

The Gender Pay Gap among Full-Time and Part-Time Workers in Serbia: Experience during the COVID-19 Pandemic

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Abstract

Background: This paper analyses the gender pay gap among full-time and part-time employees, focusing on the labour market in the Republic of Serbia. **Objectives:** Using data from the annual household survey on income and living conditions, this paper examines whether the crisis caused by the COVID-19 pandemic has affected the extent of the pay gap in the Republic of Serbia between the two groups of workers who can be defined as full-time and part-time employees in terms of the employment contract. **Methods/Approach:** Separate models were estimated for full-time and part-time employees in the wage sector using the 2019-2020 data sample. **Results:** Applying this approach reveals differences in wages between men and women depending on working hours. The efficiency of full-time and part-time employed women in earning their potential wage is 9.3% and 19.8% lower than that of men, respectively. **Conclusions:** In Serbia, during the COVID-19 period, there was a significant decline in part-time employment for both men and women, but this trend continued after the crisis, showing a new reality in the labour market.

Keywords: gender pay gap, potential wage, Serbia, stochastic frontier, survey data, working hours

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Introduction

The extent and structure of the gender pay gap in this paper are analysed by considering paid work in full-time and part-time employment. The analysis of this practice is important for any society, as it can have far-reaching economic and social consequences for shaping the overall labour supply. This paper focuses in particular on the Serbian labour market and examines the extent of this practice during the COVID-19 pandemic. The special feature of Serbia as a post-transition country is that labour market changes are slow despite its long transition. Serbia is one of the countries in Central and Eastern Europe (CEE) that is characterised by a relatively low overall pay gap (Blunch, 2018; Ognjenović, 2021), but also by a very low labour force participation rate among the working-age female population (Blunch & Sulla, 2014). In recent years, there has also been a differentiation of employees by gender and by full-time and part-time employment, with part-time employment slowly becoming women's dominant work. However, the differentiation of this practice in the Serbian labour market is still far below the European Union (EU) average. The share of women with a part-time employment contract in Serbia is 6.6%, while the EU-27 average is 28.5% (Eurostat, 2024). A special section of this paper, which examines the motives for investigating this practice, also includes a statistical analysis of employment by working time and sex. Consideration of the specificity of this practice in the labour market is additionally important because employment under a full-time and part-time contract implies different wages for the same work, reflects the weaker bargaining position of workers employed on a part-time basis, and reduces the importance of the intangible benefits of part-time employment, as previous research has shown (e.g. Böheim et al., 2021; Dorjnyambuu & Galambosné Tiszberger, 2024; Fitzenberger & de Lazzar, 2022; Matteazzi et al., 2018; Matteazzi et al., 2014; Schaffer & Westenberg, 2019).

Therefore, several research questions are important for analysing the differences between full-time and part-time employment and how this may affect men and women. One of the research questions that arises from the known facts found in other labour markets in different contexts is how this practice is reflected in the employment of men and women in the Serbian labour market. From this consideration, the remuneration of employees also emerges as an important aspect of this type of employment. The next research question can be linked to the statement that failing to account for this type of employment's differentiation would likely lead to an underestimation of the overall pay gap. The significance of this practice in the Serbian labour market is therefore important for at least two reasons: the low labour force participation rate of women and the increasing proportion of women in part-time employment.

For Serbia, there are currently no studies that analyse the gender pay gap by full-time and/or part-time employment status. In addition, studies that address the impact of the COVID-19 pandemic as a latent threat on labour market outcomes are scarce; some exceptions include Ognjenović (2023, 2024) and Ognjenović and Đukić (2023). The aim of this paper is therefore to investigate the extent and statistical significance of the gender pay gap in Serbia separately for full-time and part-time employment in the context of the COVID-19 crisis. Based on the research questions, one research hypothesis tests the significance of the gender pay gap. It identifies its dimensions, and the other statistically determines the factors influencing the extent of the pay gap based on the available dataset. Thus, when defining the initial hypotheses, the theoretical assumptions derived from the literature, the results of previous studies, statistical trends, and possible differences between full-time and part-time employment contracts are taken into account. The importance of a properly defined

context stems from the fact that underestimating a working-time component can reduce the significance of the pay gap, which is a bad signal for public policies aimed at improving the position of women, advocating a more transparent path to pay, and promoting equal opportunities.

The methodological approach for testing the research hypotheses is based on a wage model specified as a stochastic frontier and estimated separately for full-time and part-time employees in the wage sector. This specification makes it possible to calculate the inefficiency of women in earning the potential market wage compared to men as a measure of the pay gap. In technical terms, this procedure uses the estimation of a female dummy in the inefficiency part of the wage model as the basis for concluding the (in)efficiency of women in achieving the market wage compared to their male counterparts, examining the effects of the observed individual characteristics of workers embodied in human capital, such as age, work experience, education and health, job-related characteristics, employer-related characteristics and other measurable variables that appear to be relevant to the study of workers' pay. The data used come from the annual household Survey on Income and Living Conditions conducted in Serbia for the period 2019-2020, covering the potential impact of the COVID-19 pandemic.

The rest of the paper is divided into six sections. The next section provides an overview of the relevant literature. In contrast, the following section explains why it is important to examine gender-specific differences in full-time and part-time employment, using the example of the Serbian labour market and comparing it with the EU-27. The methods used to conduct the empirical study are described in a separate section. A section on the main research findings presents the extent of the pay gap between full-time and part-time employed men and women and highlights possible effects of the COVID-19 crisis. The discussion of the findings and the link to the main research hypotheses are presented in a separate section, followed by concluding remarks, recommendations for policymakers, limitations of the current research and further research directions.

Literature Review

In emerging European countries after the transition to a market economy, the gender pay gap is becoming increasingly important, as it is assumed that this transition worsens women's labour-market position and thus widens the gender pay gap. However, empirical studies do not yield a uniform conclusion and differ across countries (Tverdostup & Paas, 2022; Zajíčková & Zajíček, 2021). In most post-transition countries, women's economic position was worse in the first years of transition. Thereafter, the relative position of women improved, not only because the market prevented discriminatory behaviour, but also because of the structural change that accompanied privatisation and the opening of economies. Although there is a general trend towards wage convergence due to women's improved characteristics, the gender pay gap remains deeply entrenched (Blunch & Sullá, 2014; Cukrowska-Torzewska & Lovasz, 2016; Nikoloski, 2019). Countries with different levels of labour market development and institutional efficiency cannot be grouped exclusively according to the factors that explain the gender pay gap, since, at least in European countries, institutions for the prohibition of discrimination and the protection of workers' rights are at the heart of all socio-economic, as well as family-oriented policies (Amate-Fortes et al., 2021; Johnson, 2022). Despite this favourable environment concerning gender equality, the latest United Nations report (United Nations Department of Economic and Social Affairs, 2024) on the implementation of the Sustainable Development Goals (SDGs) emphasises that, despite some

improvements, women in Europe and North America are still disproportionately burdened with unpaid domestic work, with women spending on average 1.9 times more hours than their spouses. This discourages women from working, as the worldwide distribution of employed people is still 40-60% in favour of men.

Numerous studies addressing this issue present results showing that the gender pay gap is due to the greater participation of women in certain economic and property sectors, educational segregation and segregation by occupation with less access to high-paying occupations, which, combined with greater income inequality due to more difficult access to top positions, leads to a widening of the pay gap (Alaez-Aller et al., 2015; Blau & Kahn, 2017; Johnson, 2022). On the other hand, the low labour-market participation of women with poorer human capital characteristics narrows the pay gap, which may reflect an unsustainable situation. For example, some authors show that higher female labour force participation can have an impact on widening the pay gap, as more women with different levels of education, experience and skills required by the labour market, as well as a willingness to work less than full-time, are included (e.g. Aldan, 2021; Leythienne & Pérez-Julián, 2022; Zajíčková & Zajíček, 2021).

There is sound evidence on the factors that cause wage inequality at the country level (Ortiz-Ospina & Roser, 2018). The more people are employed, the greater wage inequality becomes, due to both low and high wages (i.e., different skills and productivity levels) and to hidden or potential effects of discrimination. In some European countries, such as Austria, it has been shown that the gender pay gap is decreasing over time, but that at the same time the female labour force participation rate is increasing, and that the reason for this is the improvement in women's observed and unobserved characteristics (Böheim et al., 2021). It is likely that in this situation the effect of segregation of women in low-paid jobs is less significant, which also means that economies are more advanced in terms of a lower share of low-paid jobs or that the dimension of collective bargaining, i.e. the minimum wage, is higher on average and protects workers in low-paid jobs, which is mainly a feature of the economy that can be characterised as a social market economy. Dorjnyambuu & Galambosné Tiszberger (2024) examined the causes of changes in wage inequality in selected European countries in the decade before COVID-19 and found that, in addition to labour market institutions (i.e. the minimum wage), it was mainly the effects of education and permanent employment that influenced the decline in wage inequality in Poland and Slovakia. In the Czech Republic and Romania, wage inequality remained fairly stable, while in Bulgaria it gradually increased, and in Hungary it increased significantly just before the health crisis. The unobserved factors, as the authors showed, explained a considerable part of the increase in wage inequality in Hungary through spillover effects of the minimum wage. Some previous work for Serbia shows that the gender pay gap is smaller than in the EU and some former CEE countries, due to a lower female employment rate. However, an unfavourable trend is evident, with a slight widening of the pay gap (Ognjenović, 2021, 2024).

Since the seminal work of Mumford and Smith (Mumford & Smith, 2009), which examined the discrepancies between men's and women's wages in full-time and part-time employment in a developed economy, much research has confirmed the same finding: full-time workers earn higher hourly wages, as expected, but occupational choice or propensity toward female occupations contributes significantly to the gender pay gap for part-time employment, while the results are less common when gender differences are observed for full-time employment. Why is this important in the context of the crisis? Any crisis first manifests itself through its impact on the labour market, leading employers to be reluctant to hire new workers,

especially those needed to fill part-time jobs or those seeking more flexible working conditions (Schaffer & Westenberg, 2019). Some of these stylised facts can be derived from the latest Eurostat data for comparison purposes and serve to describe the motivation for such an analysis.

The research presented in this article, therefore, aims to show the extent of the gender pay gap during the COVID-19 pandemic by dividing employees in the wage sector in Serbia by employment contract type and distinguishing between full-time and part-time work. The basic indicators for the Serbian labour market during the COVID-19 period showed slight movements in the female labour force, leading to imbalances (Statistical Office of the Republic of Serbia, 2024). European countries' experiences with the COVID-19 pandemic's impact on the labour market vary. In the most developed European economies, the imbalances in the labour market that have arisen under the influence of the pandemic, viewed through the prism of working conditions, are not the most important factor explaining the subjective perception of differences in women's well-being (Zoch et al., 2022). Studies examining the impact of government measures on monetary poverty and income inequality have confirmed their effectiveness (Almeida et al., 2021). Studies examining the impact of COVID-19 on the position of women in the family, on the other hand, pointed to an exacerbation of gender gaps in unpaid care for dependent persons such as children, the elderly and the helpless (European Institute for Gender Equality, 2022; Nivakoski & Mascherini, 2021). These studies confirmed that COVID-19 had an additional impact on the existing differences in European labour markets, as the closest developed labour market to which Serbia can be compared.

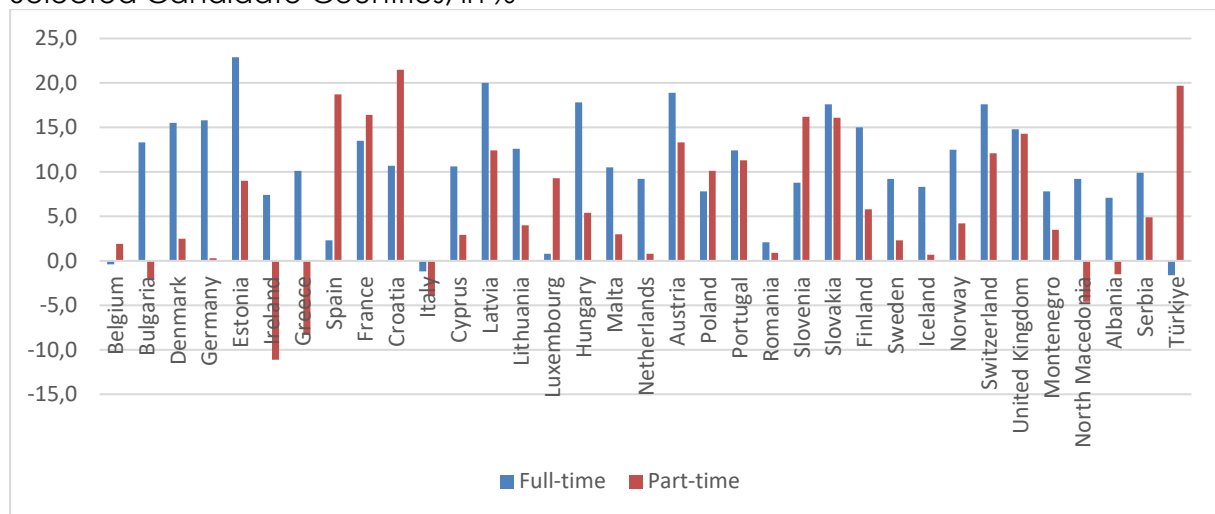
Background

During the recent COVID-19 crisis, part-time employment in the EU-27 fell by 811 thousand, representing a 2.3% decrease from 2020 levels. The decline in part-time employment in Serbia was larger in relative terms (8.9% of total employment) and affected 21.5 thousand people in 2020 (Eurostat, 2024). Women are overrepresented in part-time jobs in the EU-27. In 2019, the share of women and men working part-time in total employment was 29.9% and 8.4%, respectively (Eurostat, 2024). At the same time, the share of part-time employed women and men in total employment in Serbia was 10.6% and 8.9%, respectively (Eurostat, 2024). The European countries with the highest part-time employment rates for women are the Netherlands, Germany, Austria and Belgium, where between 2/5 and 3/5 of women work part-time. Former CEE transition countries such as Bulgaria, Romania, Slovakia, Hungary, Croatia, Lithuania, Poland and the Czech Republic have the lowest shares of female part-time employment in total employment, ranging from over 2% in Bulgaria to over 10% in the Czech Republic. To a certain extent, this corresponds to the high participation of women in the labour force in the pre-transition period and the probably lower willingness of employers and employees to accept more flexible working conditions after EU accession, which encouraged labour mobility within European labour markets. It can also be concluded that the COVID-19 crisis has had an impact on reducing the importance of part-time employment for women and that the downward trend has continued even after the crisis, as evidenced by the recent participation of women in part-time employment in Serbia and the EU-27 of 6.6% and 28.5%, respectively (Eurostat, 2024).

European countries such as Croatia, Spain, Slovakia, Slovenia, Austria, Latvia and Portugal have the largest (unadjusted) gender pay gaps for part-time workers in 2022, ranging from 21.5% (Croatia) to 11.3% (Portugal), while part-time workers in Serbia have a gender pay gap of 4.9% according to 2018 data (Eurostat, 2024). At the same

time, the largest (unadjusted) gender pay gaps for full-time employees are characteristic of the labour markets in Hungary, Slovakia, Germany, Denmark, Bulgaria, Lithuania and Portugal, ranging from 17.8% in Hungary to 12.4% in Portugal. In Serbia, the gender pay gap for full-time employees was estimated at 9.9% in 2018 (Eurostat, 2024). Figure 1 shows the pairs of unadjusted gender pay gaps for full-time and part-time employees in the EU-27 and the candidate countries. Most of the data refer to 2022, while for some countries, particularly the Balkan countries and Turkey, the latest data are from 2018, as the percentages are estimated using the Structure of Earnings Survey methodology.

Figure 1
Unadjusted Gender Pay Gap for Full-time and Part-time Employees in the EU-27 and Selected Candidate Countries, in %



Source: Eurostat, 2024.

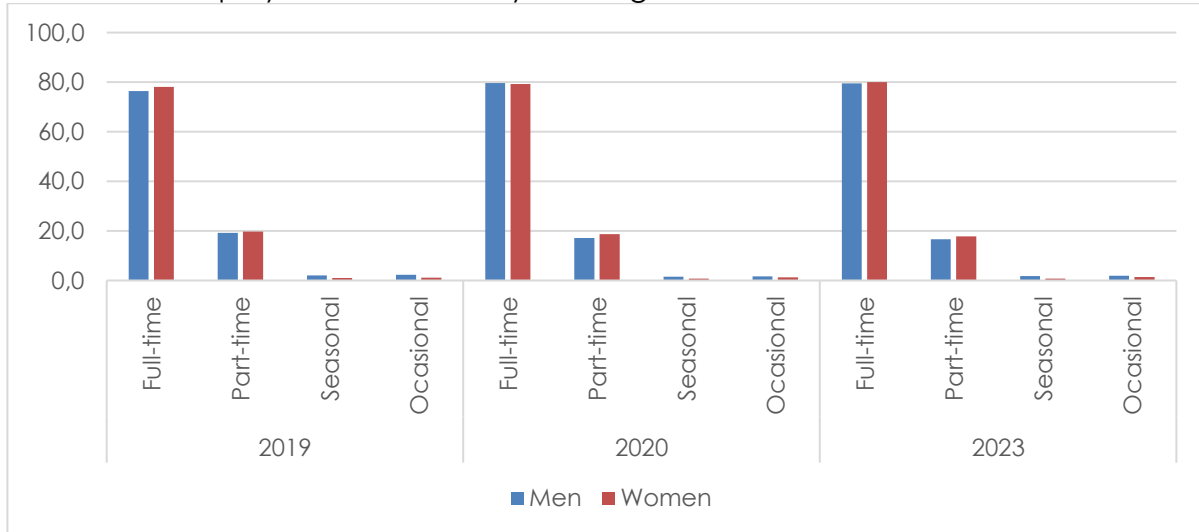
Note: The data refer to the most recent year available for the countries observed. For the Czech Republic, no data is available for full-time and part-time employees.

The largest shares of women in part-time employment do not necessarily go hand in hand with the largest unadjusted gender pay gaps for part-time workers, as the Eurostat data for European countries show (Eurostat, 2024). In the EU-27, the largest shares of female part-time employment were found in Spain, France, Ireland, Luxembourg, Italy, Denmark, Belgium, Germany, Austria and the Netherlands, all of which account for more than 20% of total female employment. In the first three countries mentioned, the proportion of female part-time employees exceeds half of total employment. Comparing this situation in Serbia using the same data source, it can be concluded that the unadjusted gender pay gap for part-time workers (4.9%) and the proportion of female part-time employees (6.6%) are significantly lower than in these EU countries.

Figure 2 shows the distribution of the workforce by working hours and sex in the period 2019-2023. The proportion of full-time employees is increasing for both men and women, while part-time employment is gradually declining. However, the proportion of female part-time employees remains higher than the proportion of total female employment. Other atypical forms of employment, such as seasonal and occasional work, have become even less important for both men and women after COVID-19. In fact, a new trend is emerging on the Serbian labour market after COVID-19, showing an increasing importance of full-time jobs on the one hand and a decreasing share of other forms of employment that are more dependent on flexible working conditions

on the other. To illustrate this and for comparison with the 2019-2020 period, the 2023 data are used in Figure 2, which shows that the importance of full-time employment is increasing. This can be observed because of the preferences of both employers and employees, who recognise the importance of remote work, a practice that gained popularity during COVID-19.

Figure 2
Structure of Employment in Serbia by Working Time and Sex, in %



Source: Statistical Office of the Republic of Serbia. (2024), LFS data for 2019, 2020 and 2023.

Table 1 summarises the correlation analysis between female labour force participation and the unadjusted gender pay gap for the EU countries. No data on the gender pay gap in a longer time series is available for Serbia, as there are only estimates for 2014 and 2018 based on the Structure of Earnings Survey. In general, countries with a relatively low female labour force participation rate, such as Poland and Slovenia, do not show a significant correlation with the unadjusted gender pay gap, which is lower than the EU average. The EU-27 average in 2022 was 12.7%, calculated according to the Structure of Earnings Survey methodology. The other group of countries includes Bulgaria, Spain, France, Lithuania and Hungary, where the pay gap is relatively larger than the EU-27 average, but this does not indicate a statistically significant relationship with the female labour force participation rate. The empirical literature suggests that the reasons for this may be related to the low female employment rate, the distribution of working hours, the quality of employment contracts, or the impact of labour market institutions. For all other countries, apart from Latvia and Croatia, the estimated relationships are as expected, i.e. the female labour force participation rate forms an inverse and statistically significant association with the gender pay gap. Latvia, along with Croatia, is an exception, where there is a positive correlation between female labour force participation and the unadjusted gender pay gap, which could be due to both high female labour force participation and a high gender pay gap. In general, the Baltic countries have relatively high female labour force participation rates, which are above the EU-27 average. The correlation analysis is carried out using Eurostat data on female labour force participation and the gender pay gap for individual countries in the period 2011-2022.

Table 1

Estimates of the Correlation Coefficients between Female Labour Force Participation and the Unadjusted Gender Pay Gap at the Level of the EU-27 Countries

Country	Coefficient	95% Confidence Intervals	
Belgium	-0.8814***	-0.966	-0.622
Bulgaria	-0.4141	-0.862	0.395
Czechia	-0.7483***	-0.925	-0.306
Denmark	-0.7592***	-0.929	-0.328
Germany	-0.9128***	-0.976	-0.712
Estonia	-0.8849***	-0.967	-0.632
Ireland	-0.6237**	-0.882	-0.078
Spain	-0.3828	-0.784	0.245
France	-0.5712	-0.862	0.004
Croatia	0.7453***	0.300	0.924
Italy	-0.5916**	-0.870	-0.027
Cyprus	-0.8515***	-0.957	-0.543
Latvia	0.8351***	0.502	0.953
Lithuania	0.2017	-0.421	0.695
Luxembourg	-0.9817***	-0.995	-0.934
Hungary	-0.1571	-0.671	0.458
Malta	0.4781	-0.132	0.825
Netherlands	-0.8922***	-0.970	-0.652
Austria	-0.9641***	-0.990	-0.874
Poland	0.1344	-0.476	0.658
Portugal	-0.6490**	-0.891	-0.120
Romania	-0.6152**	-0.879	-0.064
Slovenia	0.2250	-0.401	0.708
Slovakia	-0.6687**	-0.898	-0.154
Finland	-0.9460***	-0.985	-0.814
Sweden	-0.9046***	-0.973	-0.688

Note: (***, **, *) stands for the statistical significance at the 1%, 5% and 10% level, respectively. The data refer to the most recent year available for the countries observed. No data on the unadjusted gender pay gap are available for Greece, except for 2014 and 2018, which were estimated using the Structure of Earnings Survey methodology. Although the correlation analysis is for illustrative purposes only, a preliminary test of the variables' normality was performed to identify those that deviate from normality. Since the analysis was performed on a small number of observations, all variables met the normality condition at the 95% confidence level, except the female labour force participation rate in Slovenia, which passed the normality test at the 90% confidence level. $t = 12$ years.

Source: Author's calculation.

Table 2 shows that the gender pay gap is primarily linked to gross domestic product (GDP), with an inverse relationship that contributes to income inequality by widening economic activity gaps. Exceptions are Croatia, Latvia, Lithuania, Malta, Poland and Slovenia, where the data show a positive correlation between GDP and the gender pay gap. However, this relationship was statistically significant only for Croatia and Malta.

Table 2

Estimates of the Correlation Coefficients between the Gross Domestic Product p.c. and the Unadjusted Gender Pay Gap at the Level of the EU-27 Countries

Country	Coefficient	95% Confidence Intervals	
Belgium	-0.7575***	-0.928	-0.325
Bulgaria	-0.5798**	-0.866	-0.009
Czechia	-0.8080***	-0.944	-0.437
Denmark	-0.8895***	-0.969	-0.645
Germany	-0.8265***	-0.950	-0.481
Estonia	-0.9320***	-0.981	-0.770
Ireland	-0.6617**	-0.896	-0.142
Spain	-0.6062**	-0.876	-0.050
France	-0.1717	-0.679	0.446
Croatia	0.7797***	0.372	0.935
Italy	-0.3622	-0.775	0.267
Cyprus	-0.7749***	-0.934	-0.362
Latvia	0.4498	-0.167	0.814
Lithuania	0.1161	-0.490	0.647
Luxembourg	-0.6905**	-0.906	-0.193
Hungary	-0.0873	-0.630	0.512
Malta	0.5788**	0.007	0.865
Netherlands	-0.8969***	-0.971	-0.666
Austria	-0.4120	-0.797	0.212
Poland	0.0594	-0.533	0.612
Portugal	-0.6562**	-0.894	-0.132
Romania	-0.6884**	-0.905	-0.189
Slovenia	0.1667	-0.450	0.676
Slovakia	-0.6396**	-0.888	-0.104
Finland	-0.7727***	-0.933	-0.357
Sweden	-0.8988***	-0.972	-0.671

Source: Author's work

Note: (***, **, *) stands for the statistical significance at the 1%, 5% and 10% level, respectively. The data refer to the most recent year available for the countries observed. No data on the unadjusted gender pay gap are available for Greece, except for 2014 and 2018, which were estimated using the Structure of Earnings Survey methodology. Although the correlation analysis is for illustrative purposes only, a preliminary test of the variables' normality was performed to identify those that deviate from normality. Since the analysis was based on a small number of observations, all variables met the normality assumption at the 95% confidence level. $t=12$ years.

Methodology

The data originates from the Serbian Household Survey on Income and Living Conditions (SILC) for 2019-2020 (Statistical Office of the Republic of Serbia, 2022). The sample of respondents in the SILC includes people aged 18 years and older. SILC research is conducted in May and June each year. The survey data is usually available the following year, around mid-October, so that the impact of COVID-19 on the functioning of the labour market can be captured in the SILC data for 2020. The present study is based on an adjusted sample of respondents who participated in the surveys in both 2019 and 2020. A total of 18,648 respondents aged 18 years and older were included in the realised sample. They are divided into three sub-samples, depending on how often they appear in the Survey. Those who were interviewed for the third and fourth time in 2020 include 6,568 people, those who were interviewed for the second and third time include 6,444 respondents, and those who were interviewed for the first and second time include 5,636 people in the total sample. These three

figures yield a total of 18,648 respondents who participated in the Surveys in both 2019 and 2020. The response rate was slightly higher in 2019, estimated at 85.3%, while in 2020 it was 83.0%. However, for the research conducted in this paper, only those respondents who were employed and provided positive information about the wages and working hours of their main job were included in the final sample of employees. Finally, the sample comprised 5,507 full-time employees and 101 part-time employees. The difference between the number of respondents who worked full-time and those who worked part-time is that part-time employment in the Serbian labour market remains low (less than 6% of total employment, with a declining trend). It is also worth noting that fewer observations were discarded due to missing data, and, apart from that, the share of full-time and part-time employees in the sample remains at a sufficient level. The description of the variables entered into the model (1), including minimum and maximum values and the number of observations, is presented in Table 3, while Table A1 in the Appendix provides a detailed description of the sample.

Table 3
Description of the Variables

Variable	Description	Full-time			Part-time		
		Min	Max	N	Min	Max	N
Wage	Log of hourly net wage	3.904	8.047	5507	4.086	8.286	101
Age	Age in years	19	68	5507	22	66	101
Exper	Experience in years	0	49	5507	0	36	101
LEdu	No education and primary, ISCED 0-1, excluded	1	0	5507	1	0	101
MEdu	Secondary education, ISCED 2-4	1	0	5507	1	0	101
HEdu	Tertiary education, ISCED 5-8	1	0	5507	1	0	101
PerEm	Permanent employment	1	0	5507	1	0	101
Resp	Supervisory position	1	0	5507	1	0	101
PHe	Poor health	1	0	5507	1	0	101
Reg	Region Serbia-North	1	0	5507	1	0	101
TPop	Thinly populated, excluded	1	0	5507	1	0	101
IntPop	Intermediate populated	1	0	5507	1	0	101
DenPop	Densely populated	1	0	5507	1	0	101
Micro	Micro enterprises, excluded	1	0	5507	1	0	101
Small	Small enterprises	1	0	5507	1	0	101
MedLar	Medium and large enterprises	1	0	5507	1	0	101
Privat	Private ownership	1	0	5507	1	0	101
Agri	The agriculture, forestry and fishing sector, excluded	1	0	5507	1	0	101
Ind	Industry and construction	1	0	5507	1	0	101
Serv	Services	1	0	5507	1	0	101
Un	Previously unemployed	1	0	5507	1	0	101
Man	Managers, ISCO-08 1, excluded	1	0	5507	1	0	98
Tech	Professionals, technicians and others, ISCO-08 2-5	1	0	5507	1	0	98
Skill	Skilled workers and others, ISCO-08 6-8 occupations	1	0	5507	1	0	98
El	Elementary occupations, ISCO-08 9	1	0	5507	1	0	98

Source: Author's calculation.

The stochastic frontier model is applied in estimating the discrepancy between men's and women's wages. This approach was recently used in Ángeles Díaz & Sánchez (2011) to identify the empirical relationship between wage determination and the potential impact of market discrimination in European countries. The stochastic frontier approach allows market discrimination to be embedded in a female dummy, which is included in the model of potential market wages. Model (1) represents the wage frontier:

$$\ln(Wage)_{ijt} = c_j + a_{1j}Age_{ijt} + a_{2j}AgeSq_{ijt} + a_{3j}Exper_{ijt} + a_{4j}ExperSq_{ijt} + a_{5j}MEdu_{ijt} + a_{6j}HEdu_{ijt} + a_{7j}PerEm_{ijt} + a_{8j}Resp_{ijt} + a_{9j}PHe_{ijt} + a_{10j}Reg_{ijt} + a_{11j}IntPop_{ijt} + a_{12j}DenPop_{ijt} + a_{13j}Small_{ijt} + a_{14j}MedLar_{ijt} + a_{15j}Privat_{ijt} + a_{16j}Ind_{ijt} + a_{17j}Serv_{ijt} + a_{18j}Un_{ijt} + a_{19j}Tech_{ijt} + a_{20j}Skill_{ijt} + a_{21j}El_{ijt} + e_{ijt} - u_{ij}, \quad (1)$$

where $i \in (1, \dots, n)$, $j \in (1,2)$, $t \in (1,2)$ and stands for the number of employees (N), full-time ($j=1$) or part-time ($j=2$) employment, and the time dimension of the data (two years are observed). For the empirical study, a pooled sample of people who were employed in the period 2019-2020 and who provided information on positive wages and hours worked was, therefore, used in (1). The dependent variable measures the net hourly wage of the main job transformed by the natural logarithm, while human capital and individual characteristics such as age (*Age*), age squared (*AgeSq*), work experience (*Exper*), work experience squared (*ExperSq*), secondary (*MEdu*) and higher (*HEdu*) education, health status (*PHe*), but also job- and employer-related characteristics, including permanent employment (*PerEm*), supervisory function (*Resp*), previous unemployment (*Un*), occupations such as professionals, technicians (*Tech*), skilled workers (*Skill*) and elementary occupations (*El*), region (*Reg*), degree of urbanization (*IntPop*, *DenPop*), enterprise size (*Small*, *MedLar*), private ownership (*Privat*) and economic sector (*Ind*, *Serv*) are a set of explanatory variables included in the wage model (1) according to the theoretical constructs representing an extended Mincerian wage equation. This part of the model (1) is a mathematical representation of realised wages, where the first error component e_{ijt} is a random disturbance term. The second term $-u_{ij}$ is an inefficiency component and represents the discrepancy between the realised and the potential market wage in the empirical model (1). This component is usually expressed in terms of its mean as a function of a reduced set of variables selected to explain the existing difference between the realised and the potential market wage. A different distributional assumption applies to each of the error components in model (1), including their mutual independence and the independence of the set of regressors. Greene (1980) showed that the maximum likelihood (ML) is a consistent estimator of the stochastic frontier model.

Some authors have used panel data that include unobserved heterogeneity, which can be seen as a proxy for unobserved preferences for involvement in domestic production, which disproportionately characterise women's engagement (Ángeles Díaz & Sánchez, 2011). However, because the sample used has a small temporal dimension ($t=2$), dummy variables are included in the inefficiency model to indicate the time at which an individual appears in the 2020 Survey. The model is therefore estimated for a pooled sample of employees. The part of the model relating inefficiency to attract the potential market wage includes family status (*Married*), and the time of appearance in the sample (*2nd and 3rd times* and *3rd and 4th times*), in addition to the dummy variable for female employees (*Women*). To account for the family situation, the variable measuring the number of children was included in the model, but it was not statistically significant. Therefore, the variable capturing the multiple impacts of family situation on a worker's inefficiency in attracting the potential market wage is marital status. Model (1) is estimated separately for full-time and part-time employees.

Results

Table 4 presents the ML estimates of the stochastic frontier model for wage earners in Serbia, broken down by hours worked. The left-hand panel of Table 4 presents the

results of the model estimated on a subsample of full-time employees, while the right-hand panel presents estimates from a subsample of part-time employees. The first part of the wage model estimates the wage frontier, while an inefficiency component is also estimated, considering information on women and family situations to assess how these factors determine workers' ability to earn the maximum wage. The generalised one-sided likelihood ratio (LR) test was conducted to investigate the relevance of stochastic frontier analysis as previously suggested by Kumbhakar et al. (2015). Based on the log-likelihood (LL) values of the unconstrained stochastic frontier model estimated using the ML method [Model 1 (-1999.05); Model 2 (-69.72)] and the log-likelihood obtained from the estimates of the constrained generalized linear model [Model 1 (-2067.56); Model 2 (-72.28)], calculated values of the LR statistics [Model 1 (137.03); Model 2 (5.14)] indicate that for both models the null hypothesis H_0 , that the inefficiency term is zero, can be rejected at the 95% level, i.e. $LR \in (137.03; 5.14) > \chi^2_{0.05}=2.71$). The model fit statistics for both wage equations show a high joint relevance of the regressors ($p < 0.01$). As explained in the methodology section, the sub-sample of part-time employees is significantly smaller than that of full-time employees. For the former, the number of observations is $n=101$, which is used for the estimation of Model 2. In addition, Model 2 is estimated with a reduced set of variables due to the relatively small number of responses to certain questions. More specifically, some variables are excluded from the analysis due to the small number of non-zero values used to create certain dichotomous variables, such as the indicators for medium and large enterprises, professionals, technicians, skilled and elementary occupations, and a worker's previous unemployment episode. Another threat to the use of variables was the potential problem of multicollinearity.

Age and work experience have an inverse U-shaped relationship with wages, with the relationship more pronounced for full-time employees (see Table 4). In other words, the coefficient on age variable ($\widehat{age} = 0.006$, $p < 0.17$) can be interpreted in a way that, holding all other variables at their mean values, an additional year of age will imply a 0.6% increase in wages, while the coefficient, on the squared term of the age variable shows that an additional year of age reduces wages by -0.01% ($\widehat{age\ squared} = -0.0001$, $p < 0.01$). This relationship goes back to the theory of human resource development, which explains the relationship between workers' age and wages, implying an increase in wages until a turning point at which they begin to fall. These two observed coefficients together contribute to a 0.59% increase in wages. A similar interpretation can be applied to the pattern of experience and wages over the life cycle, noting that the estimates for the experience and experience-squared variables in Model 1 have a larger impact on potential market wages and, together, contribute to a 1.08% increase in wages for full-time employees. The level of education correlates positively with the potential market wage, i.e. a secondary and higher level of education increases the potential wage of full-time employees by 9% and 35%, respectively, compared to a low level of education, as do permanent employment (by 6%) and the level of responsibility in the enterprise (by 18%). All employees in the private sector can expect a premium of 4% in the form of a wage increase, while those in manufacturing and construction can expect a premium of 8% compared to those in agriculture, forestry, and fisheries, the excluded category. The obstacle for a worker to reach the full market wage is reflected in the negative effects of poor health (a 10% decrease in the potential market wage), regional job displacement (a 2% decrease, but the estimates for the intermediate and densely populated area variables are not statistically significant at conventional levels, with the excluded category of thinly populated area), labour market status associated with previous unemployment (a 3% decrease, the estimate is not statistically significant), and attachment to certain

occupational groups. These characteristics reduce the employee's potential market wage for full-time employment.

Table 4

ML Estimates of the Wage Model (Dependent Variable Log Hourly Net Wage from Full-time and Part-time Employment in Serbia)

Variable	Model 1 Full-time Employees				Model 2 Part-time Employees			
	Coefficient	Std. Error	95% CI _{lower}	95% CI _{upper}	Coefficient	Std. Error	95% CI _{lower}	95% CI _{upper}
Age	0.01	0.00	-0.00	0.01	0.02	0.05	-0.07	0.11
Age squared	-0.00**	0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.00
Experience	0.01***	0.00	0.01	0.02	0.03	0.03	-0.02	0.08
Experience squared	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00
Secondary education	0.09***	0.02	0.06	0.13	0.21	0.29	-0.35	0.38
High education	0.35***	0.02	0.30	0.40	0.49*	0.30	-0.09	1.08
Permanent employment	0.06***	0.01	0.03	.08	0.10	0.12	-0.14	0.35
Responsibility	0.18***	0.01	0.15	0.21	0.46**	0.20	0.06	0.86
Health status	-0.10***	0.03	-0.17	-0.04	-0.30	0.26	-0.81	0.21
Region Serbia-North	0.12***	0.01	0.10	0.14	0.49***	0.12	0.24	0.73
Degree of urbanization (intermediate)	-0.02	0.01	-0.04	0.01	-0.06	0.13	-0.32	0.20
Degree of urbanization (densely)	-0.02	0.01	-0.04	0.00	-0.18	0.15	-0.48	0.12
Small enterprise	0.11***	0.01	0.09	0.13	-0.15	0.12	-0.39	0.09
Medium and large enterprise	0.12***	0.01	0.09	0.14				
Privately owned	0.04***	0.01	0.02	0.06	-0.26**	0.13	-0.52	-0.00
Industry	0.08**	0.03	0.01	0.15	0.96***	0.36	0.26	1.16
Services	0.04	0.03	-0.02	0.11	1.06***	0.33	0.41	1.71
Technicians	-0.22***	0.02	-0.25	-0.18				
Skilled	-0.24***	0.02	-0.28	-0.20				
Elementary	-0.30***	0.02	-0.34	-0.26				
Unemployed	-0.03	0.02	-0.07	0.01				
Intercept	5.16***	0.10	4.97	5.35	3.84***	1.05	1.78	5.91
Inefficiency model								
Family status-married	0.01	0.01	-0.01	0.04	-0.13	0.12	-0.37	0.12
Women	0.12***	0.01	0.10	0.15	0.24*	0.13	-0.01	0.48
2 nd and 3 rd times in 2020	-0.00	0.02	-0.04	0.03	0.17	0.13	-0.09	0.43
3 rd and 4 th times in 2020	-0.01	0.02	-0.04	0.03	0.11	0.13	-0.16	0.37
Model fit statistics								
LL					-1999.05			-69.72
$\chi^2(k' = k - 1)$					2595.21 (k' = 21)			85.44 (k' = 16)
σ_e	0.35		0.34	0.35	0.48		0.42	0.55
σ_u ($\rho = 0.05 = 2.71$)	0.01		0.001	0.14	0.003		-0.00	0.00
λ	0.03		0.001	0.06	0.007		-0.07	0.09
$\chi^2(\rho = 0.05 = 2.71)$					137.03			5.14
No. of obs.					5,507			101

Source: Author's work

Note: (***, **, *) stands for the statistical significance at the 1%, 5% and 10% level, respectively. With regard to the categorical variables, the following categories were excluded: low education for the categorical variable education, thinly populated areas for the categorical variable degree of urbanisation, micro enterprises for the categorical variable enterprise size, agriculture, forestry and fishing for the categorical variable economic sector and managers for the categorical variable occupation, those appearing in the sample for the first and second time are excluded for the variable representing the number of participations in the survey. For dummy variables such as permanent employment, fixed-term contracts are an excluded category; for responsibility, all other jobs that do not include a managerial position are an excluded category; the health status variable stands for poor health status, so that good health status is an excluded category; for the Serbia-North macro-region variable, Serbia-South is an excluded category; for the private ownership variable, all other forms of ownership of enterprises are an excluded category, for the dummy variable unemployed, wage earners who have not experienced a previous episode of unemployment are an excluded category, for the variable marital status, the unmarried, divorced and widowed are an excluded category, and in terms of gender, men are an excluded category.

The results presented in Table 4 (Model 1, left-hand panel) show that being a full-time employed woman in the Serbian labour market statistically significantly increases the gap between the realised and the potential wage, as shown by a positive sign of the estimate of a female dichotomous variable ($\widehat{women} = 0.12, p < 0.05$) in the inefficiency part of the stochastic frontier model. As expected, the family situation, i.e. being married, also increases individual inefficiency in reaching full market potential compared to those who are not in this position, but the estimate is not statistically significant ($\widehat{married} = 0.01, p < 0.25$). Comparing those who have previously participated in the survey with those who were selected in the year of COVID-19, it can be concluded that the former are more efficient in achieving their potential market wage than those newly included in the survey; however, the estimates are not statistically significant at conventional levels. The further interpretation of the coefficients of the inefficiency component in the form of marginal effects is presented in more detail below and is based on the results in Table 5.

The stochastic frontier model for the wages of part-time employees has almost the same structure as the wage model for full-time employees (Table 4, Model 2, right-hand panel), although the parameters are less precisely estimated, which is mainly due to the small sample of wage earners who work part-time ($n=101$). Age and work experience also have an inverse U-shaped relationship with wages, but the estimates are not statistically significant. Based on the coefficients for the variables age and age squared, and experience and experience squared, the joint positive effects of age and experience on potential market wages for part-time work are estimated to be 1.94% and 2.75%, respectively. If all other variables remain constant, a secondary and higher level of education increases the potential wage of part-time employees by 21% and 49% respectively compared to a low level of education, although only the first estimate is statistically significant ($\widehat{higher} = 0.49, p < 0.10$). A managerial position in the enterprise (increase by 46%), workers employed in companies operating in the North of Serbia (increase by 49%), as well as industry specialisation, have a positive effect on achieving the potential market wage for part-time employees. Poor health conditions reduce the potential market wage of part-time employees by 30%, and employment in small enterprises by 15% compared to the excluded category of micro enterprises, while permanent employment can increase the wages of part-time employees by 10%, although the coefficients are not statistically significant at conventional levels. Looking at the part of the model that deals with inefficiency, the situation of women working part-time contributes to a statistically significant increase in inefficiency in

achieving the potential market wage a woman could earn compared to men ($women = 0.24, p < 0.10$). This means that although women are more likely to work part-time (65.3% of women in the sample work part-time, Table A1 in the Annex) and have a higher level of education – of the 44.6% of employees with higher education who work part-time, 66.7% are women and 33.3% are men – women who work part-time are still paid less than their male counterparts, indicating unfair pay.

Table 5 presents the marginal effects calculated from the sample of observations used for the estimation in Table 4 (last row), as suggested by Belotti et al. (2013). This strategy was adopted because the estimates of the determinants of inefficiency, as presented in Table 4, can only indicate the direction of the relationship between the estimated variable and the dependent variable, as embodied in the inefficiency to achieve the full market wage. Therefore, the marginal effects around the (unconditional) mean of the predictor calculated for each observation of the part of the determinants of inefficiency of the stochastic frontier model can measure both the direction (sign of the estimate) and the magnitude of the change (numerical value of the estimate) of the (in)efficiency measured in Models 1 and 2.

Table 5

Marginal Effects of the Determinants of Inefficiency Part of Models 1 and 2

Variable	Model 1: Inefficiency Variables Average effect	Model 2: Inefficiency Variables Average effect
Family status-married	0.011	-0.105
Women	0.093	0.198
2 nd and 3 rd times in 2020	-0.001	0.141
3 rd and 4 th times in 2020	-0.021	0.087

Source: Author's calculation from Table 4.

Note: Marginal effects were calculated for each observation, and the average effects were then determined.

The interpretation of the marginal effects shown in Table 5 is as follows. Women who work full-time miss out on their potential wage by 9.3% compared to men who work full-time, while the gap is larger for women who work part-time, amounting to 19.8% of the maximum market wage they could earn compared to men. The family situation can help to increase inefficiency by 1.1% when full-time workers are considered, while for part-time workers, the family composition can reduce inefficiency to reach the potential wage for those practising this form of employment by 10.5%. On the other hand, those workers who continued to participate in the survey have better prospects in the competitive labour market than those selected in the year of COVID-19 or immediately before, suggesting that the former are more likely to cope with the potential impact of COVID-19 than the latter. Similarly, employees are reluctant to answer questions about their earnings when it comes to their profession, position, situation within the enterprise, or experience with previous crises. Concern about the effects of the crisis is even more pronounced among part-time employees. The two selected groups of employees expect their efficiency in achieving the potential market wage to deteriorate by 14.1% and 8.7%, respectively, when working part-time.

Based on the descriptive statistics presented in Table 6, women's efficiency in achieving the potential market wage is estimated at 87.6%, indicating that, on average, women's efficiency is below the full potential, as reflected in the deviation from the frontier. However, in the sub-sample of full-time employees, there is not much variation between the least and most efficient women compared to men. The range extends from 86.9% to 88.9%. The wages of the most efficient women are therefore

well below the maximum value, which is measured as 100% efficiency. In the sub-sample of part-time employees, the situation is even less favourable for women, as the average efficiency of 78.5% shows, with the range between the worst and best realised wage relative to the potential wage being 66.6% to 89.4%.

Table 6

Descriptive Statistics of Efficiency for Full-time and Part-time Employees Derived from Models 1 and 2

Variable	Model 1: Full-time Employees			Model 2: Part-time Employees		
	Mean	Min	Max	Mean	Min	Max
Family status-married	93.2%	86.9%	98.9%	87.2%	75.5%	99.9%
Women	87.6%	86.9%	88.9%	78.5%	66.6%	89.4%
2 nd and 3 rd times in 2020	93.8%	87.1%	99.3%	79.2%	66.6%	95.8%
3 rd and 4 th times in 2020	94.1%	87.4%	99.4%	83.1%	71.0%	99.9%

Source: Author's calculation from Table 4.

Discussion

Summary of research

Stochastic frontier analysis was used to estimate wage models for Serbian workers, with preferences for full-time or part-time jobs incorporated into the models. In estimating the empirical model, both individual characteristics and job-related characteristics, including those that characterise the employer, are used. This approach determines the potential market wage an employee can earn, taking into account the above-mentioned characteristics (human capital, job-related, and employer-related). Using a sample of full-time and part-time employees, two models were estimated to determine the extent to which women can approximate the market-estimated value of their work, while accounting for factors that may contribute to the existing discrepancy. In other words, the difference between the realised and potential wage measures the inefficiency a worker experiences in earning the full market wage. The estimates of the variables in the stochastic frontier model explain workers' inefficiency in achieving their potential wage. Since the labour market in Serbia is characterised by persistent differences in wages between men and women, it was of particular interest to investigate whether this difference was significant during the COVID-19 pandemic and what characterises these differences between full-time and part-time workers, especially because women dominate in the latter practise and that the extent of this practise is far below the EU level, but also compared to CEE countries (Fitzenberger & de Lazzer, 2022).

Two main research hypotheses were investigated in this paper. The first hypothesis examines the extent and statistical significance of the gender pay gap, while the other hypothesis identifies the factors known to influence the pay gap. Consequently, it also examines whether these factors differ depending on the type of employment, i.e. full-time or part-time. These differences are hypothesised based on previous studies, which raises the question of potential factors on both the supply and demand

sides, mainly reflected in employees' preferences and employers' working conditions (Mumford & Smith, 2009; Schaffer & Westenberg, 2019).

Theoretical contributions

Results revealed that, in general, women who work full-time are more efficient at achieving their wage potential than men, but the findings can vary from country to country. Ángeles Díaz & Sánchez (2011) examined gender pay differences using a full sample of part-time and full-time employees and showed that in countries with a larger proportion of female part-time employees, such as the United Kingdom (33.7%), Germany (23.1%) and Italy (21.9%), the average deviation of women's realised wages from potential market wages compared to men is greater than in countries with a lower proportion of part-time workers, including Spain (16.7%) and France (16.6%). These estimates are significantly higher than the results for Serbia obtained in this study, which divided the sample of wage earners into full-time and part-time workers and found that the inefficiency of women in achieving the potential wage compared to men is 9.3% and 19.8% for the first and second practise, respectively. These results confirm the existence of the gender pay gap as well as some discriminatory factors that prevent women from achieving the full market wage compared to men, and confirm the main research hypothesis. An alternative explanation may be warranted regarding workers' behaviour, especially those with part-time jobs. The efficiency of workers increases with the length of their time in the sample, indicating that they are less reluctant to provide more accurate information about their wages. These workers may also have more innate skills, better self-awareness of market challenges, and are, on average, better educated and more willing to adapt to the situation (Almeida et al., 2021; Nivakoski & Mascherini, 2021; Zoch et al., 2022). Other explanations can also be found in the literature. Although women are more responsible, they may lack characteristics that make them more successful in management. Based on a sample of Serbian medium-sized manufacturing companies, Stevanović & Simović (2017) found that women are less successful in management than their male counterparts.

Human capital factors largely determine the wage structure of full-time employees, while only a high level of education is an important factor for the wages of part-time employees. Permanent contracts play an important role in determining the wages of full-time employees, while this type of contract is not associated with part-time employment. On the other hand, supervisory functions are important for both employee groups. On the employer side, regional diversity, private ownership, and industry type can positively contribute to wage levels for full-time employees. For part-time employees, on the other hand, employment in private-sector companies can lead to lower average wages. This confirms the second research hypothesis that employees are guided by different factors when choosing between full-time and part-time employment.

In addition, the low participation and employment rate of women in the Serbian labour market can also be seen as a merit, which may lead to a lower gender pay gap, meaning that the observed discrepancies could be even greater. Similar explanations are used to justify the lower gender pay gaps in some European countries (e.g. Aldan, 2021; Alaez-Aller et al., 2015; Amate-Fortes et al., 2021). Ognjenović (2024), for example, using the same household-based SILC data for Serbia, found that women earn, on average, between 9.8 and 10.9 percentage points less than their male counterparts, controlling for the same set of explanatory variables. In addition, Ognjenović (2021) disaggregated the gender pay gap and estimated the unexplained portion of the gap to be 12.1%, indicating discriminatory practices in the determination of women's wages. On the other hand, Zajíčková & Zajíček (2021)

found relatively high and persistent gender pay gaps in the Czech labour market by examining the period 2006-2017 using SILC data. The authors found a difference of over 30% between men's and women's wages, largely due to differences in rewards between the two groups (exceeding 20%), which may also indicate gender discrimination.

Limitations

The present study has several limitations related to the methodology used and, above all, to the data, which should be addressed to better understand the results and to highlight possible causes. However, apart from these limitations, the results of the present work are quite consistent with previous research on this topic conducted with Serbian data. They are listed below, but not necessarily in order of their importance.

One limitation of this paper is that it uses a pooled sample of respondents. The main reasons for this are the short time dimension, covering only two years (2019 and 2020), and the constraint on data availability for monthly wages and hours worked, which prevented the direct calculation of net wages per hour (which were transformed using logarithms).

Certainly, the longitudinal dimension of the data would allow the inclusion of information on unobserved effects in the analysis of wage differentials. However, in this paper, variables are derived to indicate the frequency of an employed person's appearance in the survey. These variables are included in the inefficiency part of the wage model.

One of the limitations of this paper is the lack of responses, especially for categorical variables, which certainly affected the reduction in the number of units in the sample (5,507 and 101 for full-time and part-time employees, respectively), although the initial filtering of sample units included the non-negative values for wages and hours worked.

In addition, the number of explanatory variables differs between the two models estimated for full-time and part-time employment, which could also be seen as a limitation of the current study. For example, the occupational structure variable is excluded from the wage model for part-time employees, as are dummies representing the size of the enterprise in which a part-time employee works.

The fact that a comparison with other European countries, analysing the gender pay gap based on the Structure of Earnings Survey over a long period of time, is not possible is also a limitation of the present study, as this survey has been conducted only a few times in Serbia.

However, all these limitations were highlighted in the paper and can serve as a guideline for further studies on the pay gap. Of course, the analysed wage models for both full-time and part-time employees include all relevant variables from the data set used in the analysis and are supported by theoretical and empirical foundations from similar studies conducted in other countries or groups of countries, which are highly cited in this paper.

Concluding remarks

This paper uses the stochastic frontier model to identify the discrepancy between men's and women's wages and to show the differences in women's efficiency in earning potential market wages, as measured by an indicator variable representing female workers included in the inefficiency part of the wage model. The results of applying this approach confirm a statistically significant difference between men's and women's wages, indicating that workers differ in their efficiency, as measured by the gap between their realised and potential wages. These findings may have implications for public social and family policies that address women's financial

vulnerability in the labour market, but they may also inform management to be aware of differences in preferences based on family situation, career choice, and many other factors.

The aim of this paper was therefore to investigate the extent and statistical significance of the gender pay gap in Serbia separately for full-time and part-time employees in the context of the COVID-19 crisis. The data used come from the household-based SILC research for Serbia for the period 2019-2020, which covers the potential impact of the COVID-19 pandemic. The results confirm that full-time and part-time employed women receive 9.3% and 19.8% less than the potential market wage they could receive compared to men. Both estimates are statistically significant at conventional levels. These measures of the gender pay gap are consistent with some previous research for Serbia, but may be lower compared to other European countries and neighbouring countries with similar institutional frameworks (family support laws, minimum wage, treatment of various sources of discrimination, etc.), depending in part on the activity of working-age women in the labour market. The Serbian labour market is characterised by a relatively low participation rate (65.6%) and employment rate (58.9%) of women of working age, but they have a higher share of part-time jobs than men, as shown by the rates of 6.6% and 5.4%, respectively, from the LFS data for 2023.

In addition, this paper addresses important questions to determine whether women, especially during the recent crisis, are less likely to convert their human capital into higher wages, both in full-time and part-time work. In this context, all available explanations of how age, work experience, and health status influence wages over the life cycle are used. On the other hand, the deviation of realised wages from potential wages may also depend on the supply of jobs, on the demand for certain occupations, which can be a gateway to the labour market but also a barrier, especially in times of crisis, on employers' reluctance to hire, on government subsidies to boost income and demand and to help enterprises overcome the difficulties caused by uncertainty, on workers' willingness to accept permanent or more flexible contracts, and on many other factors that are beyond the scope of this paper. Further research could therefore address some of these issues that have not yet been sufficiently clarified in the literature.

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Appendix

Table A1

Descriptive Statistics of Variables and Tests of Differences between Full-time and Part-time Employees

Variable	Full-time		Part-time		Differ- ence	95% CI	
	Mean	S.D.	Mean	S.D.		lower	CI upper
Wages, log of	5.455	0.425	5.812	0.661	-0.357***	-0.488	-0.226
Age, no.	43.302	11.350	43.535	11.051	-0.232	-2.434	1.969
Experience, no.	16.302	11.049	14.089	10.343	2.213**	0.151	4.276
Low education, %	0.075	0.265	0.039	0.196	0.036	-0.003	0.075
Secondary education, %	0.730	0.444	0.515	0.502	0.215***	0.117	0.313
High education, %	0.194	0.396	0.446	0.499	-0.251***	-0.349	-0.154
Permanent employment, %	0.811	0.391	0.535	0.501	0.277***	0.179	0.375
Responsibility, %	0.147	0.354	0.079	0.271	0.068*	0.015	0.122
Health status, %	0.021	0.144	0.049	0.218	-0.028**	-0.071	0.014
Region Serbia-North, %	0.451	0.498	0.564	0.498	-0.113**	-0.210	-0.015
Thinly populated, %	0.313	0.464	0.337	0.475	-0.024	-0.117	0.069
Intermediate populated, %	0.292	0.455	0.406	0.493	-0.114**	-0.211	-0.018
Densely populated, %	0.395	0.489	0.257	0.439	0.138***	0.052	0.224
Micro enterprise, %	0.322	0.467	0.436	0.498	-0.113**	-0.211	-0.016
Small enterprise, %	0.461	0.498	0.426	0.497	0.035	-0.062	0.132
Medium and large enterprise, %	0.217	0.412	0.139	0.347	0.078*	0.010	0.146
Privately owned, %	0.319	0.467	0.208	0.408	0.112**	0.032	0.192
Agriculture, %	0.019	0.138	0.030	0.171	-0.010	-0.044	0.023
Industry, %	0.388	0.487	0.109	0.313	0.279***	0.217	0.342
Services, %	0.592	0.492	0.861	0.347	-0.269***	-0.338	-0.201
Unemployed, %	0.061	0.238	0.139	0.347	-0.078***	-0.146	-0.011
Managers, %	0.158	0.365	0.429	0.497	-0.270***	-0.369	-0.172
Technicians, %	0.367	0.482	0.326	0.471	0.041	-0.053	0.135
Skilled, %	0.344	0.475	0.112	0.317	0.23***	0.168	0.295
Elementary, %	0.131	0.337	0.133	0.341	-0.002	-0.070	0.066
Family status-married, %	0.646	0.478	0.663	0.475	-0.018	-0.111	0.075
Woman, %	0.445	0.497	0.653	0.478	-0.208***	-0.302	-0.114
No. of obs.	5,507		101				

Source: Author's work

Note: (***, **, *) stands for the statistical significance at the 1%, 5% and 10% level, respectively. Different tests are performed for nominal values of the variables and for proportions. The *t*-test is based on the assumption of unequal variances. Standard deviation (SD) for dummy variables is calculated using the formula $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$. For the occupational dummies in part-time employment, the actual number of observations is 98.

About the author

Kosovka Ognjenović is a senior research associate at the Institute of Economic Sciences, where she has worked for more than 12 years. She holds a PhD in economics from the Faculty of Economics of the University of Belgrade. Her area of expertise is labour economics, with a particular focus on labour market imbalances, gender gaps and in-work poverty. In her recent research articles, Dr. Ognjenović analyses gender wage gaps, the impact assessment of employment policies and the propensity of young people to entrepreneurship. She is an active member of several economic associations. The author can be contacted at kosovka.ognjenovic@ien.bg.ac.rs.