WAGE DIVERSIFICATION IN OECD MEMBER COUNTRIES: A CHALLENGE FOR SOME COUNTRIES' GOVERNMENTS AND SOCIAL SYSTEMS

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Abstract

In all OECD member countries, the average wage and the median wage differ by more than ten percent. The wage median differs the least from the average wage in Sweden (by 10.2%), Finland (by 10.5%), Canada (by 10.9%), Denmark (by 11%), Norway (by 11.1%). %), Japan (by 12.4%), New Zealand (by 12.8%), Germany (by 13%), Italy (by 14.9%) and Switzerland (by 15.1%). On the contrary, the wage median differs the most from the average wage to Turkey (by 44.8%), Mexico (by 37.8%) and Greece (by 32%). The main objective of this research is to capture wage inequality in OECD member countries and to find out in which countries wages are the most levelled and in which countries wages are the most diversified. The Gini coefficient and hence the Gini index were used for this purpose. The ratios of quantiles were used as an additional indicator of wage inequality. Another important aim of this study is to create clusters of OECD member countries so that the countries within the same cluster are as similar as possible in terms of the mentioned indicators of wage inequality. For this purpose, OECD countries were primarily divided into seven blocs according to their geographical location, historical development, culture, social systems, and level of advancement. Cluster analysis and within that, Euclidean distance were used for this purpose. Five clustering methods, namely the farthest neighbour method, the nearest neighbour method, the Ward method, the centroid method, and the group average method, were used to classify countries into seven clusters. The highest values of the Gini index were found in two Latin American OECD member countries, namely in Chile and Mexico, values exceeding 45 percent indicate strong wage diversification. On the contrary, Slovenia, Slovakia, the Czechia show a strong levelling of wages, the values of the Gini index are around 25 percent.

Key words: Wage diversification, Gini coefficient of diversification, Gini index of diversification, Lorenz curve of diversification, cluster analysis

JEL Code: C38, J31, E24

Introduction

In the developed countries of the world, wage shears are constantly opening up. Wages and salaries of employees with the highest incomes are rising the most. For example, wage differences are evidenced by the difference between the average wage and the median wage, too. Most employees in the developed countries in the world do not reach the average wage. Real wages of experts are currently rising in the developed countries of the world, so it can be expected that this disparity will continue to increase.

Rising wage and income inequality is also a major problem in Organization for Economic Cooperation and Development (OECD) countries, especially in view of the recent coronary crisis and the fact that the prospects for a slowdown in this growth is currently very low, especially for more developed countries. In this context, many researchers and scholarly articles around the world are published on topic of wage and income diversifications and inequality.

(Marjit, Beladi and Chakrabarti, 2004) provide a theoretical analysis of the possible impact of trade and fragmentation on the skilled–unskilled wage gap in a small developing economy. In particular, they illustrate the possibility of a decline in the relative wage of the unskilled labour following an improvement in the terms of trade. Analysing data from the Current Population Survey for 1963 to 2005, (Autor, Katz and Kearney, 2008) find that the slowing of the growth of wage inequality in the 1990s hides a divergence in the paths of upper-tail (quantiles 90/50) inequality, which has increased steadily since 1980, even adjusting for changes in labour force composition, and lower-tail (quantiles 50/10) inequality, which rose sharply in the first half of the 1980s and plateaued or contracted thereafter. Fluctuations in the real minimum wage are not a plausible explanation for these trends since the bulk of inequality growth occurs above the median of the wage distribution. (Western and Rosenfeld, 2011) observe that from 1973 to 2007, private sector union membership in the United States declined from 34 to 8 percent for men and from 16 to 6 percent for women. During this period, inequality in hourly wages increased by over 40 percent. The authors report a decomposition, relating rising inequality to the union wage distribution's shrinking weight and they argue that unions helped institutionalize norms of equity, reducing the dispersion of nonunion wages in highly unionized regions and industries. (Acosta and Gasparini, 2007) present evidence of the hypothesis that capital accumulation can modify the relative productivity between skilled and unskilled workers, leading to changes in the wage structure, taking advantage of the variability in wage premia and capital investment across

industries in Argentina's manufacturing sector. The authors conclude that the wage premium for skilled workers increased more in those industries with higher investment in machinery and equipment. A duo of authors (Fortin and Lemieux, 2015) uses the Canadian Labour Force Survey to understand why the level and dispersion of wages have evolved differently across provinces from 1997 to 2013. The authors pronounce that the faster increase in the level of wages and the decline in wage dispersion in Newfoundland, Saskatchewan and Alberta are the starkest interprovincial differences. They find that they are accounted for by the growth in the extractive resources sectors, which benefited less-educated and younger workers the most. (Machin, 1996) writes that recent years have seen the distribution of labour market rewards become more unequal in some countries, most notably Britain from the late 1970s and the United States since the end of the 1960, while remaining largely unchanged in others. In the post war period, study of inequality of income or earnings had become something of a specialist area, but, in the last few years, trends in the inequality of labour market earnings and family or household income have received a great deal of attention from economics more widely. The author discusses their work in this paper. Authors (Tamkoç and Torul, 2020) investigate the evolution of Turkey's wage, income and consumption inequalities using a cross-country comparable methodology and the Turkish Statistical Institute's Household Budget Survey and the Survey of Income and Living Conditions micro data sets. They found that Turkey's wage, income and consumption inequalities all exhibit downward time trends over the 2002–2016 period and they state that this observation aligns well with the rapid minimum wage growth over the period. (Brzozowski, Gervais, Klein and Suzuki, 2010) document some features of the distribution of income, consumption and wealth in Canada using survey data from many different sources. They find that wage and income inequality have increased substantially over the last 30 years, but that much of this rise was offset by the tax and transfer system and as a result, the rise in consumption inequality has been relatively mild. The paper (Zhang, 2013) states that most existing studies examine the issue of skilled-unskilled wage inequality by using models that are relevant only in the long-run. Using a product variety model, the author examines the issue of the skilled–unskilled wage inequality when producer services are internationally traded and he shows that, irrespective of the size of income share of capital, inflow of capital (which can also be interpreted as foreign direct investment) has no effect on skilled–unskilled wage inequality in the short-run. Research (Robertson, 2004) examines the link between relative goods prices and relative wages during two periods of Mexico's trade liberalization. It was found that the relative price of skill-intensive goods rose following Mexico's entrance to the General Agreement and

Tariffs and Trade in 1986 but fell after Mexico entered the North American Free Trade Agreement in 1994. Acknowledging that wage inequality and intergenerational mobility are strongly interrelated, (Hassler, Mora and Zeira, 2007) present a model in which both are jointly determined. A main implication of the model is that differences in the amounts of public subsidies to education and educational quality produce cross-country patterns with a negative correlation between inequality and mobility. (Rueda and Pontusson, 2000) draw on a new data set that enables the authors to compare the distribution of income from employment across OECD countries and specifically, the article conducts a pooled cross-sectional time-series analysis of the determinants of wage inequality in sixteen countries from 1973 to 1995. The authors find that the qualities that distinguish social market economies from liberal market economies shape the way political and institutional variables influence wage inequality. The paper of authors (Ordine and Rose, 2011) proposes a theoretical framework where within graduate wage inequality is related to overeducation, educational mismatch in the labour market. This research shows that wage inequality may arise because of inefficient self-selection into education in the presence of ability-complementary technological progress and asymmetric information on individuals' ability. (Guadalupe, 2007) examines the effect of product market competition on firms' willingness to pay for workers of different skills. Using a panel of British workers and two different quasi-natural experiments, this paper shows that returns to skill within an industry increase with competition and it also investigates the mechanisms behind this relationship: in addition to the indirect effects that operate through union bargaining and skill-biased technical change, there is evidence for a direct effect of competition beyond those channels. The article (Oliver, 2008) investigates how a particular wage-bargaining institution mitigates pressures from growing international competition and new production techniques and affects the degree of wage inequality growth. The author shows that the extent to which industry-wide wage minima (wage scales) cover both higher and lower skilled workers affects developments in inequality and the results strongly indicate that the presence of industry-wide wage scales is a key factor in the evolution of wage inequality across OECD countries. The study (Sanchez, 2002) presents a wage inequality analysis for 158 large US metropolitan statistical areas and this research is concerned with whether public transport has a detectable influence on 1990 levels of wage equality. The results of this research provide a macroscopic view of the effectiveness of urban transport investments with respect to urban wage inequality. (Taylor, 2006) looks at male wage inequality in the United Kingdom across industries and regions over a fifteen-year period. The paper examines that part of wage inequality which cannot be explained by

observable worker characteristics, this is undertaken at both the industry and regional level to assess the key themes dominant in the literature capable of explaining within-group wage inequality. The article (Watson, 2016) examines wage inequality in Australia from 1982 to 2012 using income distribution data from the Australian Bureau of Statistics and the analysis shows that wage inequality grew steadily during this period, and that the growth was particularly strong from 1996 onward. The author states that through the use of quantile regression it is possible to decompose the growth in inequality into three components: changes in the wage structure, changes in workforce characteristics and a residual unobservables. The trio of authors (Card, Lemieux and Riddell, 2004) emphasizes that the impact of unions on the structure of wages attracts interest as analysts have struggled to explain the rise in earnings inequality in several industrialized countries. The authors states that Canada, the United Kingdom, and the United States provide a potentially valuable set of countries for examining this question, all three countries now collect comparable data on wages and union status in their regular labour force surveys and several features of the collective bargaining institutions of these countries make them suitable for studying the relationship between unions and wage inequality.

This paper deals with the analysis of the development of wage diversification in OECD member countries in the period just after the global economic crisis, specifically 2013–2018. The main aim of the current research is to quantify the development of wage diversification using the Gini diversification coefficient and then the Gini diversification index with the intention of comparing this development in individual countries or their groups. An equally important objective of this research is to create clusters of OECD member countries so that countries within the same cluster will be as similar as possible in terms of wage diversification expressed by Gini coefficient, the ratio of the fifth wage decile to the first wage decile, the ratio of the ninth wage decile to the fifth wage decile and the ratio of the ninth wage decile to the first wage decile. Cluster analysis was used for this purpose, with a total of five clustering methods used in the cluster analysis. There is the farthest neighbour method, the nearest neighbour method, the Ward method, the centroid method and the group average method. The Euclidean distance was used in the cluster analysis. Prior to the use of cluster analysis, OECD member countries were primarily divided into seven blocs based on their geographical location, historical development, culture, social systems, and level of advancement of the country. There are Western European developed countries, Scandinavian countries, Anglo-Saxon countries, South European countries, Central European post-

communist countries, Baltic countries and Non-European countries. The following scientific hypotheses follow from the set research objectives:

H1: In all OECD member countries, the wage diversification expressed by the Gini index does not exceed 50 percent.

H2: Wage diversification in post-communist countries is lower than in other countries due to the past almost egalitarian system.

H3: Central and South American OECD countries show the highest degree of wage diversification within OECD member countries.

H4: Non-European OECD member countries are characterized by a higher degree of wage diversification than European countries.

H5: Clusters of OECD member countries, created so that the countries within the same cluster are as similar as possible in terms of wage diversification, roughly correspond to the blocs of countries determined on the basis of their geographical location, historical development, culture, social systems, and level of advancement of the country.

1 Database

The data for this research come from the official Organization for Economic Cooperation and Development Statistical Database OECDSTAT (2020) and International Labour Organization Statistical Database ILOSTAT (2020). Gross annual wage after its conversion to purchasing power parity (PPP) in 2018 constant prices at USD is the main research variable. Then, average gross annual wage after its conversion to PPP in 2018 constant prices at USD is the main research wage indicator – hereinafter in the text referred to as average wage. All 36 OECD member countries are statistical units of research. These states are divided into seven blocs according to their geographical location, historical development, culture, social systems and level of advancement of the country, see Tab. 1.

The data for this research includes employees in both business and non-business spheres. The wage is paid to the employee for the work done in the private (business) sphere, salary in the budget (state, public, non-business) sector. From the point of view of the analysed data from the OECD statistical database, both wages in the business sphere and salaries in the non-business sector are included under the wage term.

The data was processed using the SAS, SPSS and Statgraphics statistical packets and the Microsoft Excel spreadsheet.

Tab. 1: Country blocs of the OECD member states, country names and their international codes

Group of countries	Country	Code	Group of countries	Country	Code
Western European developed countries	Austria	AUT	**Central European post-communist countries**	Czechia	CZE
	Belgium	BEL		Hungary	HUN
	France	FRA		Poland	POL
	Germany	DEU		Slovakia	SVK
	Luxembourg	LUX		Slovenia	SVN
	Netherlands	NLD	**Baltic countries**	Estonia	EST
	Switzerland	CHE		Latvia	LVA
Scandinavian countries	Denmark	DNK		Lithuania	LTU
	Finland	FIN	**Non-European countries**	Australia	AUS
	Iceland	ISL		Canada	CAN
	Norway	NOR		Chile	CHL
	Sweden	SWE		Israel	ISR
Anglo-Saxon countries	Ireland	IRL		Japan	JPN
	United Kingdom	GBR		Mexico	MEX
South European countries	Greece	GRC		New Zealand	NZL
	Italy	ITA		South Korea	KOR
	Portugal	PRT		Turkey	TUR
	Spain	ESP		United States	USA

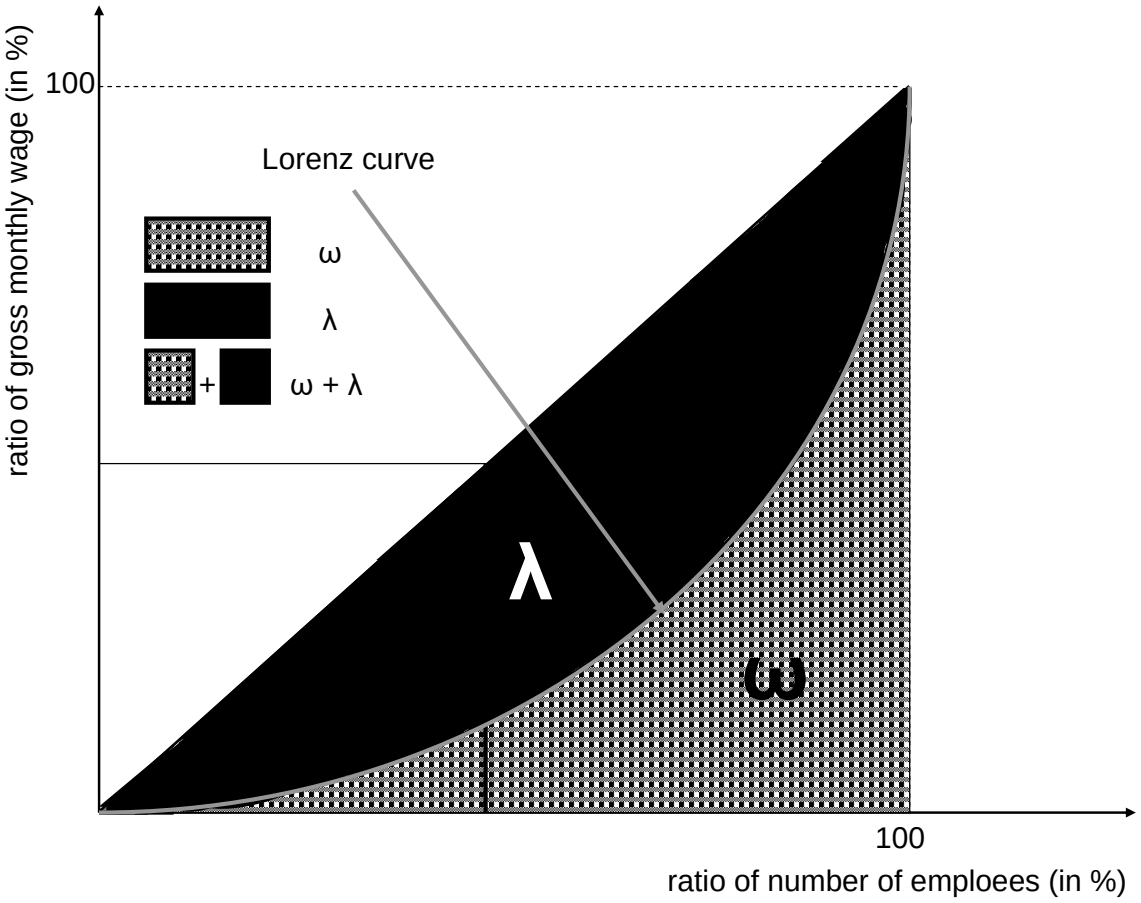
Source: www.mvcr.cz

2 Theory and Methodology

2.1 Measurement of Wage Disparities

Gini coefficient is related to the popular Lorenz curve, see Fig. 1. In this figure, the Lorenz curve represents the arc indicated by the arrow. The two extreme Lorenz curve shape options for full levelling and full diversification are shown here, too.

Fig. 1: Lorenz curve



Source: www.mvcr.cz

Lorenz curve is plotted in a rectangular chart with two scales from zero percent to a hundred percent. The cumulative relative frequencies (in percentages) of the statistical units that carry the variable of interest are on the horizontal axis. On the contrary, the cumulative totals (in percentages) of the concentrated variable are on the vertical axis. Thus, the coordinates of the points on the Lorenz curve are the cumulative relative frequencies (in percentages) of the statistical units that carry the variable under consideration, and the corresponding cumulative totals (in percentages) of the concentrated variable. In the case of full levelling, the Lorenz curve coincides with the indicated diagonal of the square, which means that each statistical unit obtains the equal part from the total sum of the values of the researched variable. The more the Lorenz curve bends, the greater is the diversification of the variable under investigation, i. e. the concentration of a relatively large part of the total sum of the values of the monitored variable into a small number of statistical units. In the case of full diversification, the Lorenz curve turns into two each other perpendicular lines, i. e. it merges with the horizontal axis and the right edge of the graph (shown in bold in Fig. 1). This means that the total sum of the values of the variable being examined is concentrated into only one statistical unit.

The characteristic of diversification is then the ratio of the area content between the square diagonal and the Lorenz curve to the area content of the whole triangle below the diagonal of the square. This characteristic is called the Gini coefficient of diversification

$$GC = \frac{\lambda}{\lambda + \omega}. \qquad (1)$$

The Gini coefficient takes values in the range from zero to one, where it gets value zero at extreme levelling, when each statistical unit obtains the equal part from the total sum of the values of the researched variable, and it gets value one at extreme differentiation, when the total sum of the values of the variable being examined is concentrated into only one statistical unit. The Gini coefficient is considered to be one of the most suitable indicators of measuring wage and income inequalities. The Gini coefficient multiplied by a hundred is called the Gini index. This is the same statistic, expressed only as a percentage.

We calculate the Gini coefficient from the interval frequency distribution as

$$GC = \frac{\sum_{i=1}^{l} [M_i(h) - M_i(d)] \times k(p_i) \times [1 - k(p_i)]}{\sum_{i=1}^{l} [M_i(h) - M_i(d)] \times [1 - k(p_i)]}, \qquad (2)$$

where: $M_i(h)$ is upper limit of the i^{th} interval, $i = 1, 2, \ldots, l$,

$M_i(d)$ is lower limit of the i^{th} interval, $i = 1, 2, \ldots, l$,

p_i is relative frequency in the i^{th} interval, $i = 1, 2, \ldots, l$,

$k(p_i)$ is cumulative relative frequency in up to the i^{th} interval, $i = 1, 2, \ldots, l$,

l is number of intervals,

or, if we know the averages at each interval, using the formula

$$GC = \frac{\sum_{i=1}^{l} [\bar{M}_{i+1} - \bar{M}_i] \times k(p_i) \times [1 - k(p_i)]}{\bar{M}}, \qquad (3)$$

where: $\bar{M}_{i+1} - \bar{M}_i$ is the difference of the i+1-th and i^{th} interval averages, $i = 1, 2, \ldots, l$,

$\bar{M}$ is the total average over all intervals,

p_i is relative frequency in the i^{th} interval, $i = 1, 2, \ldots, l$,

$k(p_i)$ is cumulative relative frequency in up to the i^{th} interval, $i = 1, 2, \ldots, l$,

l is number of intervals.

Gini coefficient can be also calculated using the mathematical formula as an average of differences in wages between all possible pairs of individuals

$$GC = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right|}{2\,n^2\times\bar{x}}, \qquad (4)$$

where: x_i, x_j are wages of two randomly chosen individuals, $i, j = 1, 2, \ldots, n$,

n is number of individuals,

$\bar{x}$ is an average of the individuals.

The advantage of this calculation procedure is that it is not necessary to sort individuals or groups according to monitored variable.

However, the so-called Brownian formula is more often used to calculate the Gini coefficient

$$GC = \left|1 - \sum_{i=1}^{n}(x_i - x_{i-1})\times(y_i + y_{i-1})\right|, \qquad (5)$$

where: x_i is the cumulative ratio of beneficaries of monitored variable, $i = 1, 2, \ldots, n$,

y_i is the cumulative ratio of monitored variable, $i = 1, 2, \ldots, n$.

Another indicator of the inequality rate is derived from the Gini coefficient. This is the price for inequality, which enables to assess the inequality of wages expressed by the Lorenz curve. The calculation of this indicator is based on the Gini coefficient and it takes the following form

$$PI = 100\times(1 - GC). \qquad (6)$$

This indicator is suitable, for example, for modeling estimates of wage growth in the business sector and salaries in the non-business sector.

In the case of wage distribution, the quantile description of wage inequalities is a relatively accurate and transparent indicator of wage differentiation. Indicators that can be used to measure wage differentiation are based on quantile ratios. Indicator based on the ratio of the first decile to the ninth decile has the form

$$100\times P_{10/90} - 100 = 100\times\frac{x_{10\%}}{x_{90\%}} - 100, \qquad (7)$$

which represents ratio of the lowest and highest wages excluding 10 % of employees with the lowest wage and 10 % of employees with the highest wage. This indicator measures how

many percent the first decile participates in the ninth decile. This takes a value from zero to one, the more the value of this indicator approaches one, the more the first and ninth deciles are closer, and wages are more egalitarian. The closer the value of this indicator is to zero, the more the first and ninth deciles are distant, and wages are more differentiated. Indicator based on the ratio of the median to the ninth decile has the form

$$100 \times P_{50/90} - 100 = 100 \times \frac{x_{50\%}}{x_{90\%}} - 100, \tag{8}$$

which measures, how many percent the median participates in the ninth decile. This takes a value from zero to one, the more the value of this indicator approaches one, the more the median and the ninth decile are closer, and wages are more egalitarian. The closer the value of this indicator is to zero, the more the median and ninth decile are distant, and wages are more differentiated. Indicator based on the ratio of the first decile to the median has the form

$$100 \times P_{10/50} - 100 = 100 \times \frac{x_{10\%}}{x_{50\%}} - 100, \tag{9}$$

which measures, how many percent the first decile participates in the median. This takes a value from zero to one, the more the value of this indicator approaches one, the more the first decile and the median are closer, and wages are more egalitarian. The closer the value of this indicator is to zero, the more the first decile and the median are distant, and wages are more differentiated. We can compare the values of these indicators (8) and (9).

Similarly, we can consider the ratios of deciles in reverse order. For example, the ratio of the ninth decile to the first decile

$$100 \times P_{90/10} - 100 = 100 \times \frac{x_{90\%}}{x_{10\%}} - 100, \tag{10}$$

which indicates how many percent the ninth decile exceeds the first decile. Likewise, the ratio of the ninth decile to the median

$$100 \times P_{90/50} - 100 = 100 \times \frac{x_{90\%}}{x_{50\%}} - 100, \tag{11}$$

which indicates how many percent the ninth decile exceeds the median or the ratio of the median to the first decile

$$100 \times P_{50/10} - 100 = 100 \times \frac{x_{50\%}}{x_{10\%}} - 100, \tag{12}$$

which indicates how many percent the median exceeds the first decile.

Other indicators of wage differentiation are based on the ratio of the minimum wage to the wage expected value. Indicator based on the ratio of the minimum wage to the average wage has the form

$$100 \times P_{x_{\min}/\bar{x}} - 100 = 100 \times \frac{x_{\min}}{\bar{x}} - 100, \tag{13}$$

which measures, how many percent the minimum wage participates in the average wage. This takes a value from zero to one, the more the value of this indicator approaches one, the more the minimum and average wages are closer, and wages are more egalitarian. The closer the value of this indicator is to zero, the more minimum and average wages are distant, and wages are more differentiated. Indicator based on the ratio of the minimum wage to the median wage has the form

$$100 \times P_{x_{\min}/x_{50\%}} - 100 = 100 \times \frac{x_{\min}}{x_{50\%}} - 100, \tag{14}$$

which measures, how many percent the minimum wage participates in the median wage. This takes a value from zero to one, the more the value of this indicator approaches one, the more the minimum and median wages are closer, and wages are more egalitarian. The closer the value of this indicator is to zero, the more minimum and median wages are distant, and wages are more differentiated. Indicator base on the ratio of average wage to minimum wage has the form

$$100 \times P_{\bar{x}/x_{\min}} - 100 = 100 \times \frac{\bar{x}}{x_{\min}} - 100, \tag{15}$$

which measures, how much percent the average wage exceeds the minimum wage.

The closer the values of indicators (13)–(15) approach zero, the wage distribution is more levelled, and vice versa, the higher the positive values they acquire, the more the wage distribution is differentiated.

2.2 Cluster Analysis

The essence of cluster analysis is explained in detail, for example, in Everitt, Landau, Leese and Stahl (2011). In this research, OECD countries were classified according to wage

diversification (Gini coefficient, fifth to first wage decile ratio, ninth to fifth wage decile ratio, and ninth to first wage decile ratio) in 2018.

The Ward method and the Euclidean distance are the most common techniques that have also been used in cluster analysis. From the point of view of the Ward method, which belongs to the methods of hierarchical clustering, the procedure is not based on the optimization of distances between clusters. The minimization of cluster heterogeneity is solved according to the increment of the intra-cluster sum of squares of deviations of objects from the centre of gravity (centroids) of the clusters. Ward method tends to remove clusters that are too small, so it tends to form clusters of about the same size, which is a welcome feature in terms of clustering in OECD countries. For this reason, the Ward method was used in the cluster analysis. Because the groups of OECD countries in Tab. 1 are not the same size, the Ward clustering method is supplemented by the farthest neighbour method, the nearest neighbour method, the centroid method, and the group average method.

In terms of measures of distances and similarity of objects, we choose according to how we need to strengthen the influence of variables, for which an extremely large difference is observed on the total sum. Because in this case we do not need to strengthen the influence of any variable (points with the same Euclidean distance from the centre lie on the circle), the Euclidean distance was chosen in this case.

There are various methods and recommendations in cluster analysis for determining the optimal number of clusters, but they do not provide any definitive conclusions, as cluster analysis is basically an exploratory approach, so it is not a statistical test. The interpretation of the resulting hierarchical structure depends on the context, and in theory there are often several possible solutions. There are several approaches, especially validation indexes, with which we can determine the optimal number of clusters. The well-known Dunn index is one of the best-known validation indexes. Because OECD countries are divided into seven groups in Tab. 1, the number of clusters was also chosen to be seven without the use of any validation index.

3 Results

3.1 Comparison of Gini index values

Figs. 2–6 quantify the development of diversification of OECD member countries in the period 2013–2018. Specifically, Fig. 2 refers to Western European developed countries, Fig. 3 represents Scandinavian countries, Fig. 4 represents Anglo-Saxon and South European

Countries[1], Fig. 5 refers to Central European post-communist and Baltic post-communist countries, and finally Fig. 6 includes Non-European Countries.

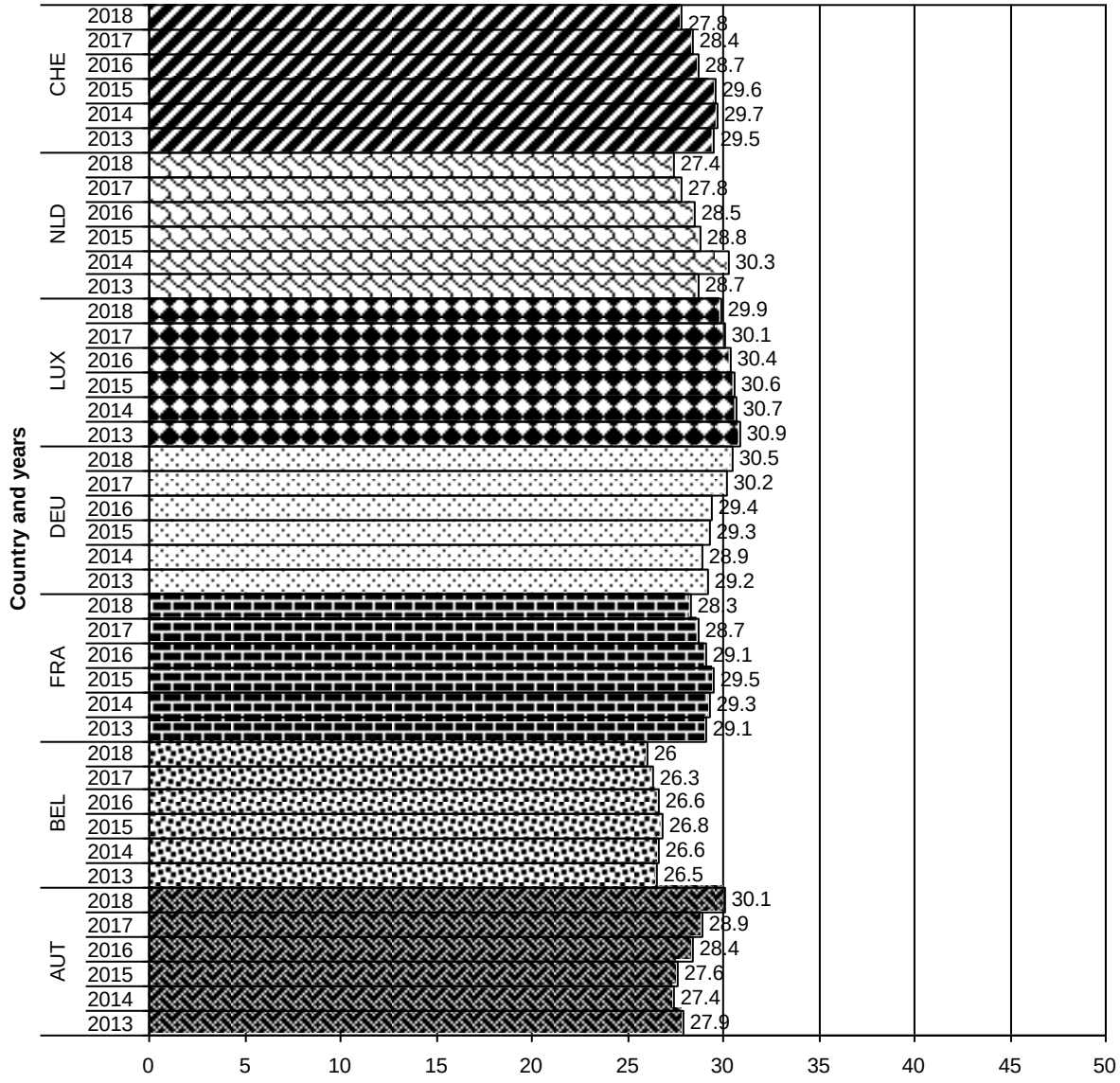
The Gini index takes values in the range from zero to one hundred, where it gets value zero at extreme levelling, when all employees have the same wage, and it gets value one hundred at extreme differentiation, when all wage belongs to one employee. The closer the Gini index is to one hundred, the higher inequality is in wage distribution. The closer the Gini index is to zero, the higher levelling is in wage distribution.

Figures 2–6 show that the highest values of the Gini index were found in two Latin American OECD member countries, namely in Chile and Mexico, with values in excess of 45 percent indicating strong wage diversification. Chile and Mexico are the only Latin American countries to be members of the OECD. Low taxes are typical for both countries. Employers' wage costs in both countries are the lowest among OECD member countries. When comparing average net wages, the differences between Western European countries and the two Latin American countries are much lower than when comparing gross wages.

On the contrary, post-communist countries, namely Slovenia, Slovakia and the Czechia, show the lowest wage diversification, which does not exceed 27 percent. As the people of post-communist countries switched from the original egalitarian systems to capitalism from the early 1990s, they encountered a new phenomenon, such as the rise of social inequality. The original Yugoslavia had a looser regime even before the collapse of the communist bloc, which also affected the economy, and since some time it was even possible to do business freely. The Slovenian economy benefits from its advantageous location, which in a small state connects the eastern part of the Alps, which is important for tourists in all seasons, several tens of meters long coast of Adriatic Sea and it is a transit country for travel to the Balkans, especially to neighboring Croatia. The country has a high level of banking, a very good infrastructure, a dense and high-quality motorway and road network and high-quality tourist centers.

Fig. 2: Gini index (in %) of wage of Western European developed countries

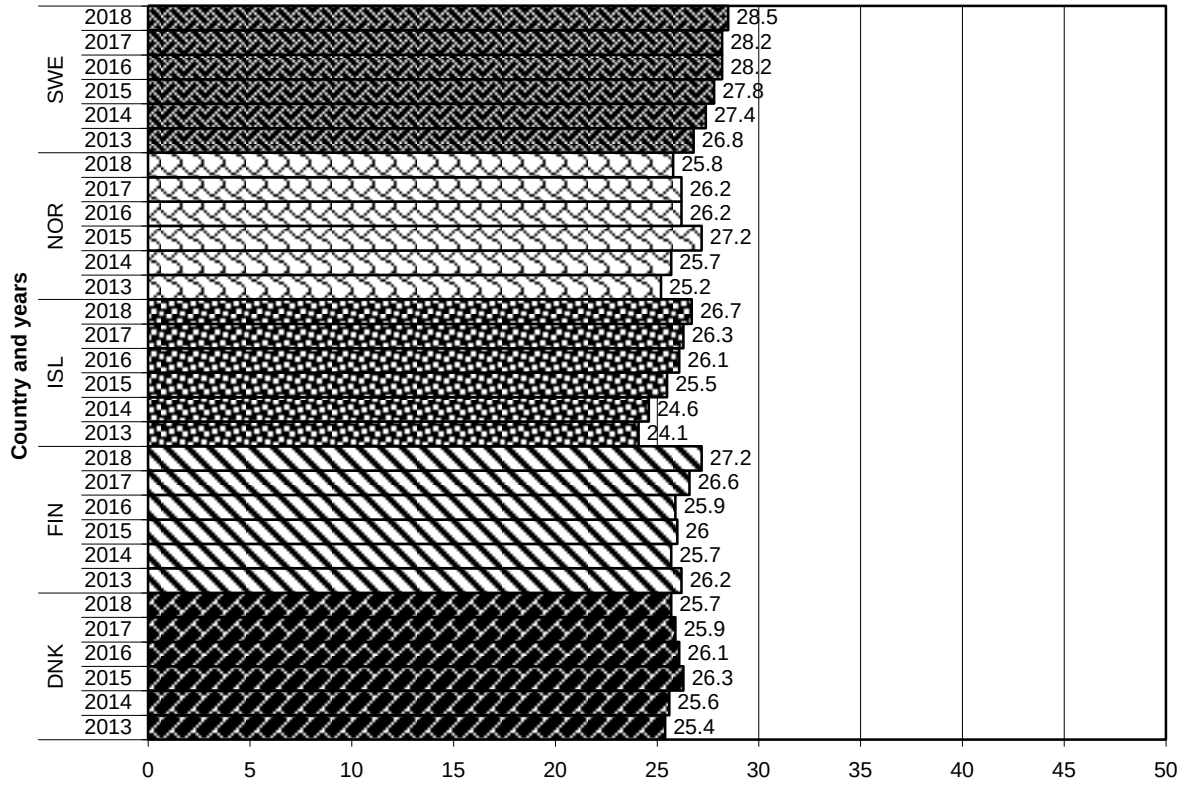
[1] Too small blocs of countries from Tab. 1 were plotted with another small bloc.



Source: Own research

When independent Czechia and Slovakia emerged from the original Czechoslovakia on the 1st January 1993, these were countries in which the process of economic transformation was already underway. Both countries were affected by an unsuitable and completely unsustainable structure of industry, focused mainly on heavy industry, with Slovakia accounting for about 30 percent and the Czechia for about 70 percent of the industrial production of the entire federation. In Slovakia, however, in the first years of independence, reforms slowed down and mainly corruption appeared.

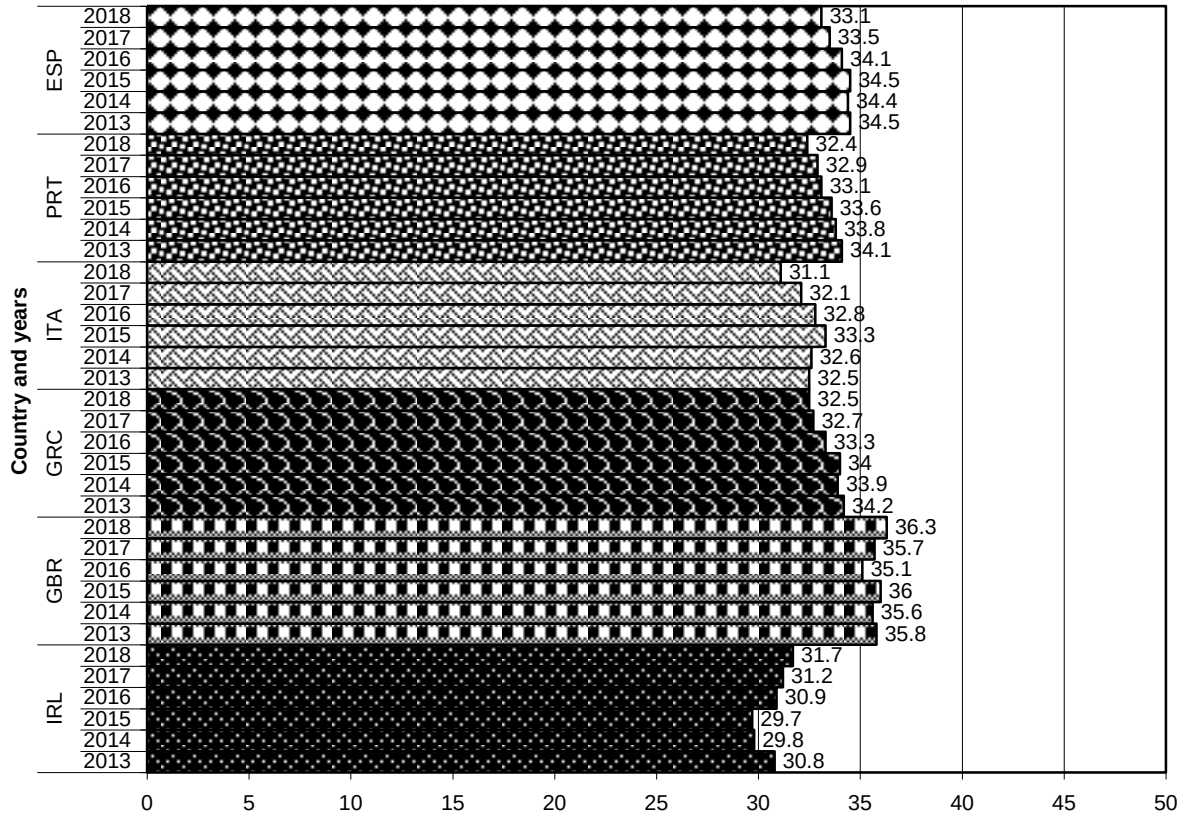
Fig. 3: Gini index (in %) of wage of Scandinavian countries



Source: Own research

However, at the beginning of the third millennium, some economic reforms, which triggered very sharp GDP growth and falling unemployment, were sharply criticized by the left parties, especially for lower living standards, mostly poorer. Slovakia is the third strongest economy of the post-communist countries after the Czech Republic and Slovenia. The Czechia has the most stable and prosperous economy of all the countries of the former Council of Mutual Economic Assistance (CMEA). The basis of the Czech economy is industry and services, agriculture and other primary production are underrepresented. The Czechia has the largest number of self-employed persons per capita in Europe. Unemployment and government debt in the Czech Republic remain among the lowest in Europe.

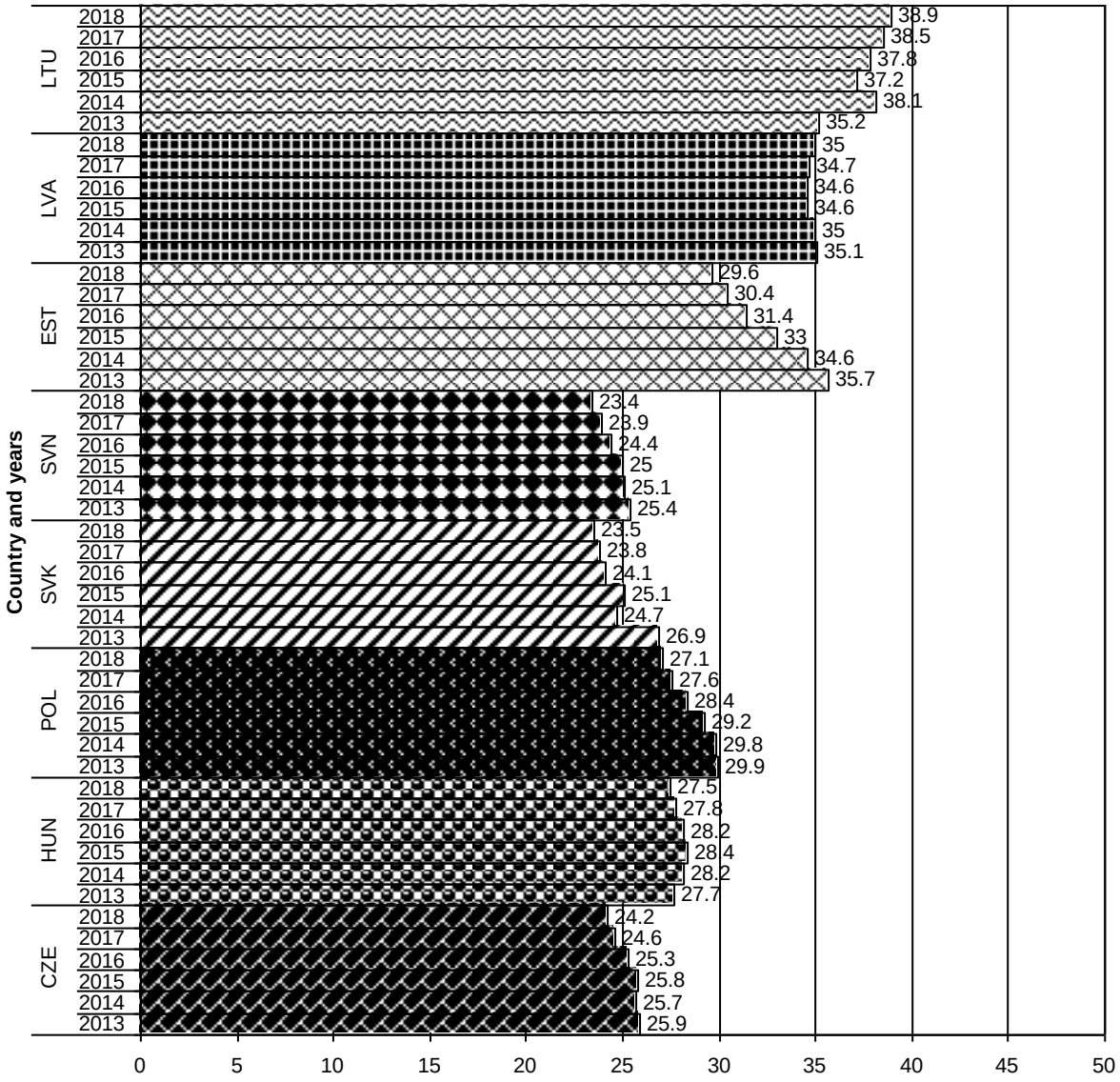
Fig. 4: Gini index (in %) of wage of Anglo-Saxon and South European Countries



Source: Own research

Overall, it can be stated that wage diversification is higher in non-European countries rather than in European countries. From European countries, the United Kingdom shows a relatively large wage diversification, which does not fall below 35 percent throughout the period under review. All four southern European countries also show a relatively high degree of wage diversification, which does not fall below 31 percent over the entire period. On the contrary, all Central European post-communist countries are characterized by low wage diversification not exceeding 30 percent in any of these countries throughout the period under review, only Poland approached 30 percent in the period immediately after the global economic crisis. The situation is different in the post-communist Baltic countries, where we record relatively strong wage diversification, especially in Lithuania, where it has reached almost 39 percent in the last years of the period under review. All Scandinavian countries and all Western European developed countries are characterized by relatively low wage deversification, which does not exceed 31 percent in any country throughout the research period.

Fig. 5: Gini index (in %) of wage of Central European post-communist and Baltic post-communist countries

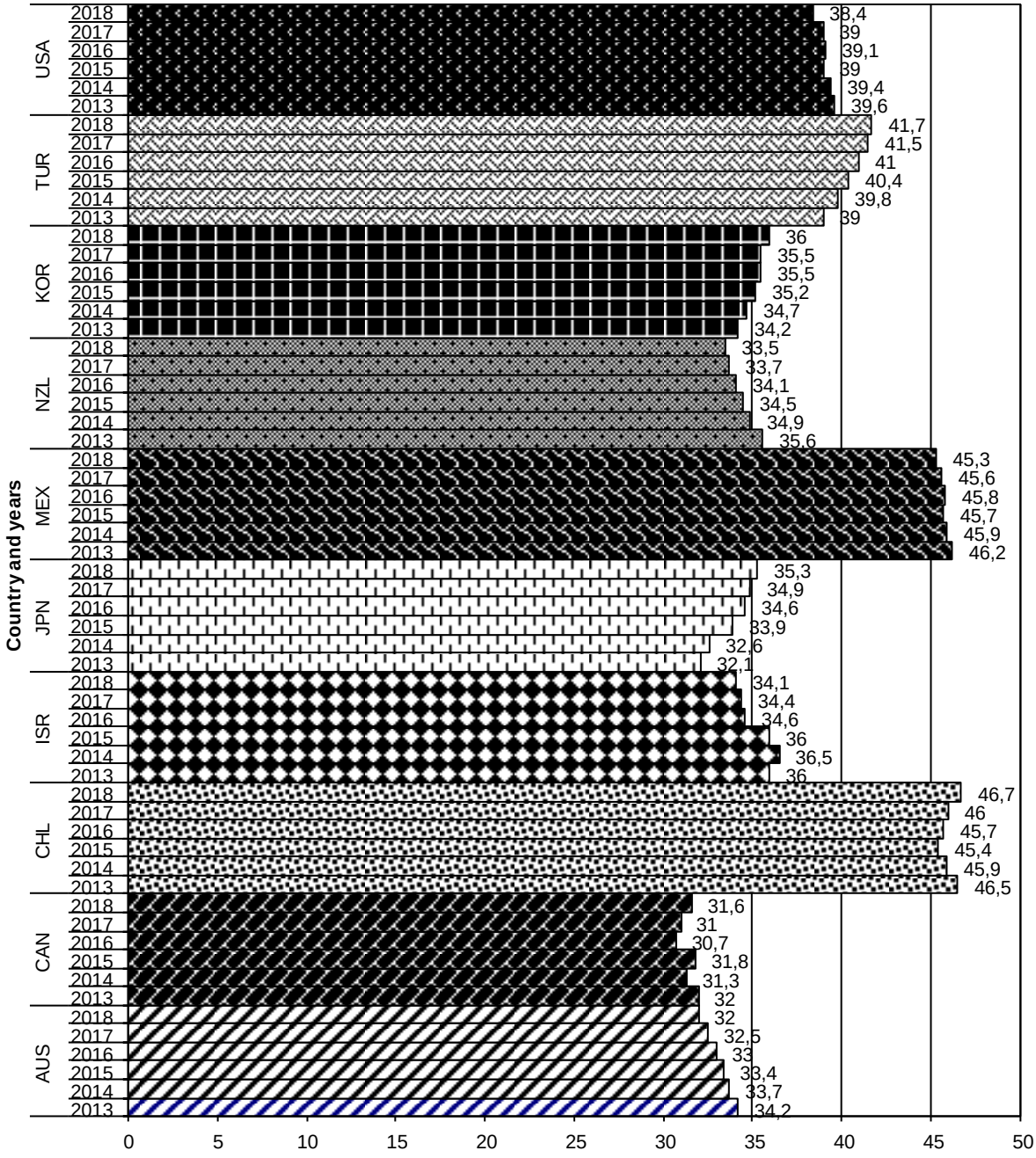


Source: Own research

3.2 Clustering Results

Figs. 7–11 show dendrograms of cluster analysis using the Euclidean distance and five different clustering methods: the farthest neighbour method (Fig. 7), the nearest neighbour method (Fig. 8), Ward method (Fig. 9), centroid method (Fig. 10) and group average method (Fig. 11). The results are presented in Tab. 2. Because before the start of the research, OECD member countries were classified into seven blocs based on their geographical location, historical development, culture, social systems and level of advancement, OECD member countries were grouped into seven clusters.

Fig. 6: Gini index (in %) of wage of Non-European Countries

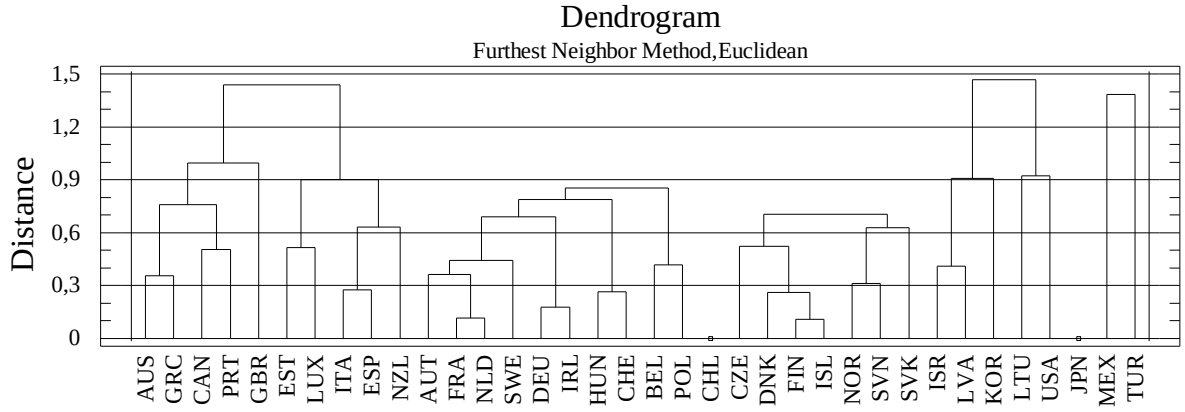


Source: Own research

It can be seen form Figures 7–11 and Table 2 centroid method and group average method yielded exactly the same results. We can see that three non-European countries (Australia, Canada and New Zealand), all four South European countries (Greece, Italy, Spain and Portugal), and always one country from bloc of Western European developed countries (Luxembourg), one Anglo-Saxon country (United Kingdom) and one Baltic country (Estonia) always form the same cluster, whatever clustering method is used. These ten countries form the first group of countries that are as similar as possible in terms of wage diversification. Together, these are countries with a medium rate of wage diversification, where the Gini

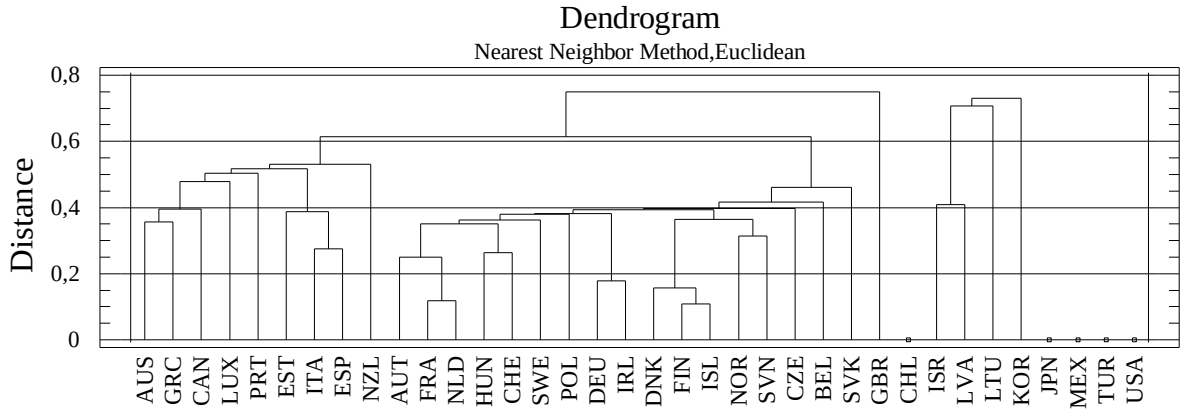
index is around 30–35 percent. Estonia has also been assigned to these countries, as it has the lowest wage diversification among the Baltic countries.

Fig. 7: Results of cluster analysis: sorting of countries into seven clusters using the method of the farthest neighbour and Euclidean distance



Source: Own research

Fig. 8: Results of cluster analysis: sorting of countries into seven clusters using the method of nearest neighbour and Euclidean distance

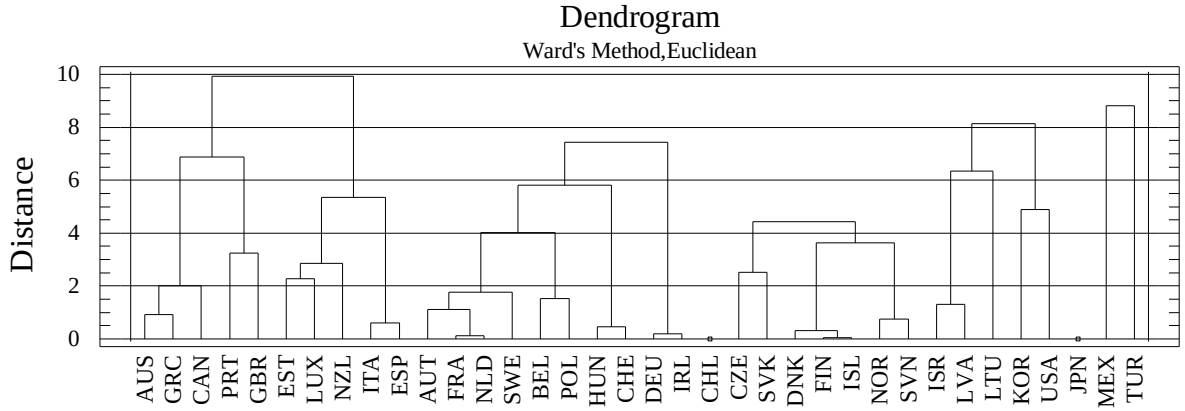


Source: Own research

Predominantly Western European developed countries (six countries: Austria, Belgium, France, Germany, the Netherlands and Switzerland) form another group of countries as similar as possible in terms of wage diversification. Two Central European post-communist countries (Hungary and Poland), the remaining Anglo-Saxon country (Ireland) and one Scandinavian country (Sweden) still belong to this group. The ten countries in this group of

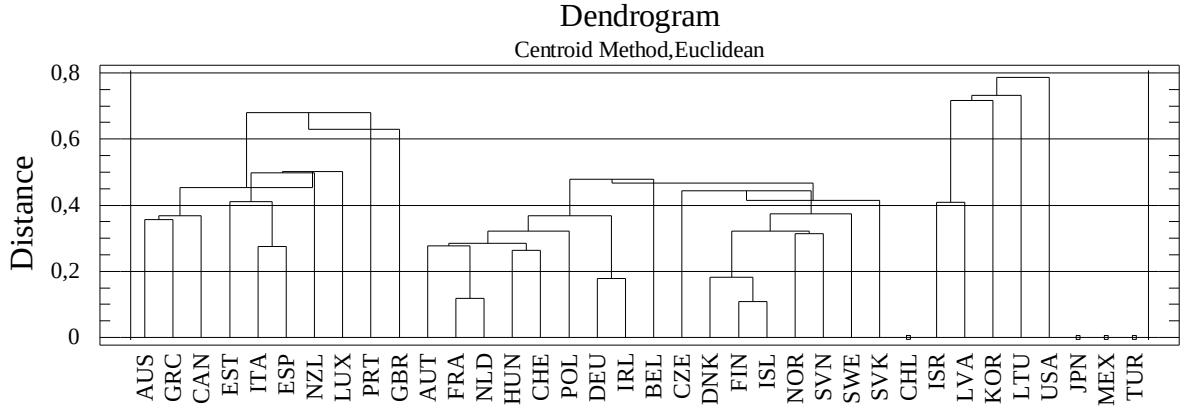
countries are characterized by a moderately lower degree of wage diversification, where the Gini index is in the range of about 25–30 percent.

Fig. 9: Results of cluster analysis: sorting of countries into seven clusters using the Ward mathod and Euclidean distance



Source: Own research

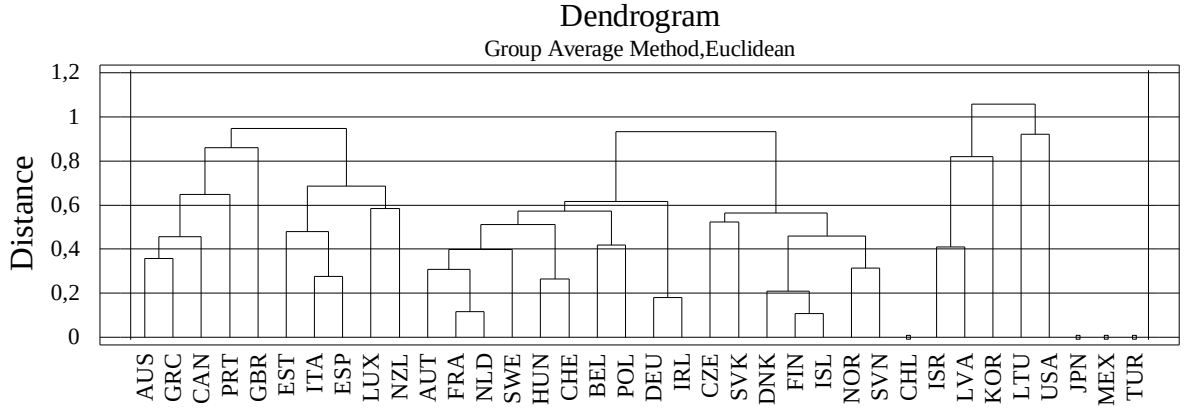
Fig. 10: Results of cluster analysis: sorting of countries into seven clusters using the centroid method and Euclidean distance



Source: Own research

All four remaining Scandinavian countries (Denmark, Finland, Iceland and Norway) and all three remaining Central European post-communist countries (Czechia, Slovakia and Slovenia) always belong to the same cluster, no matter which clustering method of the five methods is used. These seven countries therefore form the third group of countries that are as similar as possible in terms of wage diversification, which is very low and usually does not exceed 27 percent as measured by the Gini index.

Fig. 11: Results of cluster analysis: sorting of countries into seven clusters using the group average method and Euclidean distance



Source: Own research

The two Non-European countries (Israel and South Korea) and the remaining two Baltic countries (Latvia and Lithuania) represent another group of countries always belonging to the same cluster using any of the five clustering methods. These are countries with a moderately higher degree of wage diversification, where the Gini index is in the range of approximately 34–38 percent. The United States still belongs to this group of countries in four cases of the five clustering methods used. The Gini wage diversification index is slightly higher in the United States than in the other four countries in the group, and it is between about 38–40 percent with slightly decreasing trend. The United States forms a separate cluster using one, the remaining clustering method (the nearest neighbour method).

Of the remaining Non-European countries, Chile is a country with very high wage diversification, which fluctuates just below 47 percent, as measured by the Gini index. This country always forms a separate cluster using any of the five clustering methods. Similarly, Japan always forms a separate cluster using all five clustering methods with a Gini index in the range of approximately 32–35 percent.

Tab. 2: Results of cluster analysis using five different clustering methods, Euclidean distance and seven clusters

Clustering method				
Furthest neighbour	**Nearest neighbour**	**Ward**	**Centroid**	**Group average**
1st cluster	**1st cluster**	**1st cluster**	**1st cluster**	**1st cluster**
1st AUS	1st AUS	1st AUS	1st AUS	1st AUS
2nd CAN	2nd AUT	2nd CAN	2nd CAN	2nd CAN
3rd ESP	3rd BEL	3rd ESP	3rd ESP	3rd ESP

4th EST	4th CAN	4th EST	4th EST	4th EST
5th GBR	5th CHE	5th GBR	5th GBR	5th GBR
6th GRC	6th CZE	6th GRC	6th GRC	6th GRC
7th ITA	7th DEU	7th ITA	7th ITA	7th ITA
8th LUX	8th DNK	8th LUX	8th LUX	8th LUX
9th NZL	9th ESP	9th NZL	9th NZL	9th NZL
10th PRT	10th EST	10th PRT	10th PRT	10th PRT
2nd cluster	11th FIN	**2nd cluster**	**2nd cluster**	**2nd cluster**
1st AUT	12th FRA	1st AUT	1st AUT	1st AUT
2nd BEL	13th GBR	2nd BEL	2nd BEL	2nd BEL
3rd CHE	14th GRC	3rd CHE	3rd CHE	3rd CHE
4th DEU	15th HUN	4th DEU	4th CZE	4th CZE
5th FRA	16th IRL	5th FRA	5th DEU	5th DEU
6th HUN	17th ISL	6th HUN	6th DNK	6th DNK
7th IRL	18th ITA	7th IRL	7th FIN	7th FIN
8th NLD	19th LUX	8th NLD	8th FRA	8th FRA
9th POL	20th NLD	9th POL	9th HUN	9th HUN
10th SWE	21st NOR	10th SWE	10th IRL	10th IRL
3rd cluster	22nd NZL	**3rd cluster**	11th ISL	11th ISL
1st CHL	23rd POL	1st CHL	12th NLD	12th NLD
4th cluster	24th PRT	**4th cluster**	13th NOR	13th NOR
1st CZE	25th SVK	1st CZE	14th POL	14th POL
2nd DNK	26th SVN	2nd DNK	15th SVK	15th SVK
3rd FIN	27th SWE	3rd FIN	16th SVN	16th SVN
4th ISL	**2nd cluster**	4th ISL	17th SWE	17th SWE
5th NOR	1st CHL	5th NOR	**3rd cluster**	**3rd cluster**
6th SVK	**3rd cluster**	6th SVK	1st CHL	1st CHL
7th SVN	1st ISR	7th SVN	**4th cluster**	**4th cluster**
5th cluster	2nd KOR	**5th cluster**	1st ISR	1st ISR
1st ISR	3rd LTU	1st ISR	2nd KOR	2nd KOR
2nd KOR	4th LVA	2nd KOR	3rd LTU	3rd LTU
3rd LTU	**4th cluster**	3rd LTU	4th LVA	4th LVA
4th LVA	1st JPN	4th LVA	5th USA	5th USA
5th USA	**5th cluster**	5th USA	**5th cluster**	**5th cluster**
6th cluster	1st MEX	**6th cluster**	1st JPN	1st JPN
1st JPN	**6th cluster**	1st JPN	**6th cluster**	**6th cluster**
7th cluster	1st TUR	**7th cluster**	2nd MEX	1st MEX
1st MEX	**7th cluster**	1st MEX	**7th cluster**	**7th cluster**
2nd TUR	1st USA	2nd TUR	3rd TUR	1st TUR

Source: Own research

Using the two clustering methods (the farthest neighbour method and Ward method), the remaining two Non-European countries (Mexico and Turkey) form a common cluster, the two countries form separate clusters using the remaining three clustering methods (the nearest neighbour method, centroid method and group average method). Both these countries are characterized by very high wage diversification, Mexico is the country with the second highest wage diversification, the Ginino index is 45–46 percent, and in Turkey, wage

diversification is slightly lower (than in Mexico), at around 39–42 percent measured by the Ginino index.

Conclusion

According to the results obtained, Slovenia, Slovakia and the Czechia show the lowest wage diversification of all OECD member countries. For example, in the Czechia, when comparing one-fifth of the highest-paid employees and one-fifth of the lowest-paid employees, this group of the richest has about 3.5 times more than the group of the poorest. There are several reasons why wages are so balanced in these countries. One of them is the historical heritage from the communist era, when in a non-free environment, the wages of employees were limited and distorted. However, this would not be enough for the first place in the ranking, because other countries have communist experience, too. One of the reasons why wage diversification is so low in these countries is the relatively successful transformation of the economies of these countries. If we look at the opposite end of the scale, we see some Eastern bloc countries where the transformation of the economy after the end of communism was much wild than in the three countries.

Now, we evaluate the defined scientific hypotheses based on the obtained research results:

H1: Proven. The two OECD member countries of Latin America show the highest wage diversification within the OECD member countries in the period 2013–2018. There are Chile and Mexico, the wage diversification expressed by the Gini index does not exceed 47 percent in either of these two countries in that period.

H2: Proven in terms of the Central European post-communist country bloc, with the exception of Poland. The Baltic post-communist countries bloc shows relatively high wage diversification, probably due to quite dramatic demographic effects.

H3: Proven, Chile and Mexico are the only two OECD member countries in Latin America to show the highest level of wage diversification within OECD member countries in 2013–2018 due to the fact that the government does not make any major interventions in the economy here. During this period, the Gini index ranged 45.4–46.7 percent in Chile and 45.3–46.2 percent in Mexico.

H4: Proven in part. Wage diversification in non-European OECD member countries is in the range of 30.7–46.7 percent, which is completely outside the wage diversification of the Scandinavian countries, the Central European post-communist and essentially Western European developed countries. However, the wage diversification of non-European OECD member countries partly overlaps with the Anglo-Saxon countries, the Southern European Countries and the Baltic post-communist countries.

H5: Proven in part. The groups of OECD member countries, always in the same cluster using the above five clustering methods, very roughly correspond to the geographical location, historical development, culture, social systems, and level of advancement of these countries.

In OECD member countries, the average wage increased even during the economic crisis, although the wage demands of many jobseekers decreased, mainly to have a job. Employees performing ancillary work in particular had a difficult situation on the labour market, while the wages of professionals who are key for employers, have risen in recent years. In all developed OECD countries, therefore, the best investment for citizens is spending on education and increasing their own know-how. Professionals in all fields have the best starting position on the labour market. Which is why lifelong learning is a way to secure not only an average and higher wage, but also the easiest way to find a suitable job.

The direct relationship between employees' wages and their purchasing power supports monitoring not only the level of wages, their structure, but also examining the development of wage diversification while monitoring sales opportunities for long-term and short-term consumer products. Therefore, the distribution of employees' wages should be also taken into account by entrepreneurs when considering their sale areas. The estimation of wage distributions based on data on their diversification makes possible to determine approximately the total volume of wage resources in various enterprises. Knowledge of the distribution of employees' wages accompanied by data on their diversification should be also taken into account by politicians at various steps within the state budget, such as at various considerations regarding the level of the tax burden.

In the following research, it is possible to focus on estimates of the future development of wage distributions, which would enable to combine considerations of wage diversification with socio-political considerations, for which it is usually not enough to estimate future wage level developments, but to estimate the future shares of low, medium and high wages, too.

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