the US and 5.4% in Japan. These changes had a negative effect on the labour markets of all triad entities. The changes in unemployment rates in the EU, the US, and Japan are shown in Figure 1.

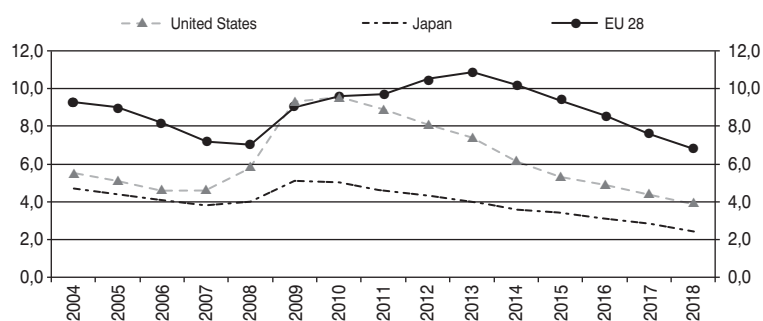


Fig. 1. The unemployment rate in the EU, Japan, and the United States. Source: Own preparation based on (Eurostat, 2019).

It is worth noting that in the case of both the United States and Japan, the negative impact of the economic downturn on the labour market ended earlier than in the European Union. Since 2010, both countries recorded an increase in GDP growth, while in the case of the EU, the economic downturn was prolonged, which was related to the sovereign debt crisis. In 2012, the EU recorded a negative growth rate of GDP (–0.3%), and in the following year a very slight increase (+0.3%). Thus, while in the US and Japan, labour market indicators were improving for several years, in the EU the unemployment rate was growing and the employment rate remained relatively stable until 2013.

From 2014, the situation in the European Union labour market began to improve. Stable, though not very high, economic growth (ranging from 1.9% to 2.7%) translated into an increase in labour demand. The employment rate increased from 64.1% in 2013 to 67.7% in 2017. At the same time, the unemployment rate decreased in the same period by four percentage points (p. p.) from 10.8% to 6.8%. These changes, though positive, look modest against the background of the US and Japanese labour markets. In 2018, the unemployment rate in the United States was 2.9 p. p. lower than in the EU, and in Japan by as much as 4.4 p. p. At the same time, in both compared countries, the employment rate remained at a much higher level (70.1% in the US and 75.3% in Japan, compared to 67.7% in the EU). When analysing changes in the labour market in the European Union, it should be emphasized that these are aggregated data, and resulting indicators take into consideration the labour market situation of all member countries.

### 3. Developments in the Labour Markets of the V4 Countries

The Eastern enlargement of the European Union in 2004 consisted of the admission of ten new member states, including Czechia, Hungary, Poland, and Slovakia. As in the case of previous accessions, the new member states contributed to the increase in the level of economic divergence in the grouping (Pasierbiak, 2018). The varied and usually lower level of economic development that was represented by the post-socialist countries was reflected in many areas of the economy, including the labour market. The primary factor for the improvement of the situation, manifesting in general in real economic convergence with the EU15 countries, and, in particular, in the area of the labour market, was economic growth. However, the situation in this respect was quite diverse, as illustrated in Figure 2.

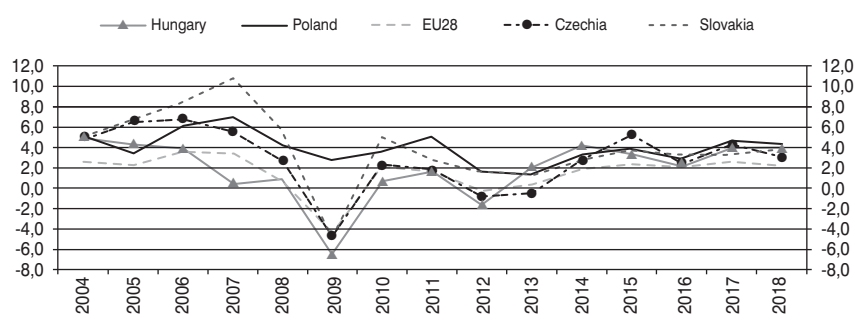


Fig. 2. Real GDP growth in the EU and V4, %. Source: Own preparations based on (IMF, 2018).

In the entire analysed period, the majority of the Visegrád Group countries showed higher dynamics of economic growth than the average for the EU28. Poland looks particularly good in this respect, because in each of the analysed years, even in the most crisis ones (2008–2009), it experienced positive GDP dynamics.

The difference between the EU average and the indicator for Poland even reached 7.1 p. p. in 2007. All other countries showed an absolute decline in GDP in 2009, which was the deepest in Hungary (-6.6%). In the next three years (up to 2012), this country showed lower growth dynamics than the EU average. A similar phenomenon occurred in Czechia in 2011–2013. In the case of Slovakia, only once (in 2009) was there a situation in which the dynamics of GDP growth was lower than the EU28 average.

As the pace of economic growth is the basic measure of economic activity and the most important factor affecting the labour market, the diversification in this area had to be reflected in the labour markets of the V4 countries. The basic data on the changes in the labour markets of the countries discussed are presented in Table 2.

The comparison of the condition of the labour markets of the V4 countries with the average for the EU28 allows us to distinguish some of their essential features. From the point of view of the unemployment rate, two countries (Poland and Slovakia) initially showed the highest levels of the indicator. In 2004, it was at the level of 19.1% (Poland) and 18.4% (Slovakia). Meanwhile, in the case of Czechia and Hungary, the unemployment rate was 8.3% and 6.1% respectively, which was even better than the average for the whole grouping (9.3%). When comparing the situation in the V4 countries at the end of the period, it can be concluded that progress was made in all of them, but to the greatest extent this concerned Poland and Slovakia. In 2018, the unemployment rate in Poland was lower by 15.2 p. p. than in 2004 (dropped to 3.9%), while in Slovakia it decreased by 11.9 p. p. (reaching the level of 6.5%). In the case of Czechia and Hungary, declines were not as spectacular (a decline of 6.1 p. p. and 2.4 p. p., respectively), but the levels here were the lowest among V4 – 2.2% and 3.7%. The analysis of other indicators listed in Table 2 leads to similar results. It can be concluded that Poland improved its activity rate and employment rate. However, this country is not a leader in this area, because this place is occupied by Czechia, which in 2018 showed the activity rate of 76.6% and the employment rate of 74.8%. These were indicators exceeding the average levels for the EU. Other countries (except for Hungary in the case of the employment rate) showed lower levels of indicators than the EU average.

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Activity rate (labour force in population aged 15–64)														
EU 28	69.3	69.6	70.1	70.3	70.7	70.8	71.0	71.1	71.7	72.0	72.3	72.6	73.0	73.4	73.7
Czechia	70.0	70.4	70.3	69.9	69.7	70.1	70.2	70.5	71.6	72.9	73.5	74.0	75.0	75.9	76.6
Hungary	60.5	61.3	62.0	61.6	61.2	61.2	61.9	62.4	63.7	64.7	67.0	68.6	70.1	71.2	71.9
Poland	64.0	64.4	63.4	63.2	63.8	64.7	65.3	65.7	66.5	67.0	67.9	68.1	68.8	69.6	70.1
Slovakia	69.7	68.9	68.6	68.3	68.8	68.4	68.7	68.7	69.4	69.9	70.3	70.9	71.9	72.1	72.4
	Employment rate (percentage of total population aged 15–64)														
EU 28	62.9	63.3	64.2	65.2	65.7	64.4	64.1	64.2	64.1	64.1	64.8	65.7	66.7	67.7	68.6
Czechia	64.2	64.8	65.3	66.1	66.6	65.4	65.0	65.7	66.5	67.7	69.0	70.2	72.0	73.6	74.8
Hungary	56.8	56.9	57.4	57.0	56.4	55.0	54.9	55.4	56.7	58.1	61.8	63.9	66.5	68.2	69.2
Poland	51.7	52.8	54.5	57.0	59.2	59.3	58.9	59.3	59.7	60.0	61.7	62.9	64.5	66.1	67.4
Slovakia	57.0	57.7	59.4	60.7	62.3	60.2	58.8	59.3	59.7	59.9	61.0	62.7	64.9	66.2	67.6
	Unemployment rate (percentage of active population aged 15–64)														
EU 28	9.3	9.0	8.2	7.2	7.0	9.0	9.6	9.7	10.5	10.9	10.2	9.4	8.6	7.6	6.8
Czechia	8.3	7.9	7.1	5.3	4.4	6.7	7.3	6.7	7.0	7.0	6.1	5.1	4.0	2.9	2.2
Hungary	6.1	7.2	7.5	7.4	7.8	10.0	11.2	11.0	11.0	10.2	7.7	6.8	5.1	4.2	3.7
Poland	19.1	17.9	13.9	9.6	7.1	8.1	9.7	9.7	10.1	10.3	9.0	7.5	6.2	4.9	3.9
Slovakia	18.4	16.4	13.5	11.2	9.6	12.1	14.5	13.7	14.0	14.2	13.2	11.5	9.7	8.1	6.5

Tab. 2. Activity rate, employment and unemployment rates in the EU and V4 countries in the years 2004–2018, %. Source: Own preparation based on (Eurostat, 2019).



## 4. Structural Changes

The de-industrialization process that started in the 1980s in the developed economies, the United Kingdom in particular, resulted in significant changes in the labour markets. This encompassed mainly a decline in employment in manufacturing, agriculture and mining industries and an increase in services sector employment (Mucha-Leszko, 2016). Another breakthrough occurred in mid-1990s due to the development of information and communication technologies (ICT), growing computing capabilities of computers and declining prices of electronics and costs of accessing the networks. These changes resulted in further swift development of modern commercial services such as financial services, insurance, communication, data transfer, business support and other services based on the use of the Internet (DiMeglio, Galleo, Maroto, & Savona, 2018; Emery, 2019; Kaçkol, 2019).

At present, employment in the majority of countries remains on an upward trend. Nevertheless, profound structural changes are still occurring. These changes include (OECD, 2019c):

- 1) a decline in the employment share in traditional sectors such as textiles, apparel, footwear, wood, paper, gum, plastics and basic metals;
- 2) introduction of ever more restrictive environmental regulations and development of the low-carbon economy, which results in a decline of mining and high-emission industrial sector;
- 3) growth of employment in services which pertains both to traditional services like transportation, logistics or tourism as well as to modern commercial services;
- 4) development of the under-employment phenomenon due to an increase in the role of services, a growing share of low-skill employment, flexible forms of employment, and demographic changes, longer professional activity in particular.

Taking into consideration the abovementioned trends in the global labour market, we investigate which of them appear in Central European countries. The evaluation will start with the analysis of structural changes in the creation of value added and their impact on the inter-sectoral migrations of labour force. Foremost, it is necessary to point out that in 2004–2018 the extent of changes in the shares of particular sectors in the creation of value added was relatively insignificant. Major transformations occurred in the 1990s. However, certain trends emerged. All the analysed economies experienced an increase in the share of services. To a largest extent, the contribution of services to the GDP creation pertained to Slovakia (by 2.1 p. p.) and Czechia (by 1.8 p. p.). The increase in Hungary and Poland was relatively smaller, 0.6 and 0.1 percentage point respectively. The increase of services in the GDP creation was at the expense of agriculture, hunting, forestry, fishing and, in the case of Czechia and Slovakia, also industry.

In Poland and Hungary, the share of industry increased mostly due to the growing significance of manufacturing (see Table 3). The main factor contributing to the increase of manufacturing share in the value added creation was strong integration with European production networks within the global value chains, mostly through foreign direct investment and offshoring of production from the EU15 countries, Germany in particular (Damijan, Kostevc, & Rojec, 2013).

What affected the increase of the services share in the value added creation in Poland, Slovakia and Hungary the most was professional, scientific and technical activities; administrative and support service activities, thus services based on high quality, highly qualified and educated human capital. In Czechia, a significant increase (1.2 percentage points) pertained to real estate activities and information and communication (0.9 p. p.).

	Czechia		Hungary		Poland		Slovakia	
	2004	2018	2004	2018	2004	2018	2004	2018
Agriculture, forestry and fishing	2.5	2.2	5.0	4.3	3.7	2.8	4.1	3.3
Industry (except construction)	31.0	30.6	25.7	25.9	25.5	25.6	30.1	26.2
Manufacturing	25.4	25.9	21.9	23.1	18.7	19.4	23.5	22.3
Construction	6.6	5.7	5.3	5.3	7.2	8.0	6.1	8.7
Services	59.8	61.6	63.9	64.5	63.5	63.6	59.8	61.9
Wholesale and retail trade, transport, accommodation and food service activities	20.4	19.0	17.4	18.5	25.0	26.2	22.4	20.2
Information and communication	4.5	5.4	5.0	5.0	4.7	3.9	3.9	4.4
Financial and insurance activities	3.3	4.0	4.3	3.5	3.8	4.0	3.8	2.9
Real estate activities	7.7	8.9	7.8	8.1	6.1	4.9	7.8	7.1
Professional, scientific and technical activities; administrative and support service activities	6.5	6.7	7.9	9.8	6.2	8.4	5.7	9.1
Public administration, defence, education, human health and social work activities	14.8	15.4	18.6	16.8	15.5	14.0	14.0	14.8
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	2.6	2.2	2.9	2.8	2.2	2.2	2.2	3.4

Tab. 3. Value added creation by sector of the economy, %. Source: (Eurostat, 2019).

Changes in the structure of value added creation were accompanied by similar movements in employment. The direction of the changes was the same, but the extent was much bigger in the case of employment. Mostly, it included an increase in the share of services in total employment. The highest growth occurred in Hungary (of 7.9 p. p.) and Poland (6.2 p. p.). While in Slovakia the share of employment in the services sector increased by 4.0 p. p.

and in Czechia by 3.1 p. p. (see Table 4). Just as in the case of changes in the value added, the top contributor to the growing share of services in total employment was the category of professional, scientific and technical activities; administrative and support service activities. In 2004–2018, employment in this category increased by 5.1 p. p. in Hungary, 3.2 p. p. in Slovakia, 2.1 p. p. in Poland and 1.0 p. p. in Czechia. Relatively high increases pertained also to wholesale and retail trade, transport, accommodation and food service activities as well as information and communication services. The first case confirms a thesis on the increase in low-skill workers in services, often part-time. On the other hand, in the instance of professional, scientific and technical activities; administrative and support service activities as well as information and communication services, European Commission experts concluded that the major factor contributing to the increase was high income elasticity of demand (higher than in manufacturing) connected to the increase in household prosperity (European Commission, 2015).

	Czechia		Hungary		Poland		Slovakia	
	2004	2018	2004	2018	2004	2018	2004	2018
Agriculture, forestry and fishing	3.9	2.9	8.8	5.4	17.9	9.5	4.7	3.0
Industry (except construction)	29.9	29.1	24.4	20.1	23.3	24.0	27.0	24.4
Manufacturing	27.1	26.8	22.0	18.2	19.4	21.0	24.1	22.3
Construction	8.8	7.4	7.1	6.8	5.8	7.3	6.8	7.3
Services	57.4	60.5	59.8	67.7	53.0	59.2	61.4	65.4
Wholesale and retail trade, transport, accommodation and food service activities	23.6	23.7	23.1	24.4	21.3	22.7	25.1	26.4
Information and communication	2.0	2.9	2.0	3.2	1.6	2.5	2.0	2.9
Financial and insurance activities	1.7	1.7	2.0	1.8	2.0	2.5	1.6	1.9
Real estate activities	1.5	1.8	1.5	1.5	1.1	0.9	0.8	1.1
Professional, scientific and technical activities; administrative and support service activities	7.6	8.6	6.0	11.1	4.4	6.5	7.1	10.3
Public administration, defence, education, human health and social work activities	17.8	18.2	21.2	21.3	19.9	20.4	21.9	19.9
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	3.2	3.6	4.0	4.4	2.7	3.7	2.9	2.9

Tab. 4. Employment structure by sector, %. Source: (Eurostat, 2019).

Taking the aforementioned data into consideration, it is worthwhile to inquire whether the structural changes contribute to the under-employment phenomenon. Theoretically, one of the major factors of under-employment growth is development of the services sector, in particular in areas like hotels

and restaurants which are characterized by high fluctuations of demand both seasonally and depending on the time of day (Euwals & Hoyerbrugge, 2004). Moreover, under-employment can be fostered by outsourcing of low-skill tasks.

According to the OECD data (OECD, 2019c), in 2017, close to 5.5% of total employees in OECD countries were under-employed. The highest indicators pertained to Italy, Spain and Australia, where they surpassed 10%. In the case of V4 countries, only Slovakia experienced an increase in the share of under-employed from 1.0% to 3.5% of total employment (see Table 5). In Czechia and Hungary, the share of the under-employed slightly decreased, from 1.0% to 0.8% and from 1.6% to 1.5% respectively. Poland experienced the largest decrease in the share of the under-employed out of all the EU countries as well as all the OECD countries. In 2006, the share of the under-employed was 4.1% and it declined by 1.9 percentage points to 2.2% in 2017 (see Table 5). Thus, one can conclude that structural changes in the form of an increase in low-skill workers are not connected to the increase in the quantity of the under-employed in the case of Czechia, Hungary, and Poland.

Specification	2006	2017
Czechia	1.0	0.8
Hungary	1.6	1.5
Poland	4.1	2.2
Slovakia	1.0	3.5

Tab. 5. Share of the under-employed in the total employed persons, %. Source: (OECD, 2019c).

A separate issue connected with the impact of structural changes on the labour market stems from potential results of new regulations on pollution control. A move towards a low-carbon economy requires a limitation of mining operations and a decline in employment in this sector. According to Eurostat, Central European countries created 16.5% of European Union's value added (EU28) in the sector in 2016 and employed 36.8% of workers. Out of the V4 countries, Poland contributed the most, both in terms of value added and employment – 13.6% and 29.3% of the EU28 totals respectively.

Growing costs of excavation, climate policy as well as technological changes contributed to some significant changes in the size of employment and value added of the V4 countries. All the economies experienced a decrease in the share of mining (see Table 6). In 2016, the share of the sector surpassed 1% of total employment in Poland only (1.68%). In the case of value added creation, mining contributed the most in Poland (3.36%) and Czechia (1.03%).

Specification	Employment		Value added	
	2010	2016	2010	2016
Czechia	1.22	0.76	2.14	1.03
Hungary	0.23	0.15	0.33	0.24
Poland	2.20	1.68	4.74	3.36
Slovakia	0.61	0.44	0.95	0.82

Tab. 6. Share of the mining sector in employment and value added creation in V4 countries in 2010–2016, %. Source: (Eurostat, 2019).

Further changes in employment could be brought about by the implementation of the Paris Climate Agreement. According to the 2019 Eurofound report estimates, the impact of the agreement on the labour markets of the EU would increase employment by 0.5% by 2030 compared to the basic scenario (Eurofound, 2019). Moreover, the results of the estimation point to a possible increase in employment in all the EU28 countries except for Poland, which is expected to suffer a slight decline of 0.1%. In the case of Slovakia, employment would increase by 0.6%, in Czechia – by 0.5% and in Hungary – by 0.4%.

## 5. Technological Changes

The idea of technological unemployment can be traced back to John Maynard Keynes (1931) and his famous quote that unemployment is expected to increase ‘due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.’ It appears to gain extra popularity in the times of extremely fast pace of technological change the world has been experiencing for the past couple of decades. The revolution in information and communication technology (ICT) has fundamentally transformed the world economy since the 1990s. As a result, the cost of moving ideas lowered and the world entered the next phase of globalization. Better communications made offshoring much more feasible and the North-South wage gap made it profitable. Thus global value chains started to emerge. The moving of production stages was accompanied by the move of managerial know-how, marketing and knowledge, as well allowing for the faster spreading of technological progress (Baldwin, 2016).

The increased use of ICT can be measured by the level of ICT capital services per hour worked. According to OECD (2019c), the use of ICT in 1995–2007 more than doubled and then continued to grow at a slower pace. Czechia experienced one of the highest increases out of all the analysed OECD countries reaching 508.42% of its 1995 levels.

The perception of technological changes in the future of the labour market varies from very pessimistic scenarios to very optimistic ones. The first ones predict a significant decrease in the demand for jobs and growth

of unemployment. Workers are to become victims of the technological revolution which would make them obsolete and this would potentially lead to the spreading of inequality and poverty bringing about a global crisis and turmoil (Rifkin, 1995). On the other hand, some perceive technological progress as a chance for growth of employment and income, mainly due to its ability to increase productivity (Brynjolfsson & McAfee, 2011).

The major channels of technological progress affecting the labour markets are believed to be: 1) job displacement due to automation of tasks, 2) changes in the skills required of the labour force, 3) changes in the form of employment and the organization of work towards more flexible jobs.

The main threat for the labour market connected with technology is believed to be robots replacing workers. In recent years, a growing number of robots used for industrial purposes is followed by an increase in other areas of the economy, e.g. sales of and demand for industrial robots have been growing at an unprecedented pace. The orders of industrial robots have increased fivefold between 2001 and 2017, according to the International Federation of Robotics, and the forecasted growth for the next couple of years is even higher (Figure 3). As a result, OECD estimates that an average of 14% of jobs in OECD countries is at high risk of automation (this means that there is a probability of 70% that the task would be automated). The data varies among countries. For Slovakia it is the highest – 33.6%, but Poland and Czechia are also expected to lose higher than OECD average share of jobs to automation, 19.8% and 15.5% respectively. This does not include the share of jobs that are expected to change in a significant way. These would be 32% on average for OECD countries. In this respect, Poland, Slovakia, and Czechia have lower than average indicators of around 30% of jobs that will change in a significant way (Figure 4).

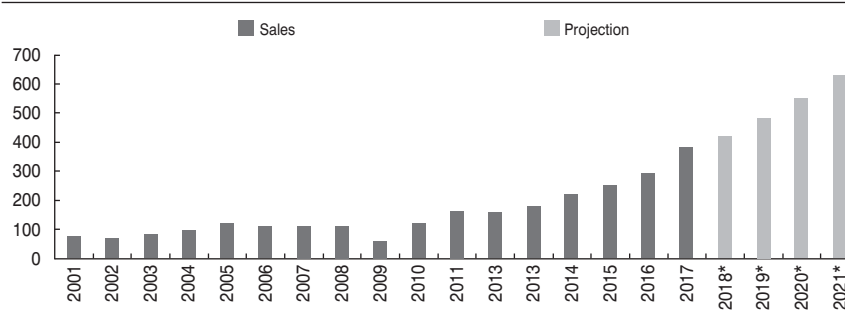


Fig. 3. Estimated worldwide annual supply of industrial robots, thousands of units. Source: (OECD, 2019c).

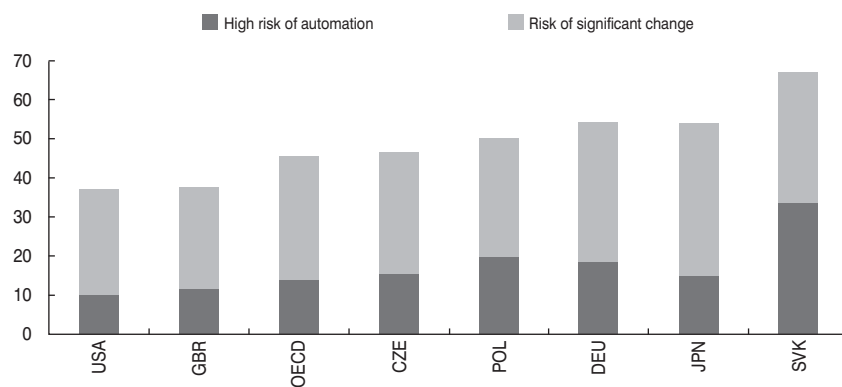
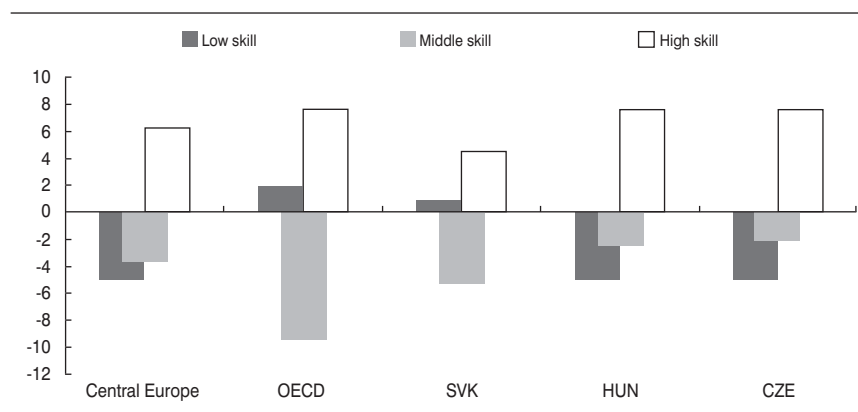


Fig. 4. Jobs at risk of automation in selected countries, %. Source: (OECD, 2019c).

The OECD estimates do not include the jobs that would be created as a result of technology and innovation. According to the World Bank data on global industrial jobs, the threat of jobs being replaced by automation has not been fulfilled so far and technological progress can generate more jobs than it destroys within a given industry. Advanced economies have shed industrial jobs, but the rise of the industrial sector in East Asia has more than compensated for this loss. What is more, in Europe, technological change that replaced routine work is estimated to have created over 23 million jobs from 1999 to 2016 (The World Bank, 2019). The evidence shows that even when machines directly replaced jobs, this still led to job creation. The data on activity rates and employment rates (see Table 2) in the V4 countries also seem to contradict the claim that robots and automation are replacing jobs.

What the technological changes seem to have caused is a process of polarization away from middle-skill jobs to low-skill and high-skill employment. This is connected to de-industrialization which is reflected in the move of employment from manufacturing to services, which, according to the OECD, accounts for about a third of this process. The remainder is due to changes in the occupational structure (OECD, 2017). The ICT revolution has affected the way production tasks are organized into occupations, in particular, requiring higher skills in many previously low-skill tasks. As a consequence, some jobs get eliminated, but the remaining workers tend to be more productive. Generally speaking, high-skill workers are better off. In the case of lower-skill workers, jobs are usually moved offshore since the preferred stages to be moved abroad were simple fabrication and assembly, but when it comes to the very low end of pay and skill, these jobs are often not threatened by offshoring since a lot of them can only be provided locally. As a consequence, a certain pattern appears, particularly

in the advanced economies, middle-skill and middle-income jobs appear to be threatened since they are either replaced by automation or moved offshore (Baldwin, 2016).



\* no data for Poland was available

Central Europe included Czechia, Hungary, Slovakia and Slovenia

Fig. 5. Polarization of the labour market in selected\* V4 countries and OECD in 1995–2015, percentage point share change in total employment. Source: (OECD, 2017, 2019c).

The data from OECD (Figure 5) appears to confirm the claim of the ‘hollowing out’ in the labour market in the case of OECD countries. In 1995–2015, the share of middle-skill jobs in total employment of OECD countries declined by 9.52 percentage points and the share of high-skill and low-skill jobs increased by 7.6 and 1.93 percentage points respectively. This was also confirmed by the World Bank data for other regions (Kelly, Liaplina, Tan, & Winkler, 2017). However, if Central European countries are taken into consideration, with the exception of Slovakia, the share of high-skill employment increased and both low-skill and middle-skill jobs shrank. Only Slovakia experienced the same trends as the OECD average.

Another consequence of the ICT revolution is a change in the form of employment and the organization of work. Jobs are becoming less stable and non-standard forms of employment are becoming more popular. Non-standard forms of employment mean anything that deviates from the ‘standard’ of full-time, open-ended contracts with a single employer. Usually, these are more flexible forms of work that include temporary employment, part-time jobs, self-employment, freelancing, working through online platforms or telecommuting (Kelly et al., 2017).



Specification	EU	Czechia	Hungary	Poland	Slovakia
2004	13.2	8.8	6.9	22.5	5.3
2005	14.0	7.9	7.0	25.6	4.9
2006	14.5	8.0	6.8	27.3	5.0
2007	14.6	7.8	7.3	28.2	5.0
2008	14.1	7.2	7.8	26.9	4.5
2009	13.6	7.5	8.5	26.4	4.3
2010	13.9	8.2	9.7	27.2	5.6
2011	14.0	8.0	9.1	26.8	6.5
2012	13.7	8.3	9.5	26.8	6.7
2013	13.6	9.1	10.9	26.8	6.8
2014	13.9	9.7	10.8	28.3	8.8
2015	14.1	10.0	11.4	28.0	10.5
2016	14.2	9.7	9.7	27.5	9.9
2017	14.3	9.6	8.8	26.1	9.4
2018	14.2	8.4	7.3	24.3	8.1

Tab. 7. Temporary employment as a percentage of the total number of employees in the EU and V4 countries. Source: (Eurostat, 2019).

Share of temporary employment in the V4 countries increased in 2004–2015 and started to decrease from 2016 on (Table 7). Out of the four countries, Poland had the highest share of temporary employment, which was twice above the EU average. The remaining three countries had much lower shares. None of them surpassed the EU average.

The accessibility of broadband Internet connections also made it possible to work from home. The EU countries have experienced an increase in the share of employed persons working from home. From 2004, it rose by 1.9 percentage point. Shares for the V4 were below the EU average. The trends varied among them. Czechia and Hungary experienced a decrease while Poland's and Slovakia's shares increased in 2004–2018. The highest share pertained to Poland and was just slightly below the EU average in 2018 (see Table 8).

Specification	EU	Czechia	Hungary	Poland	Slovakia
2004	7.9	6.8	6.6	7.2	4.5
2005	8.4	6.7	5.8	7.1	4.5
2006	7.5	5.5	4.9	7.7	4.1
2007	7.5	3.9	4.9	7.6	4.1
2008	7.7	3.9	4.6	7.8	3.6
2009	7.8	4.0	5.3	7.8	4.0
2010	8.1	4.0	5.8	8.2	4.2
2011	7.9	4.6	5.8	8.0	4.5
2012	8.2	4.6	6.3	7.9	5.3
2013	8.8	4.7	6.8	8.7	5.0
2014	8.8	4.4	6.3	8.5	5.5
2015	9.8	4.1	5.3	10.2	5.6
2016	9.8	5.0	4.2	9.4	5.0
2017	9.7	5.2	4.1	9.1	4.9
2018	9.8	5.4	3.7	9.4	5.4

Tab. 8. *Employed persons working from home as a percentage of total employment. Source: (Eurostat, 2019).*

## 6. Conclusion

In the analysed period of 2004–2018, the labour markets of the V4 countries experienced quite significant changes. These changes were a reflection of the impact of factors at the global level (alternating periods of prosperity and economic crises), at the regional level (economic situation in the European Union) and at the national level.

The situation in the labour markets of the V4 countries improved: the unemployment rates dropped (especially in the case of Poland and Slovakia), and the employment and activity rates increased. The changes on the labour markets of the Visegrád Group countries were more positive than in the case of the average for the European Union. The economic dynamics contributed to the increase in the activity and employment rates. It can therefore be concluded that the initially high divergence of labour markets between the old (EU15) and new (V4) countries was somewhat reduced.

The direction of changes in the V4 labour markets was consistent with the structural changes in the economy that included the shift in the share of sectors in the value added creation, but the extent of the changes was larger. The main factor contributing to the growing share of manufacturing in total employment was the activity of international corporations, mostly originating in Germany, while the basic factor of the increase in the share of services stemmed from the changes in the structure of global demand and

technological progress. Contrary to other EU members, structural changes in Poland, Czechia, and Hungary were not accompanied by an increase in the number of under-employed workers. A major shift in the future structure of employment, especially in Poland, can result from the policy of controlling pollution which affects the decline in mining employment, but also in other excess emission industries.

The analysed data has not confirmed the main fear related to the impact of technological progress on the labour markets in the V4 countries. During the reviewed period of 2004–2018, the employment rates actually increased, even though the OECD forecasts claim that an average of 14% of jobs are at risk of automation and an additional 32% are facing significant changes.

On the other hand, there is evidence on the polarization of jobs in developed countries into low-skill and high-skill with middle-skill jobs being either offshored or replaced by automated tasks. However, in Hungary and Czechia, both low-skill and middle-skill jobs shares decreased in favour of high-skill jobs.

In terms of increasing job flexibility, the shares of temporary employment slightly increased in all V4 countries and the shares of employees working from home varied – increased in Poland and Slovakia and declined in Czechia and Hungary.

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