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Sectors on the Czech Labour Market

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Abstract

This paper deals with the situation on the Czech labour market from the point of view of the sectors, namely Agriculture and Mining Sector, Manufacturing Industry, Energy, Construction Sector, Service Sector Requiring Mostly Personal Contact, Service Sector Rather without Personal Contact and Service Sector Usually Provided by the Public Sector. Wages and salaries together constitute the investigated variable. The main aim is not only to capture the wage and salary level in individual sectors, but an equally important objective is the construction of models of the entire distribution of wages and salaries in individual sectors. Special attention is paid to employees of individual sectors, separated into men and women, whose remuneration for work is at the level of the minimum wage. An important aim is to determine the most frequent occupations of the CZ-ISCO classification in individual distinguished sectors, while this classification codes are considered for the first three digits. Important attention is paid to the representation of foreign nationals in the position of employees in individual sectors, separated into men and women. Three-parametric lognormal curves are used in the construction of wage and salary distribution models. The amount of the minimum gross monthly wage valid on January 1 of the previous year represented the beginning of the curves, the other two parameters were estimated using the maximum likelihood method. Accuracy of lognormal curves is evaluated using Akaike and Bayes information criterion. The results show that the highest levels of wages and salaries are mainly achieved by men in the Service Sector Rather without Personal Contact. In all five monitored sectors, the level of wages and salaries of women is lower than the level of wages and salaries of men. The overall distribution of women's wages and salaries is more skewed, with higher skewness, but with lower level and variability compared to the overall distribution of men's wages and salaries.

Keywords

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I. Introduction

The topic of wages and salaries of the population is a timeless topic that is being addressed by researchers in the field of economics all over the world. Study Alhawarin and Kreishan (2017) deals with the characteristics of wage and salary workers earning below the minimum wage in the private sector in Jordan, using descriptive methods and logistic regression in data analysis. An article by Gibelman (2000) provides an information on the results of an exploratory study of a cross-section of non-profit human service organizations that examined whether and to what extent there is a glass ceiling for women in the sector, finding that men are disproportionately represented in management, particularly in senior management, and earn higher salaries than women at all hierarchical levels of the organization. Researcher Glassner (2010) provides an overview of recent developments in pay, employment and public sector wage reforms and argues that the re-introduction of collective bargaining as a public sector wage settlement mechanism is vital to avoid downward pressures on wages, sustain workers' purchasing power and contributed to stable and balanced economic development within the eurozone throughout the business cycle. Quadrini and Trigari (2007) study adds public sector of employment to the basic search and matching model to study the business cycle impact of public sector of wage and employment policies and finds that the presence of the public sector increases the volatility of employment and output. The main objective of Tansel's (2005) article is to investigate the factors that explain job choice and wage differentials in public administration, state-owned enterprises and the formal private wage sector in Turkey. The private return to schooling is found to be lower in a non-competitive public rather than in a competitive private sector. Paper Wei (2000) offers a new interpretation of the link between openness and good governance, finding that naturally more open economies exhibit less corruption even after accounting for their level of development. Zissimopoulos and Karoly (2010) examine the short-term and long-term effects of Hurricane Katrina on the labour market outcomes of individuals of prime age in the most affected states: Alabama, Florida, Louisiana, and Mississippi. The authors point out that this aggregate pattern of labour market shock and recovery has been observed in other disasters, but it obscures important differences between subgroups. This paper deals with the issue of wages and salaries of employees in the Czech Republic from the point of view of the sectors on the labour market. The labour market was examined in terms of the division into the following sectors: Agriculture and Mining Sector, Manufacturing Industry, Energy, Construction Sector, Service Sector Requiring Mostly Personal Contact, Service Sector Rather without Personal Contact and Service Sector Usually Provided by the Public Sector.

A number of scientific publications also deal with current problems on the labour market from the point of view of sectors or address the gender issue. Salaris and Tedesco (2020) research examines the main features and implications of the Italian care workforce. The analyzes are based on data from the Italian "Rilevazione continua sulle forze lavoro" or "Labour Force Survey" for the last ten years (2007–2016). The results show that the number of workers in the care sector in Italy is growing, the results also reveal that these positions were filled almost exclusively by Ukrainian women who immigrated. However, despite this

group's high employment rate, they are highly segregated, both vertically and horizontally, and experience integration difficulties and a mismatch between work education.

Card, Lemieux and Riddell (2020) examine the relationship between unionization and wage inequality in Canada and the United States of America. The authors note that historically, unionized employment has been concentrated among low-skilled men in private sector industries, but with the steady decline of private sector unions and increasing influence in the public sector, half of unionized workers are now in the public sector. These changes have been accompanied by a remarkable increase in the proportion of women among unionized workers, and women now make up approximately half of the unionized workforce in North America. The authors reveal that in both countries there are significant differences between the private and public sectors in the effects of union organization on wage inequality, and that the effects of unions on wage inequality are more pronounced in the public sector, and that from a perspective disaggregated by sector, the effects of unions on wage inequality for men and women are no different.

Segregation, gender stereotypes and environmental factors aimed at promoting the access of women in the profession of information and communication technologies in Spain are the subject of research in a study by Segovia-Pérez and Castro Núñez (2020), which aims to analyze the gender pay gap and discrimination in information and communication technology professions. The results show that female professionals in the information and communication technologies face unfavorable working conditions, especially in highly skilled jobs and sectors demanding intensive information and communication technologies. The issue of whether robotization could worsen the gender pay gap is addressed by the trio of authors Aksoy, Özcan and Philipp (2021), who present extensive evidence on the impact of industrial robots on the gender pay gap using data from 20 European countries. The study shows that robot adoption increases the earnings of both men and women, but also increases the gender pay gap, so that a 10 percent increase in robotization leads to a 1.8 percent increase in the gender pay gap. They explain these results by saying that men in middle- and high-skilled occupations benefit disproportionately from robotization through the productivity effect.

A study by Desai, Deshmukh and Pramanik (2021) examines whether the effects of lockdowns in response to the COVID-19 crisis on employment in areas around Delhi differed by gender. The authors used estimates based on random-effects logistic regression models following the employment survey between March 2019 and May 2020. The authors found that the predicted probability of employment fell from 0.88 to 0.57 for men and from 0.34 to 0.22 for women and that women's concentration on self-employment may be one of the reasons why their employment was somewhat protected.

The main purpose of this study is to capture not only the level of wages and salaries in individual sectors, separated into men and women, but also to model the entire distribution of wages and salaries within individual sectors, again separated into men and women. The basis of wage and salary distribution models are three-parameter lognormal curves, the beginning point of which is the gross monthly minimum wage in previous year, and the maximum likelihood method was used to estimate the remaining two parameters of this curves. Accuracy of lognormal curves was evaluated using Akaike and Bayes

information criterion. An important aim is the calculation of the percentage of employees receiving a wage or salary at the minimum wage level, again broken down by gender. In this study, the minimum wage area band represents an interval whose lower limit is the gross monthly minimum wage in 2020 (CZK 14,600) and the upper limit is 1.1 times the gross monthly minimum wage in 2020 (CZK 16,060). An important objective is to specify the most frequent occupations of the CZ-ISCO classification within the individual sectors (in differentiation to the first three digits of the CZ-ISCO classification) and further to determine the foreign nationalities (outside the Czechia) the most frequently appearing in the position of employees on the Czech labour market.

The data consist of both private sphere wages and public sphere salaries combined for 2018–2020. The analysis results from data on employee wages and salaries provided by the Ministry of Labour and Social Affairs of the Czech Republic, for which this data set is collected by Trexima.

II.   Theory and Methodology

The random variable X has a three-parameter lognormal distribution with parameters μ, σ^2 and θ, where $-\infty < \mu < \infty$, $\sigma^2 > 0$, $-\infty < \theta < \infty$, if its probability density function has the form:

$$f(x; \mu, \sigma^2, \theta) = \frac{1}{\sigma \cdot (x - \theta) \cdot \sqrt{2\pi}} \cdot \exp\left[-\frac{[\ln(x - \theta) - \mu]^2}{2\sigma^2}\right], \quad x > \theta, \qquad (1)$$
$$= 0, \qquad \qquad \qquad \text{else.}$$

The probability density function of the three-parameter lognormal distribution is asymmetric, positively skewed. The parameter θ is the minimum of the three-parameter lognormal curve, the expression $\exp(\mu)$ is the distance of the wage median or salary median from this theoretical minimum. The parameters μ and σ^2 represent the expected value and variance of the logarithms of wage or salary distances from the theoretical minimum θ.

Let a random semple of the range n comes from a three-parameter lognormal distribution with probability density function (1). The maximum likelihood function then has the form:

$$L(\boldsymbol{x}; \mu, \sigma^2, \theta) = \Pi_{i=1}^n f(x_i; \mu, \sigma^2, \theta) = \qquad (2)$$
$$= \frac{1}{(\sigma^2)^{n/2} \cdot (2\pi)^{n/2} \cdot \Pi_{i=1}^n (x_i - \theta)} \cdot \exp\left\{\sum_{i=1}^n -\frac{[\ln(x_i - \theta) - \mu]^2}{2\sigma^2}\right\}.$$

We set the first partial derivatives of the logarithm of the maximum likelihood function according to μ and according to σ^2 equal to zero. After adjustment, we obtain the maximum likelihood estimates of the parameters μ and σ^2 for the given parameter θ (estimated by minimum wage in 2020).

$$\hat{\mu}(\theta) = \frac{\sum_{i=1}^{n} \ln(x_i - \theta)}{n}, \tag{3}$$

$$\hat{\sigma}^2(\theta) = \frac{\sum_{i=1}^{n} \left[\ln(x_i - \theta) - \hat{\mu}(\theta)\right]^2}{n}. \tag{4}$$

III. Results

Figure 1 represents the average and median wages and salaries of men and women within each differentiated sector in 2020. This figure shows the higher level of wages and salaries of men compared to women within all five differentiated industries, especially in the case of average wage and salary in the Service Sector Rather without Personal Contact. In this sector, especially men achieve a significantly higher wage and salary levels compared to other sectors.

Figure 1: Average and median wages and salaries of men and women in 2020
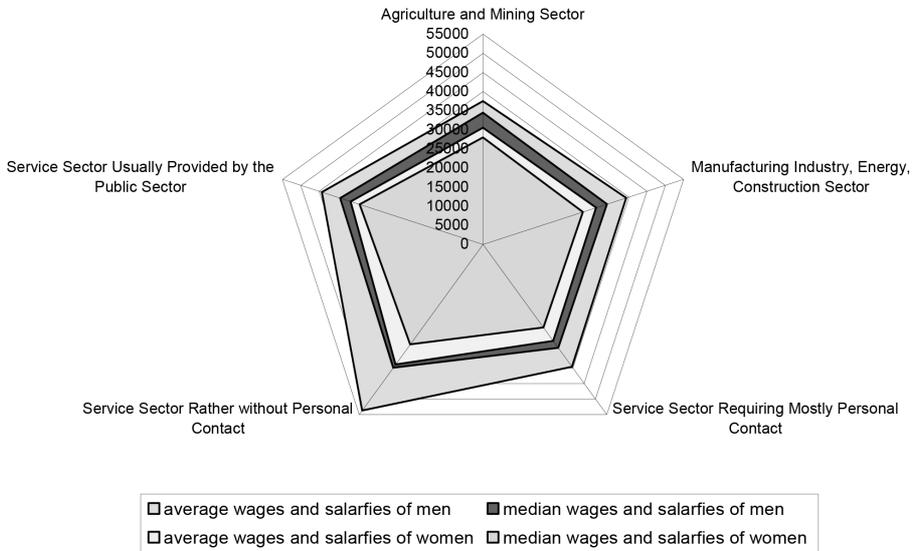
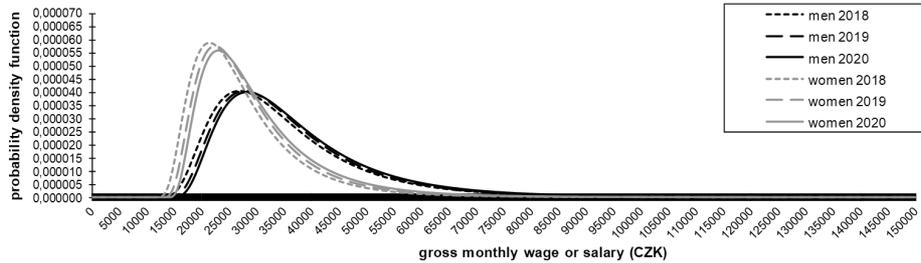*Source: Own calculation, own construction*

Figures 2–6 represent the development of the entire distribution of wages and salaries of men and women in the Czech Republic in the period 2018–2020. Figures 2–6 clearly show that women's wage and salary distributions are significantly more skewed with higher kurtosis and with a clearly lower level and variability compared to men's wage and salary distributions in all five sectors.

Figure 2: Development of wage and salary distribution models for men and women in the period before the coronavirus crisis (2018–2019) and in the first year of the coronavirus crisis (2020) within the Agriculture and Mining Sector
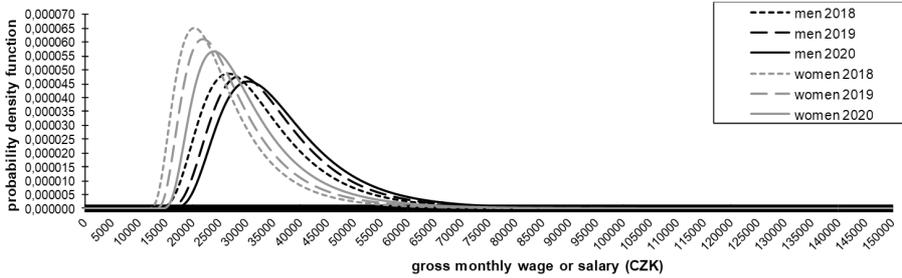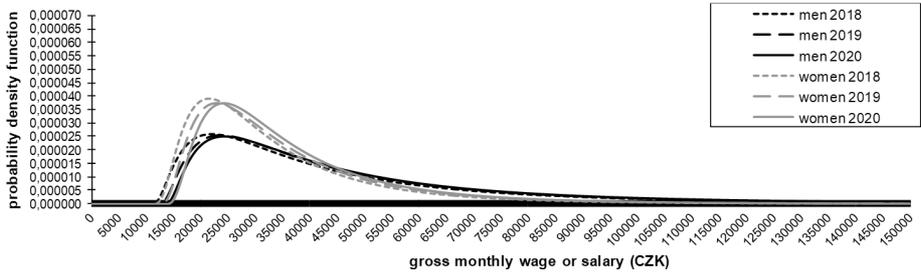

Source: Own calculation, own construction

Figure 3: Development of wage and salary distribution models for men and women in the period before the coronavirus crisis (2018–2019) and in the first year of the coronavirus crisis (2020) within the Manufacturing Industry, Energy, Construction Sector

Source: Own calculation, own construction

Figure 4: Development of wage and salary distribution models for men and women in the period before the coronavirus crisis (2018–2019) and in the first year of the coronavirus crisis (2020) within the Service Sector Requiring Mostly Personal Contact
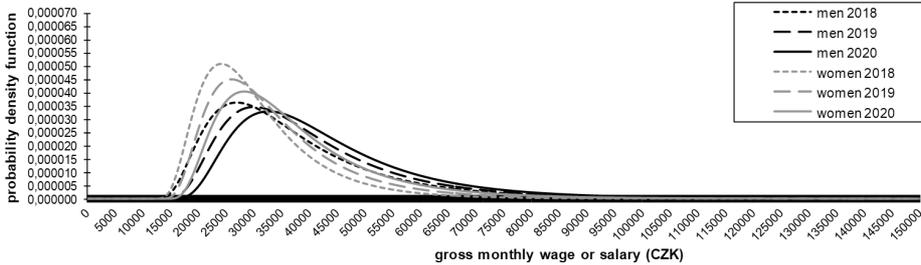

Source: Own calculation, own construction

Figure 5: Development of wage and salary distribution models for men and women in the period before the coronavirus crisis (2018–2019) and in the first year of the coronavirus crisis (2020) within the Service Sector Rather without Personal Contact

Source: Own calculation, own construction

Figure 6: Development of wage and salary distribution models for men and women in the period before the coronavirus crisis (2018–2019) and in the first year of the coronavirus crisis (2020) within the Service Sector Usually Provided by the Public Sector
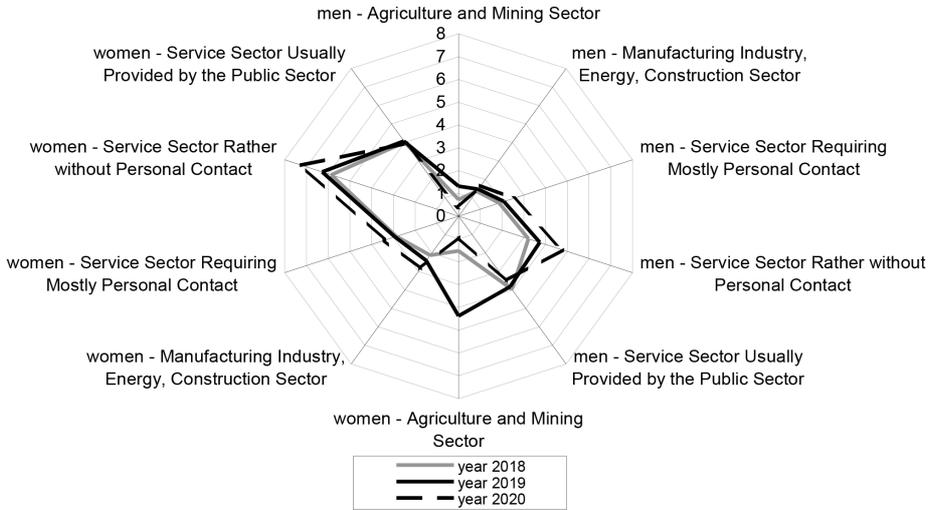

Source: Own calculation, own construction

We observe the wage and salary distributions of men and women with significantly lower skewness and kurtosis in the case of Service Sector Rather without Personal Contact, where, especially in the case of men, the higher level and variability of these distributions are evident in the entire monitored period of 2018–2020. It is also evident from these figures that the skewness and kurtosis of the wage salary distributions of men and women tend to decrease over time, while their level and variability, on the contrary, tend to increase.

Figure 7 offers an overview regarding the percentage proportions of employees receiving wages or salaries at the minimum wage level in 2018–2020, separated into men and women. Figure 7 shows a significantly higher percentage proportions of women receiving wages and salaries at the minimum wage level in the Service Sector Rather without Personal Contact in 2018–2020 both compared to men in this sector and compared to men and women in other sectors. This figure also shows significantly lower percentage proportions of men and women receiving wages and salaries at the minimum wage level in the Agriculture and Mining Sector in 2018–2020, with the exception of women in 2019, where this percentage proportion is significantly higher.

Figure 7: Percentage proportions of employees with wages or salaries at the minimum wage level (in the interval from the gross monthly minimum wage in 2020 to 1.1 times the gross monthly minimum wage in this year) in 2018–2020

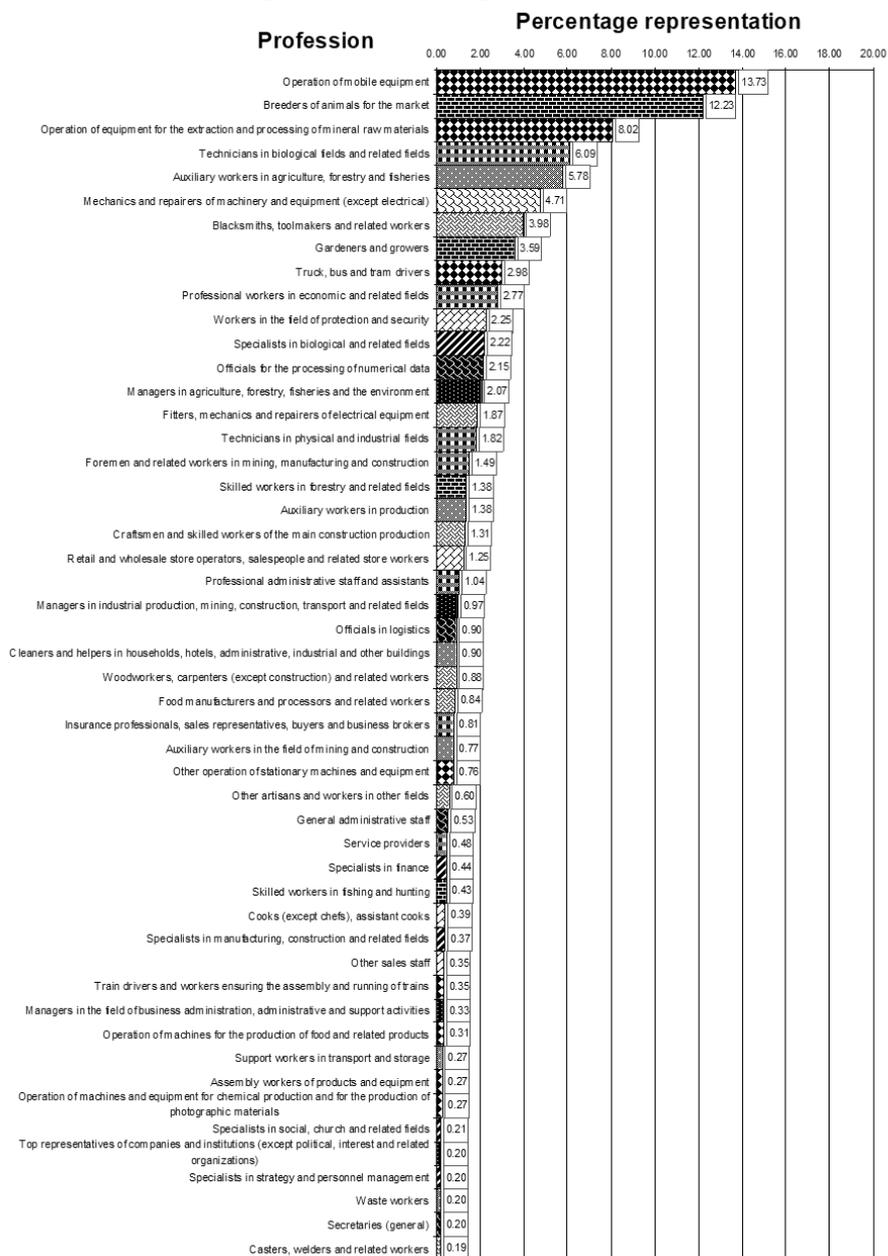*Source: Own calculation, own construction*

Table 1 presents a different style of hatching according to the main classes of the CZ-ISCO classification of occupations in Figures 8–12. These figures offer fifty the most frequented occupations according to the classification CZ-ISCO into the first three digits of the above classification in 2020.

Table 1: Color differentiation of the basic categories of professions used in Figures 8–12

|			
	0 – Armed Forces Occupations		5 – Service and Sales Workers
	1 – Managers		6 – Skilled Agricultural, Forestry and Fishery Workers
	2 – Professionals		7 – Craft and Related Trades Workers
	3 – Technicians and Associate Professionals		8 – Plant and Machine Operators, and Assemblers
	4 – Clerical Support Workers		9 – Elementary Occupations

Source: Own research

Figure 8: Percentage proportions of fifty the most frequented professions of the CZ-ISCO classification within the Agriculture and Mining Sector in 2020
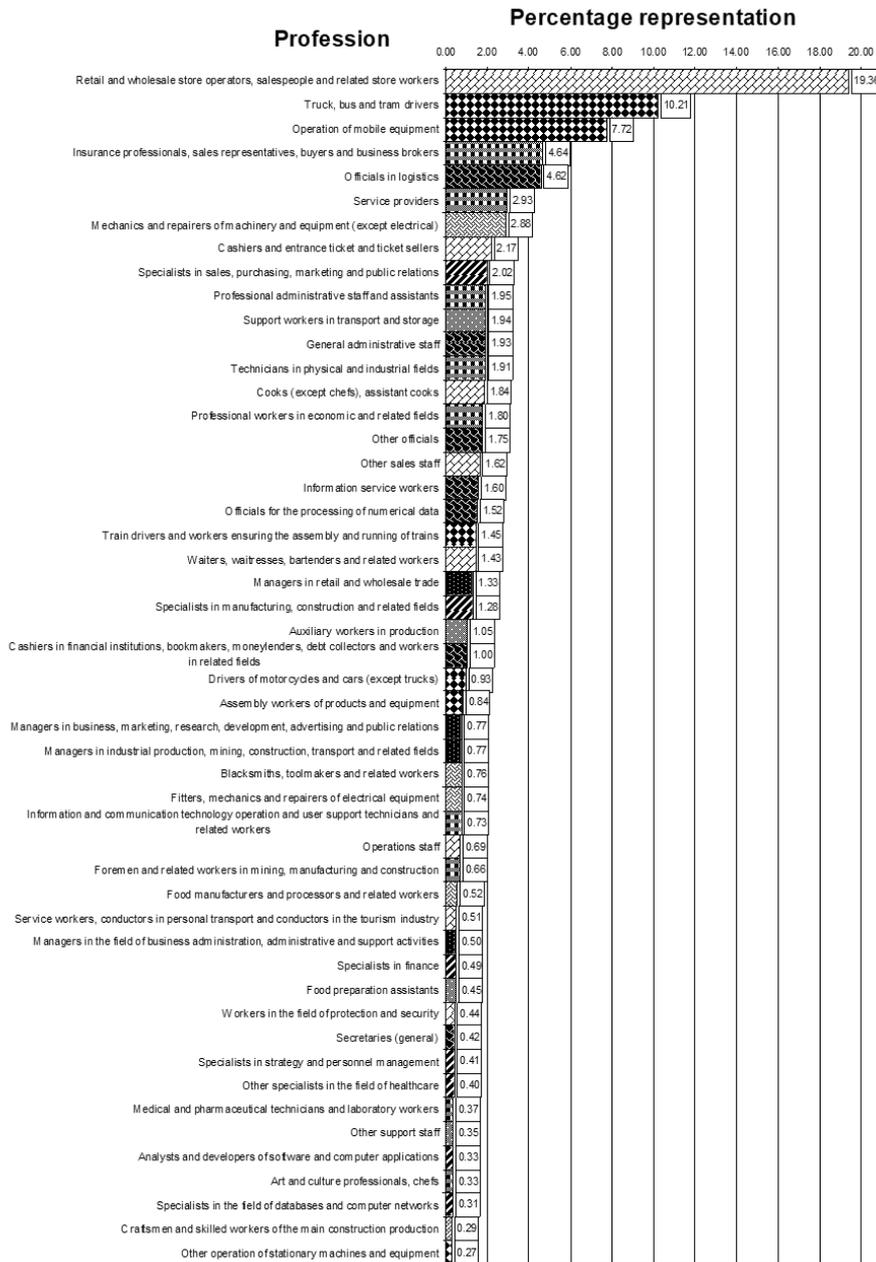

Source: Own calculation, own construction

Figure 9: Percentage proportions of fifty the most frequented professions of the CZ-ISCO classification within the Manufacturing Industry, Energy, Construction Sector in 2020
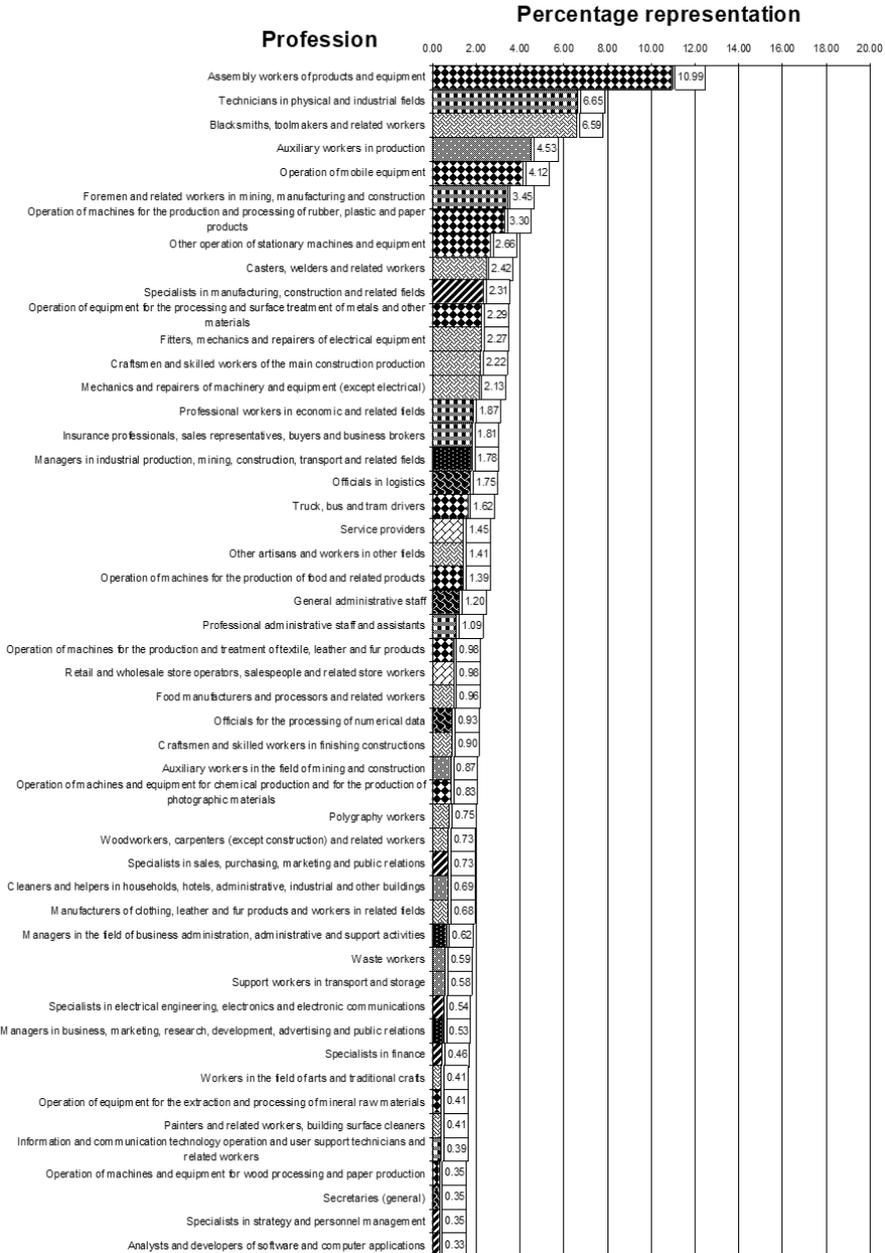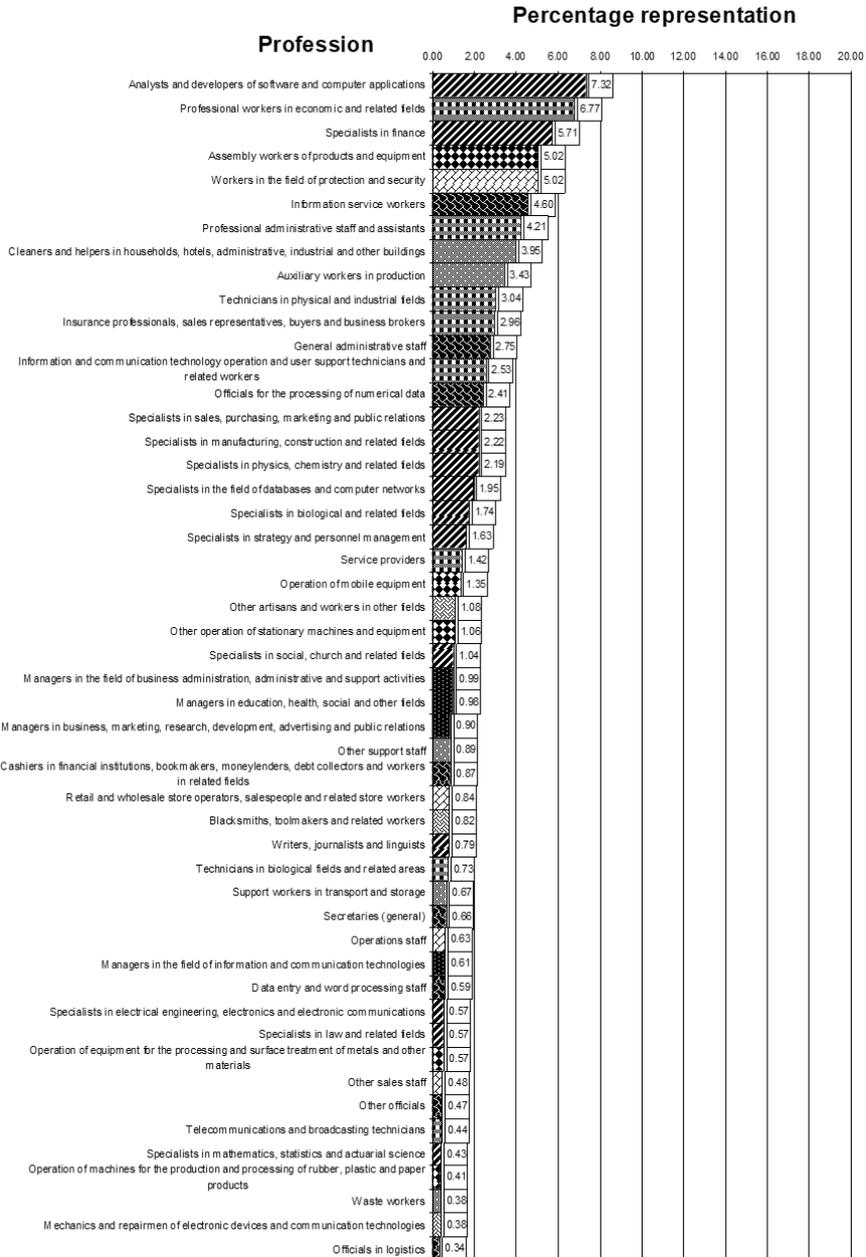

Source: Own calculation, own construction

Figure 10: Percentage proportions of fifty the most frequented professions of the CZ-ISCO classification within the Service Sector Requiring Mostly Personal Contact in 2020
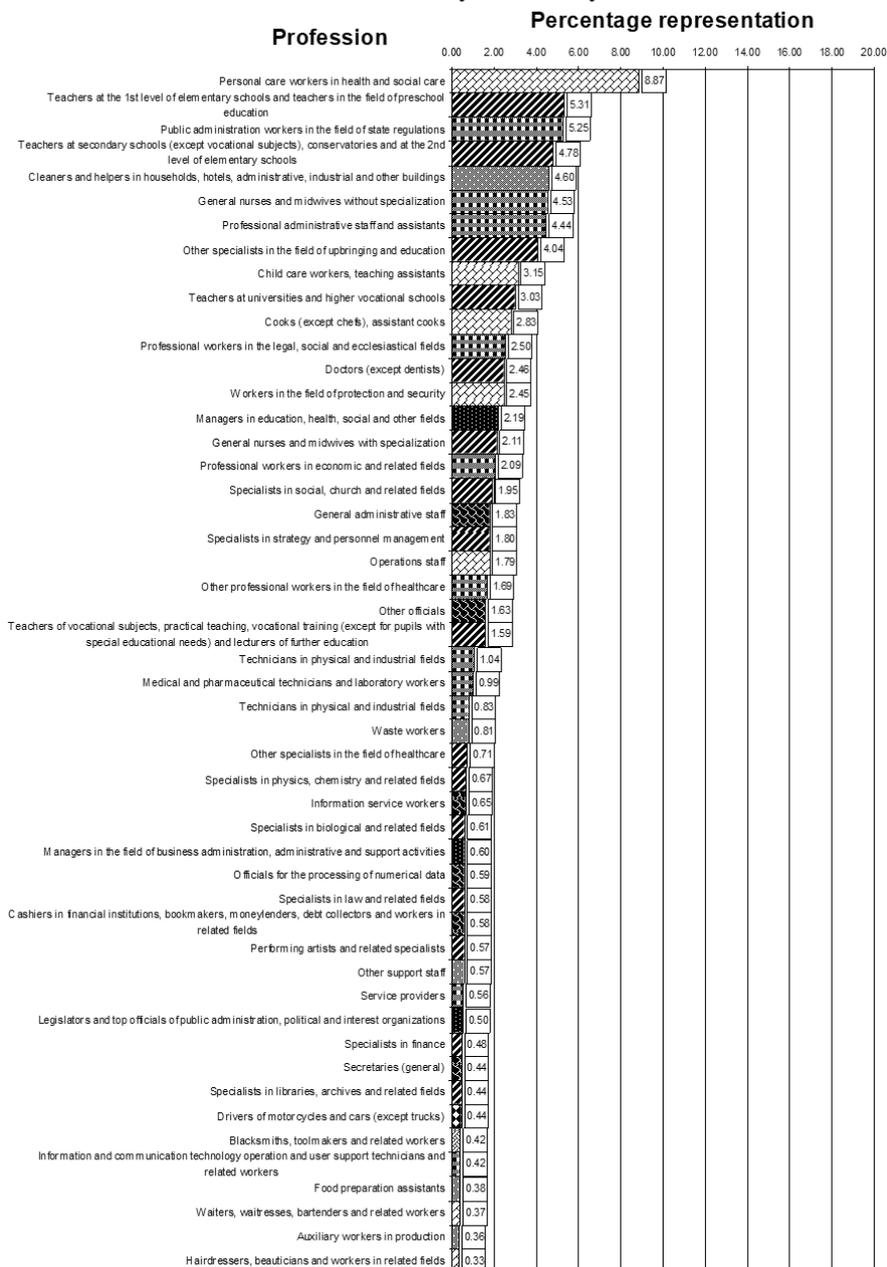

Source: Own calculation, own construction

Figure 11: Percentage proportions of fifty the most frequented professions of the CZ-ISCO classification within the Service Sector Rather without Personal Contact in 2020
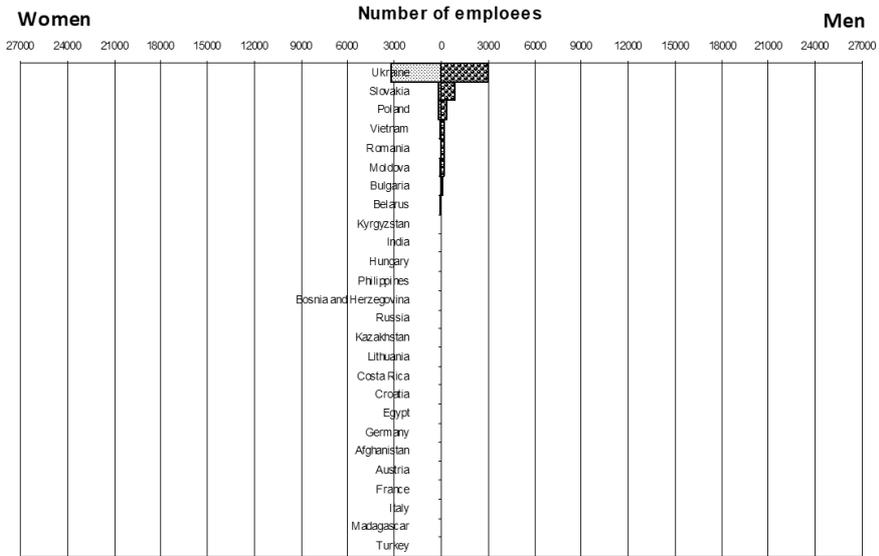

Source: Own calculation, own construction

Figure 12: Percentage proportions of fifty the most frequented professions of the CZ-ISCO classification within the Service Sector Usually Provided by the Public Sector in 2020
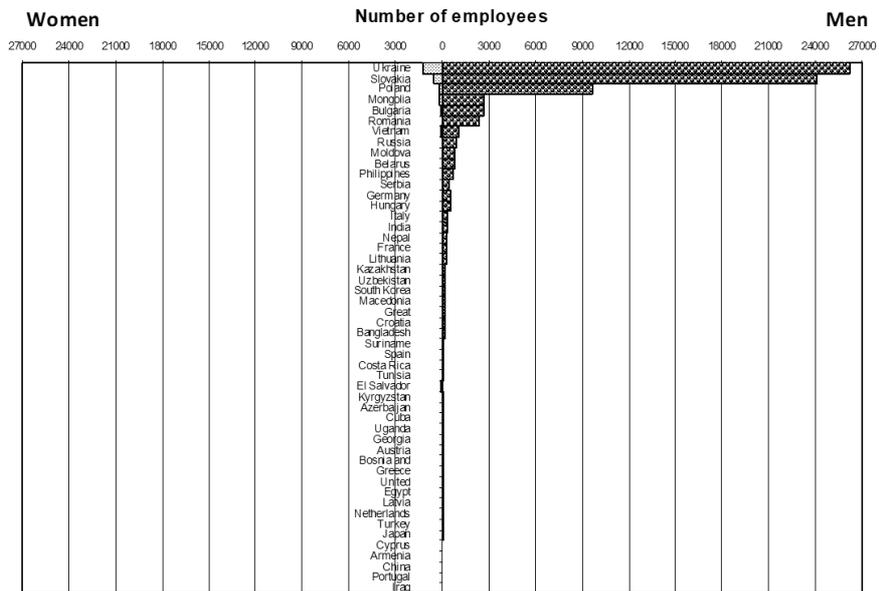

Source: Own calculation, own construction

Figure 13: Absolute frequencies of the most represented nationalities in the position of employees within the Agriculture and Mining Sector by gender in 2020

Source: Own calculation, own construction

Figure 14: Absolute frequencies of the most represented nationalities in the position of employees within the Manufacturing Industry, Energy, Construction Sector by gender in 2020

Source: Own calculation, own construction

Figure 15: Absolute frequencies of the most represented nationalities in the position of employees within the Service Sector Requiring Mostly Personal Contact by gender in 2020
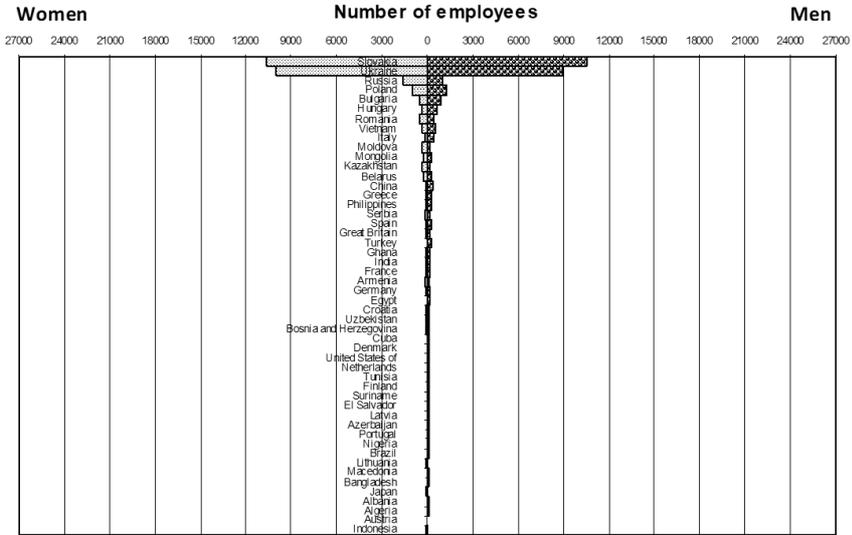

Source: Own calculation, own construction

Figure 16: Absolute frequencies of the most represented nationalities in the position of employees within the Service Sector Rather without Personal Contact by gender in 2020
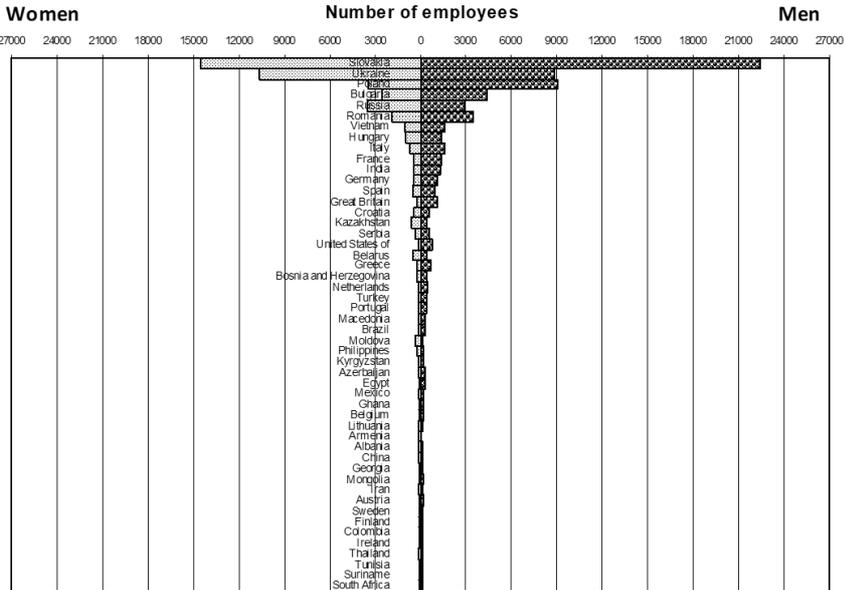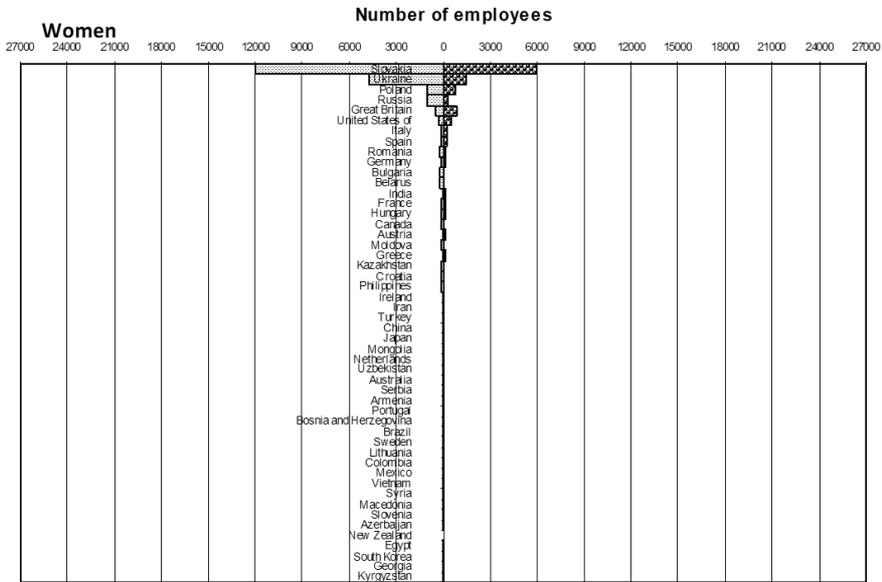

Source: Own calculation, own construction

Figure 17: Absolute frequencies of the most represented nationalities in the position of employees within the Service Sector Usually Provided by the Public Sector by gender in 2020

Source: Own calculation, own construction

Figures 8–12 show that the representation of main classes of professions of the CZ-ISCO classification varies significantly depending on the sector. In the Agriculture and Mining Sector, Plant and Machine Operators, and Assemblers; Skilled Agricultural, Forestry and Fishery Workers; and Technicians and Associate Professionals are among the most frequented professions. In the Manufacturing, Industry, Energy, Construction Sector, the most frequented professions are again Plant and Machine Operators, and Assemblers; Technicians and Associate Professionals; and then Craft and Related Trades Workers. In the Service Sector Requiring Mostly Personal Contact, there are Service and Sales Workers; again Plant and Machine Operators, and Assemblers; and Technicians and Associate Professionals.

In the Service Sector Rather without Personal Contact, the most frequented professions are Professionals; and father again Technicians and Associate Professionals; and Plant and Machine Operators, and Assemblers. In terms of the Service Sector Usually Provided by the Public Sector, there are again Service and Sales Workers; Professionals; and Technicians and Associate Professionals. A detailed overview from the point of view of the most frequanted professions within the individual sectors are offered by Figures 8–12. These were a total of 120,234 employees in 108 professions in the Agriculture and Mining Sector, 1,585,397 employees in 113 professions in the Manufacturing Industry, Energy, Construction Sector, 941,411 employees in 112 professions in the Service Sector Requiring Mostly Personal Contact, 814,850 employees in 116 professions in the Service

Sector Rather without Personal Contact and 1,373,302 employees in 125 professions in the Service Sector Usually Provided by the Public Sector.

Figures 13–17 offer an overview of fifty the most represented nationalities in the position of employees of the individual considered sectors in 2020 by gender. Nationality categories in these figures are ordered in descending order from the most numerous nationality for men and women together to the least numerous nationality for men and women together. In the case of the Agriculture and Mining Sector, only 26 nationalities are present. In the Agriculture and Mining Sector, foreign nationals represent 7.51 percent of all employees in the private and public spheres combined, with the most represented employees originating from Ukraine, Slovenia, Poland, Vietnam, and Romania. With the exception of Ukraine, there are more men than women. In the Manufacturing Industry, Energy, Construction Sector, foreign nationals represent 7.62 percent of all employees in the private and public spheres combined, with the most represented employees originating from Ukraine, Slovenia, Poland, Mongolia and Bulgaria. A total of 129 nationalities are employed in this sector, with men significantly predominating over women. In the Service Sector Requiring Mostly Personal Contact, foreign nationals represent 6.29 percent of all employees in the private and public spheres combined, with the most represented employees originating from Slovakia, Ukraine, Russia, Poland and Bulgaria. From the point of view of Slovakia, Ukraine and Russia, women predominate over men, while in Poland and Bulgaria, on the contrary, men predominate over women. There are a total of 138 different nationalities. In the Service Sector Rather without Personal Contact, foreign nationals represent even 14.94 percent of all employees in the private and public spheres combined. There are a total of 165 different nationalities, where Slovakia, Ukraine, Poland, Bulgaria, and Russia are the most represented. The representation of men prevails over the representation of women in terms of Slovakia, Poland and Bulgaria, on the contrary, in Ukraine and Russia, women prevail over men. In the Service Sector Usually Provided by the Public Sector, foreign nationals represent only 2.60 percent of all employees in the private and public spheres combined, with the most represented employees originating from Slovakia, Ukraine, Poland, Russia and Great Britain is a strangeness. With the exception of Great Britain, there are more women than men. In the Service Sector Usually Provided by the Public Sector, a total of 135 different nationalities are employed.

IV. Discussion

This paper deals with the situation on the Czech labour market in terms of wages and salaries of employees divided by five sectors. Using Brazilian household surveys and administrative panel data, study of Alvarez (2020) uses information on sector switchers and multi-job workers to compare wages for agricultural workers with other sectors. In accordance with the results from the data for the Czech Republic, also research by Alvarez (2020) states that wages in agriculture are substantially lower than in other sectors. A similar conclusion was reached by the authors of a study by Baysan, Dar, Emerick, Li and Sadoulet (2023), which deals with the redistribution of labour between agricultural and non-agricultural activities in rural areas. The authors found that workers who change

sectors over the course of years or even within a week can earn 23% higher wages by taking non-agricultural jobs.

The higher level of wages and salaries of men compared to women was confirmed in all five considered sectors, while the highest level of wages and salaries is observed in 2020 for the Service Sector Rather without Personal Contact in the case of men. In this sector, on the other hand, we observe the highest percentage proportion of women receiving wages or salaries at the minimum wage level in the period 2018–2020. On the other hand, the lowest percentage proportions of men and women receiving wages or salaries at the minimum wage level are observed in the Agriculture and Mining Sector in the entire monitored period (except for women in 2019). Wage and salary distributions for women have higher skewness and kurtosis, and at the same time lower level and variability compared to the corresponding distribution of wages and salaries for men. The wage and salary distributions of both men and women tend to flatten and become less kurtosis over time. At the same time, their level and variability increase. The representation of the most frequented professions is different from the point of view of the five sectors considered. The most represented nationalities on the Czech labour market are members of the countries of the former Soviet bloc.

The gender wage gap is not a problem only in the Czech Republic, similar results are also reported by foreign studies. An article by Sloane, Hurst and Black (2021) monitors pre-employment gender differences among college-educated people and highlights how these differences have developed over time. The authors point out that while women primarily choose fields with lower potential earnings, these differences have narrowed over time, but recent cohorts of women still choose fields and occupations with lower potential earnings. The authors emphasize that differences in the choice of major university study explain a substantial part of the wage gap between men and women for university graduates. A study by Gharehgozli and Atal (2020) analyzes gender wage inequality in the United States of America, focusing on the distribution of wages at the decile level in the United States from 1986 to 2016. The authors found that the overall female-to-male wage ratio in 1986 was 53 percent and this ratio had risen to 67 percent by 2016, indicating a very modest decline in the overall gender wage gap over three decades.

V.   Conclusion

The labour market is not only a convoluted and complicated section, but it is also a sphere that has not only parameters determining the amount of labour supplied, but also the demand for this labour, but it is also an area that significantly affects the prosperity of the country and the economic growth of the country. In essence, it is a basic and irre-placeable element of the country's production, despite the increasingly popular automation, digitization and robotization, because even these machines, digital devices or robots have still to be operated by the workforce. Satisfaction and sufficient remuneration is then the basis of providing the required performance, in terms of not only quantity, but also quality, but also in terms of aspects such as, for example, the good name of the company, its competitiveness on the labour market, low turnover, etc. The wage system is influenced by many influenceable factors, such as the complexity of the work, the necessary qualifications

or education. However, less influenceable factors such as gender, age and other basic characteristics of the workforce are also relatively negative. In this context, the term "gender" is often used, which very often occurs in connection with different remuneration for men and women from the point of view of the same profession and performance, when the Czech Republic has long-term one of the highest wage differences between men and women within the European Union and this differentiation cannot be fundamentally reduced.

From the presented development of gender wage differences on the domestic market, it emerged that the biggest difference in gross wages is in the Service Sector Rather without Personal Contact, which is mainly caused by the information and communication technology section, where there are cases where a woman equally educated and in the same job position as a man, she receives a significantly lower wage. These situations stem from anachronisms that these are so-called male professions. This is a serious problem that women are more likely to be aware of, as women confirm their perceived disadvantaged position in the work environment due to their gender. As the main cause of this situation, they see in particular the question of motherhood and further difficult conditions for harmonizing their family and work life. These are the main causes of registered discrimination. The issue of unequal remuneration, together with unequal opportunities for career growth, is one of the primary forms of discrimination, where the tendencies are rather repetitive, but the affected workers do not address it further. It would be therefore appropriate to follow up on the mentioned non-resolution of perceived discrimination with further studies and investigations, e.g. in terms of the reasons for non-resolution, the level of knowledge of procedures for clarifying discrimination, etc. Since many companies and an increasing number of legislators are beginning to understand that wage differentiation in within the framework of gender is a problem, but solvable, when it can be established that no long-term steps are needed to solve it, the future can be seen in this aspect in a rather positive light. Thanks to greater awareness, but also especially to inter-European comparisons, long-term laxity, which is the subject of criticism, it can be believed that support for solution initiatives will grow. However, the question is whether the legislators will be able to get rid of their downtime, bureaucracy and vague measures in this problem and start solving the problems concretely and effectively.

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