Factors of Differences in the Highest Wages of Employees in the Slovak Republic (2020 vs. 2010)

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Abstract

The article offers the results of statistical analysis of data on the highest wages of employees in the Slovak Republic in 2020. Descriptive analysis of sample data is supplemented by generalizing the results to the population of all employees whose salary exceeds the 99th percentile of the sample, by selected methods of statistical inference, which are probability models of the highest wages and analysis of variance. The analysis focuses on assessing the significance of the impact of selected demographic and social factors on the highest salaries of employees in SR in 2020 and their differences. The investigated factors there are gender, level of education, region of residence, the label of occupation, and age category. The article also focuses on inequalities in the number of employees at different levels of the monitored factors. The obtained results of the analysis are compared with the results of similar analysis from 2010.

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The highest wages, factors, descriptive characteristics, probability models, analysis of variance, comparisons	*https://doi.org/10.54694/stat.2022.6*	*C46, D31, D33*

INTRODUCTION

Reliable information on inhabitants' and household' incomes is important in each country for many economic and political reasons. Income data are collected by several sample surveys and the data obtained are analysed by various methods. Often the analysis ends at the level of the sample data without generalizing the findings to the whole population. Because the sample survey

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is always affected by randomness, we have to take the results of analyses of sample data only with considerable caution. Statistical inference methods using statistical software packages provide an effective tool for generalizing information from a sample to a population.

If the subject of the analysis is one random variable, e.g. wages of employees, the best and most comprehensive generalization of information from sample data to population is the probability distribution or density function of the observed variable. This knowledge will allow the calculation of important basic characteristics of the population, quantiles, probabilities of arbitrary intervals of values, etc.

This article provides the results of such a generalization by selected methods of statistical inference in the analysis of the highest wages of employees in the Slovak Republic (SR) in 2020 based on the Labour Information System sample survey, which has been carried out in the SR since 1992 by company Trexima Bratislava. The observed random variable is the average gross monthly wage (*salary_gm*) of employees in the Slovak Republic in 2020.

The starting point for the analysis there is 11 570 anonymized individual values of the variable *salary_gm* and also personal data of those employees in the Slovak Republic whose average gross monthly wage exceeded the 99th percentile equal to 4 863.17 EUR in the sample of all employees in 2020. The entire sample obtained by stratified random sampling covers more than half of the employees in the Slovak Republic (Trexima, 2022). The survey includes payroll and personnel data on employees.

The analysis also deals with the assessment of the impact of five factors on the inequalities in the highest wages in the Slovak Republic. These factors are personal demographic and social features of employees, specifically gender with categories male-female, together with classification variables as the level of education, the region of residence, label of occupation, and the categorized age.

The main goal of the article is to provide an answer to the question "Which demographic and social characteristics are typical for 1% of employees in the Slovak Republic who received the highest wages in 2020?" In order to meet this goal, it will be necessary to verify inequalities in the number of employees and in the level of their wages at different levels of the monitored factors.

The inspiration for the presented analysis in the article was also the publications Pacáková and Foltán (2011), and Pacáková et al. (2012), which have been used to compare the results of the highest wages analyses in 2020 vs. 2010 in the Slovak Republic. Both years are atypical, post-crisis years. The year 2010 followed the start of the global financial crisis, and 2020 was part of a global pandemic crisis over Covid-19.

1 LITERATURE REVIEW

Differentiation of income of private persons or households is a frequent and important topic of economic research. From various points of view, it is the subject of many publications in the world and domestic scientific economic journals. Deepening income polarization is perceived as one of the economic and social threats of the global world. The seriousness of the problem of income distribution and the associated problems of income inequality and poverty in the world is evidenced by the number of scientific publications. Foreign examples include publications Bell and Van Reenen (2013), Ayyash and Sek (2019), and Tomaskovic-Devey et al. (2020), in which attention is paid to the issue of extreme differences in wages. Conversely, the problem of low wages is the subject of publications Ryczkowski and Maksim (2018) or Skinner et al. (2002). The subject of many publications is the gender pay gap: Hara (2018), Artz and Taengnoi (2019), Whitehouse and Smith (2020).

Several works by Slovak and Czech authors are based on a statistical analysis of available data on employees' wages or household income. Because this is often sample data, it is important to generalize the information obtained to a population. Such publications include e.g. publications focused on modelling wage distributions, for example (Bílková, 2012, 2013; Malá, 2013; Bartošová, 2007; Pacáková and Sipková, 2007; Pacáková et al., 2005). The level and differentiation of employees' wages and households' incomes are examined frequently in a broader context.

The paper of Pauhofová and Martinák (2014) explores changes in income stratification of the Slovak population for determination of the possibility for consumption and propensity to save. The paper primarily examines the regional dimension of income stratification, differences in income stratification of residents in urban and rural areas, and differences in the distribution of income between genders. The analysis uses data based on national accounts data from the Slovak Statistical Office, Eurostat data, and administrative data on individual income from Social Insurance Agency in Slovakia.

Regional differentiation and development of wages after 1989 in the Slovak Republic is the topic of article Michálek (2007). The method of decomposition has facilitated the identification of not only deeper causes and implications of regional wage disparities but also their effects and impact in regions under study. The results point was two important facts, considerable regional wage differences, and their continuous deepening.

Analyses in the paper Pauhofová and Želinský (2015) are based on microdata from the Social Insurance Agency in Slovakia. According to the results, the income polarization in Slovakia is deepening and the economic performance of several districts is lowering. This results in extreme barriers for regional consumption at present, as well as the threat of generation of significantly low levels of pensions in the future.

The peculiarities of the development of the income structure in the Slovak economy examine the article Morvay (2013). Changes in the income structure were driven by shifts in the sectoral composition of the economy (e.g. expansion of branches with low wage share), but also by technological progress within sectors and branches (e.g. growth of capital intensity).

The specifics of the gender pay gap in post-socialist countries are dealt with in several articles. Mysíková (2012) quantifies the basic structure of the gender wage gaps in four Central European countries and finds the highest gender wage gap in the Czech Republic by using a dataset for the year 2008. In her study is mostly explained the observed wage gap by the remuneration effect, but is relatively less explained by the endowment effect in all considered countries. Tartaľová and Sovičová (2013) based on income data from EU SILC in the years 2005–2009 by statistical methods verify the gender pay gap in Slovakia in this period.

The aim of the paper Gottvald et al. (2013) is to capture by the wage equations several determinants affecting the level of wages in the Slovak Republic. In this paper analysis of wages determinants are based on data from the survey Information system on labour cost, which is realized by the company Trexima Bratislava.

Several publications focus on the lowest incomes in the context of the examination of poverty, for example Labudová et al. (2010), Malá (2019), Myslíková and Želinský (2019). On the contrary, in the articles Pacáková and Foltán (2011), and Pacáková et al. (2012), special emphasis is placed on the factors determining one percent of the highest wages in the Slovak Republic.

2 DATA AND METHODS

Data from the sample survey Information System on Labour Prices, which has been implemented in the Slovak Republic since 1992 by the company Trexima, were used for the analysis. The starting point for the analysis is 11570 values of the gross monthly wages of employees in the SR (random variable *salary_gm*), which exceeded the 99^{th} percentile of the sample, equal to 4 863.17 EUR in 2020. The entire sample, obtained by stratified random sampling carried out by Trexima, covers more than half of the employees in the Slovak Republic.

Descriptive characteristics of the central tendency (sampling average, median, quartiles), variability (coefficient of variation), and selected percentiles and their visualization using box plots provided clear information about the sample and its subsets.

Sampling is always influenced by randomness, so it is useful to generalize the information from the sample to the population by methods of statistical inference. The best and the most comprehensive

generalization of information from sample data is to find the probability model of the observed variable in the population. His knowledge will allow the calculation of important characteristics of the population, quantiles, probabilities of any intervals of values, etc.

As appropriate probability model for values exceeding the threshold a high enough (variable X_a), even with the existence of extreme values, it is considered to be 2-parameter Pareto distribution with distribution function in the form:

$$F_a(x) = 1 - (\frac{a}{x})^b, \quad x \geq a \tag{1}$$

where b is the shape parameter.

The basic characteristics of this probability model, that are mean, variance, and skewness, and thus the basic characteristics of the population, express the following formulas:

$$E(X) = \frac{ab}{b-1}, \; b > 1, \tag{2}$$

$$D(X) = \frac{a^2 b}{(b-1)^2(b-2)}, \; b > 2, \tag{3}$$

$$\gamma_1 = \frac{2\sqrt{b-2}(b+1)}{\sqrt{b}(b-3)}, \; b > 3. \tag{4}$$

Selected goodness-of-fit tests run to determine whether the variable X_a - *salary_gm* can be adequately modelled by a 2-parameter Pareto distribution.

Kolmogorov-Smirnov test (*K-S test*) compares the empirical cumulative distribution of the data $Fn(x)$ to the fitted cumulative distribution $F(x)$. The test statistic is given by the formula:

$$d_n = \sup_x |F_n(x) - F(x)|. \tag{5}$$

Cramer-Von Mises W^2 and *Watson* U^2 tests compare the empirical distribution function to the fitted CDF in different ways (see Pacáková et al., 2015). Since the smallest p-value amongst the tests performed is greater than 0.05, we cannot reject the idea that *salary_qm* comes from a 2-parameter Pareto distribution with 95% confidence.

The method analysis of *variance* for *salary_gm* has been used to compare the mean values of *salary_gm* for the different levels of monitored factors (gender, education, region, occupation, age category). The F-test verifies whether there are any significant differences amongst the means. If there are, the multiple range tests will tell which means are significantly different from which others. Especially for the existence of extreme values of the variable *salary_qm*, the conditions of this method are not met so it is convenient to choose the Kruskal-Wallis test which compares medians instead of means.

The *Kruskal-Wallis test* performs the null hypothesis that the medians of *salary_gm* within each of the levels of monitored factors are the same. The data from all the levels of factor is first combined and ranked from smallest to largest value. The average rank is then computed for the data at each level. Since the p-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. The various plots can help to present the results of the comparison of the means (more detailed interpretation e.g. in Labudová et al., 2021).

3 RESULTS AND DISCUSSIONS

3.1 Comparison of the basic characteristics and distributions of variable *salary_gm*

We will start the analysis with calculate the basic descriptive statistics of gross monthly wages higher than the 99th percentile in the sample (variable *salary_gm*). Table 1 includes measures of central tendency, variability, and shape for *salary_gm* in the year 2020 and their comparison with the same characteristics in 2010.

Table 1 Comparison of the basic characteristics of *salary_gm* in 2010 and 2020

Year	Count	Average	Median	Coefficient of variation	Minimum	Maximum	Lower quartile	Upper quartile
2010	9 900	6 109.57	4 662.10	88.65 %	3 434.86	165 970	3 915.86	6 387.11
2020	11 570	7 726.92	6 193.77	78.86 %	4 863.17	218 333	5 366.60	8 061.09
Diff. Δ	–	1 617.35	1 531.67	–9.79 %	1 428.31	52 363	1 450.74	1 673.98

Source: Own calculation, output from Statgraphics Centurion

In the sample of 11 570 employees in the Slovak Republic with 1% of the highest gross monthly wages (above 4 863.17 EUR) in 2020. The average gross monthly wage was 7 726.92 EUR. Half of the employees had a lower wage and half higher than the median equal to 6 193.77 EUR and the gross monthly salary of a quarter of these employees exceeded 8 061.09 EUR. With a maximum salary of 218 333 EUR. The existence of extreme values in the set of the highest wages is also confirmed by the high value of the coefficient of variation (CV) of 78.86%.

The minimum value of wages exceeding the upper percentile increased in 2020 to 4 863.17 EUR, which is 1 428.31 EUR more than in 2010. The average value of 1% of the highest wages increased by 1 617.35 EUR compared to 2010. The increase was recorded in all characteristics except for the coefficient of variation, which indicates a lower variability in 2020 compared to 2010. The values of all percentiles also increased by the value of difference Δ (Table 2).

Table 2 Comparison of percentiles of *salary_gm* in 2010 and 2020

Year	1%	10%	25%	50%	75%	90%	99%	Upper quartile
2010	3 451.24	3 610.59	3 915.86	4 662.10	6 387.11	9 226.49	26 536.4	6 387.11
2020	4 879.13	5 044.07	5 366.60	6 193.77	8 061.09	11 252.90	27 350.1	8 061.09
Diff. Δ	1 427.89	1 433.48	1 450.74	1 531.67	1 673.98	2 026.41	813.7	1 673.98

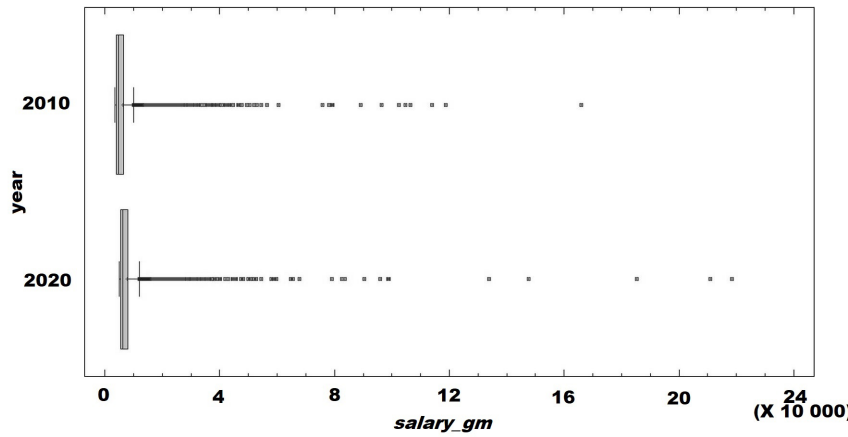
Source: Own calculation, output from Statgraphics Centurion

A graphic view of the basic characteristics of the values of gross monthly wages above the 99th percentile in 2010 and 2020 and their comparison is provided by the box plot in Figure 1.

Information from the sample has been generalized to the set of all employees in the Slovak Republic in 2020, whose *salary_gm* exceeded the value of 4 863.17 EUR. By applying goodness-of-fit tests. Table 3 shows the results of tests run to determine whether *salary_gm* can be adequately modelled by a 2-parameter Pareto distribution (1) with lower threshold a = 4 863.17 EUR and estimated shape parameter b = 2.75362.

Since the smallest p-value amongst the tests performed is greater than or equal to 0.05, we cannot reject the hypothesis that sample data of variable *salary_gm* comes from a 2-parameter Pareto distribution with 95% confidence. Figure 2 shows visually how adequately the 2-parameter Pareto distribution fits the data.

Figure 1 Box plots of gross monthly wages above the 99th percentile in 2010 and 2020



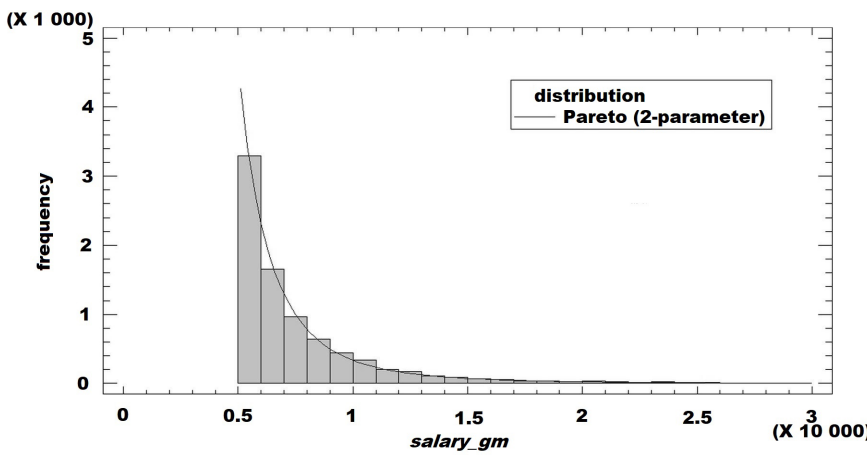
Source: Ma and Hellerstein (1999)

Table 3 The results of goodness-of-fit tests for *salary_gm*

	Pareto (2-parameter)		Pareto (2-parameter)
W^2	0.0000072044	**U^2**	–2 892.5
Modified form	–0.0000273656	**Modified form**	–2 892.7
P-Value	> = 0.10	**P-Value**	> = 0.10

Source: Output from Statgraphics Centurion

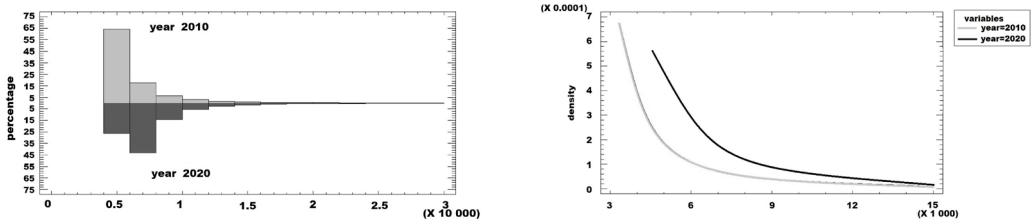
Figure 2 Graphical verification of good fit with 2-parameter Pareto distribution



Source: Output from Statgraphics Centurion

Because the Pareto distribution with lower threshold a = 3 434.86 and shape parameter b = 2.26487 was found as a suitable probability model for *salary_gm*. Exceeding the 99th percentile in 2010, we can visually compare the distribution of *salary_gm* in 2010 and 2020 (Figure 3).

Figure 3 Comparison of histograms and density functions of *salary_gm* in 2010 and 2020



Source: Output from Statgraphics Centurion

3.2 Factors of inequalities in the highest gross monthly wages

We will further focus on the assessment of factors of *gender, education, region of residence, employment classification* and *age category* for the wages of workers with salaries exceeding the 99th percentile in 2020. Table 4 contains the values of basic characteristics of *salary_gm* for men and women. They are all higher for men than for women and there is a difference in the last row of the table. The fact that among the best-earning employees is about 6 398, respectively 3.47 times more men than women indicate significant gender inequality. Also shift to lower-wage values for women is evident from the box plots in Figure 4.

Table 4 Comparison of descriptive statistics of *salary_gm* by gender in 2020

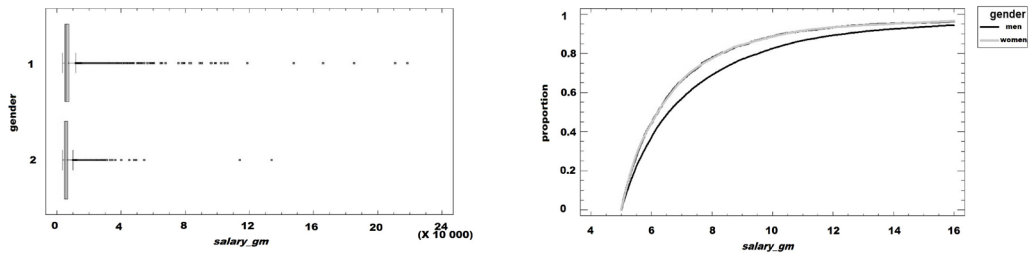
Gender	Count	Count (%)	Average	Median	Coeff. of variation	Minimum	Maximum	Lower quartile	Upper quartile
1-men	8 984	78%	7 908.38	6 260.61	82.19%	4 863.17	218 333	5 397.69	8 282.49
2-women	2 586	22%	7 096.53	5 979.41	61.13%	4 863.33	133 909	5 269.46	7 426.61
Diff.	6 398	56%	811.85	281.20	21.06	0	84 424	128.23	855.88

Source: Own calculation, output from Statgraphics Centurion

Kolmogorov-Smirnov tests (K-S tests) have been used to check up whether the 2-parameter Pareto distribution fits adequately the data of *salary_gm* for men and women. Since the smallest p-value = 0.696624 is higher than 0.05, we cannot reject the idea that *salary_gm* of men with 95% confidence comes from a 2-parameter Pareto distribution with an estimated lower threshold 4 863.17 and shape parameter 2.63536. In the same way has been verified by K-S test suitability of the 2-parameter Pareto distribution with estimated lower threshold 4 863.33 and shape parameter 3.26251 as probability model of *salary_gm* of women. The distribution functions of both fitted distribution models presents Figure 4, according to which for each value of *salary_gm* the probability of lower values is higher for women than for men.

Knowledge of the probability distribution can be used to calculate the mean (2), variance (3) and skewness (4) and compare some percentiles of gross monthly wages of employees, men and women, whose wages are higher than the 99th percentile of the sample. By calculating according to relation (2) we obtained the mean value of *salary_gm* of men equal to 7 836.93 EUR and of women equal to 7 012.859 EUR.

Figure 4 Box plots of the highest monthly wages by gender



Source: Output from Statgraphics Centurion

Both mean values increased significantly compared to 2010, the mean of men's wages by 1 406.08 EUR and the mean of women's wages by 1 542.66 EUR. The calculation of the variance according to (3) made it possible to compare the variability in the highest wages of men and women in 2020 using coefficients of variation with values of 77.3% for men and 49.3% for women. Because the shape parameter $b = 2.63536$ for men is less than 3, it is not possible to calculate the skewness γ_1 according to (4). For women the value of the skewness γ_1 is equal to 20.2, so the wages' distribution of women is strongly right-hand side, low wage values predominate. A comparison of selected percentiles by gender in 2020 in SR contains Table 5.

Table 5 Comparison of selected percentiles x_p of *salary_gm* (in EUR) by gender in 2020

CDF = p	Men	Women
0.10	5 061.54	5 022.95
0.25	5 424.10	5 311.64
0.50	6 326.26	6 014.55
0.75	8 229.51	7 438.28
0.90	11 651.30	9 850.23

Source: Own calculation, output from Statgraphics Centurion

The percentiles x_p have been found as critical values for the Pareto (2-parameter) model. The critical value x_p is defined as the value for the Pareto (2-parameter) such that Probability ($salary\_gm \leq x_p$) = $CDF = p$.

The *education factor* has 11 monitored levels: 0 – unspecified, 1 – basic, 2 – apprenticeship, 3 – secondary without GCSE, 4 – apprentices with graduation, 5 – complete secondary general, 6 – complete secondary vocational, 7 – higher professional, 8 – undergraduate 1st degree, 9 – undergraduate 2nd degree, 10 – undergraduate 3rd degree (at least PhD). The basic selection characteristics, as well as the percentage of employees with different levels of education, are shown in Table 6.

The most numerous group among the best-earning employees in the Slovak Republic in 2020 was the group 9 – undergraduate 2nd degree. However, the average wage in this group of employees in the population is significantly lower than in the groups of employees at levels 5 – complete secondary general and level 7 – higher professional (Figure 5).

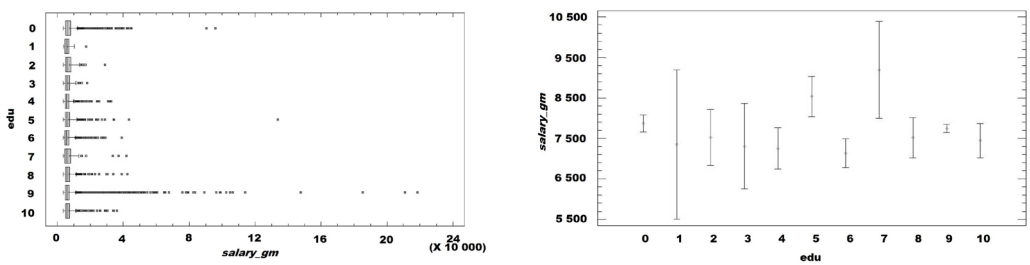
The significance of differences in the gross monthly wages of employees with a gross monthly wage above the 99th percentile in the Slovak Republic in 2020 is also caused by a factor the *employee's region*

Table 6 Descriptive statistics of the highest wages (*salary_gm*) by the level of education

Level of education	Count	Count (%)	Average	Median	Coeff. of variation (%)	Maximum	Lower quartile	Upper quartile
0	1 622	14%	7 864.55	6 336.90	65.58	95 825.5	5 434.34	8 428.14
1	21	0%	7 352.98	6 527.16	38.41	17 469.5	5 669.77	8 193.62
2	149	1%	7 523.70	6 280.06	44.27	31 223.5	5 400.79	8 731.85
3	64	1%	7 306.83	6 539.25	36.32	18 023.9	5 466.02	7 897.03
4	278	2%	7 252.61	6 019.33	53.30	32 527.6	5 259.63	7 459.20
5	286	2%	8 539.19	6 320.66	102.73	133 909.0	5 436.11	8 729.73
6	543	5%	7 133.60	6 186.15	39.91	28 476.4	5 365.06	7 987.72
7	50	0%	9 190.83	6 641.27	83.44	41 932.8	5 675.97	9 472.03
8	282	2%	7 517.94	6 260.56	51.29	42 448.6	5 478.61	8 204.68
9	7 875	68%	7 747.56	6 164.54	84.73	218 333.0	5 350.49	8 002.53
10	400	3%	7 443.83	6 053.48	55.04	34 006.0	5 266.20	7 783.14
Total	11 570	100%	7 726.92	6 193.77	78.86	218 333.0	5 366.60	8 061.09

Source: Own calculation, output from Statgraphics Centurion

Figure 5 Box plots and 95% intervals for means of *salary_gm* by level of education in 2020 in SR



Source: Output from Statgraphics Centurion

of residence. In the sample gross wages above the upper percentile are most often in the Bratislava region (61.7%) and the lowest representation there are in the Prešov (3.0%) and Banská Bystrica (4.1%) regions. In other regions the percentage of employees with a gross monthly wage above the upper percentile is approximately equal. More detailed information is provided in Table 7 and Figure 6.

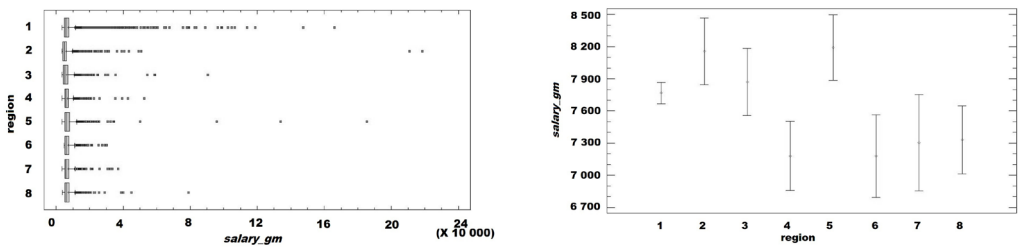
Significant variability in the amount of 1% of the highest gross monthly wages (*salary_gm*) in the regions of the Slovak Republic in 2020 is in the values beyond their upper quartile. From the box plot in Figure 7 it is clear that wages under the third quartile do not differ much, but there is great variability in a quarter of the highest values of *salary_gm* and the occurrence of extreme wages is highest in the Bratislava, Trnava and Žilina regions. The mean wages are the highest in the regions 2 – Trnava and 5 – Žilina, and in regions 4 – Nitra, 6 – Banská Bystrica, 7 – Prešov and 8 – Košice the mean wages are significantly lower than in regions 1 – Bratislava, 2 – Trnava, 3 – Trenčín and 5 – Žilina (Figure 6).

Table 7 Descriptive statistics of the highest wages (*salary_gm*) by region of residence

Region	Count	Count (%)	Average	Median	Coeff. of variation (%)	Maximum	Lower quartile	Upper quartile
1-Bratislava	7 134	62%	7 767.50	6 246.45	68.06	147 603.0	5 397.65	8 111.65
2-Trnava	735	6%	8 156.95	6 303.30	140.38	218 333.0	5 382.29	8 203.49
3-Trenčín	719	6%	7 870.23	6 177.00	79.12	90 367.6	5 335.46	8 381.28
4-Nitra	680	6%	7 179.99	5 926.10	54.62	52 568.8	5 282.19	7 479.06
5-Žilina	766	7%	8 191.20	6 201.74	115.86	185 375.0	5 354.81	8 257.49
6-B. Bystrica	478	4%	7 178.59	6 070.28	45.51	30 161.8	5 307.47	7 669.54
7-Prešov	351	3%	7 303.20	5 823.48	57.38	36 994.7	5 224.60	7 698.25
8-Košice	707	6%	7 328.78	6 110.37	62.26	79 040.2	5 265.73	7 825.19
Total	11 570	100%	7 726.92	6 193.77	78.86	218 333.0	5 366.60	8 061.09

Source: Own calculation, output from Statgraphics Centurion

Figure 6 Box plots and 95% intervals for means of *salary_gm* by region of residence in 2020



Source: Output from Statgraphics Centurion

Another important factor that affects the amount of gross monthly earnings, exceeding the upper percentile in Slovakia in 2020 was followed by a factor Classification of Occupations (isco1). Table 8 contains basic descriptive statistics for the values of *salary_gm*, corresponding to each of the 9 levels of this factor.

The most numerous groups in the sample there are the group 1 – Legislators, executives, up to 53.36 %, then the group 2 – Specialists (25.12 %) and more numerous is the group 3 – Technical and professionals (4.8%). Representation of categories 4 – Administrative staff, 5 – Service and trade workers, 7 – Skilled workers and craftsmen and 8 – Operators and fitters of machinery and equipment is less than 1%, while the gross wage of no employee with the classification 6 – Skilled workers in agriculture, forestry and fishing and 9 – Auxiliary and unskilled workers did not exceed the upper percentile of *salary_gm* in the Slovak Republic in 2020, just like in 2010. Category 0 – Unspecified employment included 14.77% of workers with a high average wage, even with several extreme wage values. The highest values of all descriptive characteristics in Table 8 there are concentrated for the values of *salary_gm* in category 1. These facts are also confirmed by plots in Figure 7. The mean wages in categories 0 – Unspecified employment and 1 – Legislators, executives are significantly higher compared to all other categories.

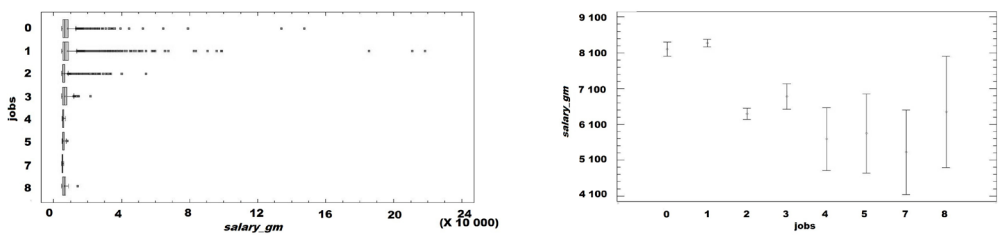
Significant differences in the numerical representation, as well as in the level of gross monthly wages, were also found in different age categories of employees of the monitored sample, as shown Table 9 and Figure 8.

Table 8 Descriptive statistics of the *salary_gm* by classification of occupations in 2020 in SR

Isco1	Count	Count (%)	Average	Median	Coeff. of variation (%)	Maximum	Lower quartile	Upper quartile
0	1 708	14.8%	8 199.94	6 444.50	83.01	147 603.00	5 468.65	8 556.92
1	6 174	53.4%	8 371.35	6 633.65	85.62	218 333.00	5 533.81	8 830.59
2	2 906	25.1%	6 396.57	5 631.29	42.26	54 440.50	5 158.63	6 504.82
3	556	4.8%	6 877.63	6 196.12	30.83	21 888.90	5 257.63	7 919.67
4	90	0.8%	5 687.10	5 610.62	10.25	6 990.02	5 147.92	6 117.91
5	57	0.5%	5 844.88	5 527.36	15.43	7 972.95	5 162.44	6 193.52
7	50	0.4%	5 318.98	5 224.72	6.21	5 960.94	5 065.38	5 636.65
8	29	0.3%	6 446.42	6 169.63	27.90	14 159.70	5 163.16	6 976.44
Total	11 570	100%	7 726.92	6 193.77	78.86	218 333.0	5 366.60	8 061.09

Source: Own calculation, output from Statgraphics Centurion

Figure 7 Box plots and 95% interval for means of *salary_gm* by classification of occupations in 2020 in SR



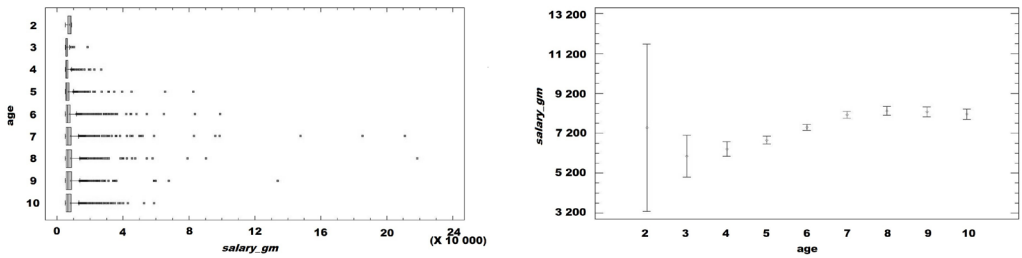
Source: Output from Statgraphics Centurion

Table 9 Descriptive statistics of the *salary_gm* by age category in 2020

Age category and interval	Count	Count (%)	Average	Median	Coeff. of variation (%)	Maximum	Lower quartile	Upper quartile
2: 20–24	4	0.03%	7 479.42	8 036.37	22.65	8 835.89	6 444.09	8 514.75
3: 25–29	64	0.55%	6 056.20	5 355.80	33.02	18 579.50	5 119.66	6 250.33
4: 30–34	522	4.51%	6 404.95	5 691.15	36.43	26 715.20	5 167.97	6 577.12
5: 35–39	1 767	15.27%	6 854.78	5 936.45	52.27	82 539.10	5 296.14	7 177.98
6: 40–44	2 979	25.75%	7 499.79	6 131.90	62.15	98 932.90	5 362.97	7 887.90
7: 45–49	2 579	22.29%	8 133.09	6 394.08	98.04	210 882.00	5 415.34	8 502.64
8: 50–54	1 550	13.40%	8 324.13	6 463.78	93.09	218 333.00	5 459.65	8 833.56
9: 55–59	1 073	9.27%	8 277.69	6 463.77	80.04	133 909.00	5 415.20	8 709.49
10: 60 and over	1 032	8.92%	8 164.50	6 393.39	67.15	58 811.30	5 424.33	8 559.19
Total	11 570	100%	7 726.92	6 193.77	78.86	218 333.00	5 366.60	8 061.09

Source: Own calculation, output from Statgraphics Centurion

Figure 8 Box plots and 95% interval for means of *salary_gm* by age category in 2020 in SR



Source: Output from Statgraphics Centurion

CONCLUSION

The results of the analysis in the article show that each factor whose impact on the level of the highest wages we examined significantly affects the wage differentiation of workers with wages above the 99th percentile in the Slovak Republic in 2020. Each monitored factor also causes large inequalities in the number of employees according to the levels of these factors.

The article includes also an assessment of changes in the highest wages of employees in the Slovak Republic in the time period from 2010 to 2020. The results in Section 2.1 show that over the course of ten years, the distribution of wages above the upper percentile of employees in the Slovak Republic has shifted by less than 1 500 EUR, but the shape of the probability distribution has hardly changed. This is absolutely clearly confirmed by the probability densities of the Pareto distributions for both years 2010 and 2020 in Figure 3. Knowledge of these distributions and their parameters allows to calculate and to compare the means $E(X)$ (by Formula 2) and the variances $D(X)$ (by Formula 3) of the one percent the highest wages of employees in the Slovak Republic in 2010 and 2020.

The mean of the highest wages increased from 6 150.44 EUR in 2010 to 7 636.39 EUR in 2020, which represents an average annual growth of 2.19%. For comparison, the average monthly wage of an employee in the Slovak economy increased from the value of EUR 769 in 2010 to EUR 1 133 in 2020, i.e. by an average of 3.95% per year. With annual average inflation of 1.63% over this period, this average wage growth is very modest (ŠÚ SR, 2022). The mean wage of 1% of the best earning employees is eight times the average wage in the SR in 2010 and the 6.74 times the average wage in the SR in 2020. Unfortunately, this applies to only 1% of employees.

On the contrary, variability of the highest wages decreased during the period from 2010 to 2020. The value of the coefficient of variation decreased from 129.1% in 2010 to 69.4% in 2020. Because the values of the shape parameters b of the Pareto distributions were less than the value 3 in both years, it was not possible to calculate and compare the skewness according to Formula (4) for these years.

The analysis of the highest wages in the crisis years of 2010 and 2020 in the Slovak Republic discovers the level of these wages and specified the groups of employees earned them.

The article may be inspiring for researchers focusing on the same issues for further research in this area.

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