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Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Matuszewska-Janica, A., & Witkowska, D. (2021). Differences between determinants of men and women monthly wages across fourteen European Union states. *Equilibrium : Quarterly Journal of Economics and Economic Policy*, 16(3), 503-531. <https://doi.org/10.24136/eq.2021.018>

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ORIGINAL ARTICLE


Citation: Matuszewska-Janica, A., & Witkowska, D. (2021). Differences between determinants of men and women monthly wages across fourteen European Union states. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 16(3), 503–531. doi: 10.24136/eq.2021.018

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Article history: Received: 10.02.2021; Accepted: 15.07.2021; Published online: 30.09.2021


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Differences between determinants of men and women monthly wages across fourteen European Union states

JEL Classification: J31; C20

Keywords: labour market; wages; wages determinants; differences in men and women wage determinants; ordered logit model

Abstract

Research background: There is a broad discussion in the literature on the situation of men and women in the labour market, especially about the differences in their remuneration. Due to the fact that females constitute a slightly different group of employees, certain factors have different impacts on the level of their remuneration in comparison to male employees. Hence, the question arises which factors cause these differences and how large the dissimilarities are.

Purpose of the article: The aim of the presented study is to diagnose and evaluate differences in the impact of designated determinants on the level of monthly wages of women and men in selected European Union member states. The novelty of our approach consists in both comparison of the intensity of influence examined factors to men's and women's earnings, and a global approach to the remuneration of male and female employees.

Methods: Due to the nature of the dependent variable (remuneration decile, which is a variable measured on an ordinal scale), the ordered logit model is applied in the analysis. The data comes from the Eurostat's Labour Force Survey.

Findings & value added: Presented results indicate that many factors have significantly different intensity of impact on the level of men and women wages. However, significant differences

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between parameters estimated for both genders are visible for the group of family variables the most often, then for variables describing the condition of work, the human capital variables, and characteristics of the workplace. This paper adds to the empirical literature a new approach to measure the intensity of factors influencing men and women wages. In addition, our investigation is a cross-country analysis.

Introduction

The situation of women and men in the labour market is widely discussed not only in the public space but also is investigated by researchers. Numerous studies show that male and female employees differ by numerous features concerning personal and workplace characteristics. Structure of employment by economic activities may be a good example, since more feminised (e.g., education or health care) and more masculinised (e.g., mining or construction) sectors are distinguished. It is also observed that women are more likely than men to choose jobs in the public sector and part-time work which is related to the traditional roles of both genders in society.

European Union member states are characterized by different levels of socio-economic development, structure of the labour market, average incomes, regulations concerning diversity in employment (e.g., quotas which influence the position of women in management), tradition and attitude to women's professional work (for instance the relatively high employment rates in communist countries which affects women's activity in labour market in post-communist countries). However, female employees are usually in a worse position than their male colleagues, and gender-based employment segregation is pervasive everywhere. Considerable differentiation in gender pay gap is also observed among EU states.

Remuneration seems to be the most important determinant of economic well-being and personal success. Wages are determined by many factors connected with personal features, general situation on labour market, socio-economic development, legislation, social norms, and tradition. Due to the variety of factors influencing earnings, it is impossible to take them all into account simultaneously.

The presented study is an extension of the analysis presented in (Witkowska *et al.*, 2019). In this study we assess the impact of selected factors on the level of remuneration of employees (regardless gender) from 14 distinguished European Union member states, indicating similarities and differences between them. The aim of the presented study is to diagnose and evaluate differences in the impact of designated determinants on the level of monthly wages of women and men in selected European Union member states. The novelty of our approach consists in both comparison of

the intensity of influence examined factors to men's and women's earnings, and the global approach to the remuneration of male and female employees in terms of application variables describing employees — their abilities and family situation, workplace and environment observed in different countries. The considered factors, apart from those usually used in the analyses, also include the field of education, care of the elderly in addition to that of children and type of job contract. Database for the investigation contains microdata from the Labour Force Survey (LFS). Analyses are conducted applying ordered logit models describing the monthly wage decile, which is used by Eurostat as a remuneration proxy. Models are estimated for male and female employees from the selected EU states separately. The differences between the strength of the certain factor's influence on incomes of men and women are verified using so-called Z test.

The article is organized as follows. In the following section, the literature overview is presented. The research methodology section contains description of applied models and variables used to their construction. In the succeeding section, the obtained results are reported and discussed. The last section summarizes our considerations.

Literature review

From an economic point of view, wages are considered as a price of labour. Thus, they are determined, like all prices, by supply and demand (Hicks, 1963, p. 1). On the one hand, remuneration ensures the livelihood of employees, and on the other hand, it is an important factor in the functioning of the organization. In general, well-paid workers are highly likely to do a better job than those who are not well-paid (Mosley *et al.*, 2015). Therefore, wage levels and wage differentials between workers depend on the employee's workload and output (effects). In addition, the wage level is highly related to the country's socio-economic development (Kessler, 2013). Also, appropriate, i.e. clear and acceptable to employees, remuneration schemes should be applied at employer level. This makes the set of wage determinants very large and often many of these factors are difficult to quantify.

Remuneration determinants and differences in wages are considered against the various economic, sociological and psychological theories. Three of them are taken into account the most often in the economic literature.

The first one is human capital theory (HCT), which was formulated by Schultz (1961) and Becker (1964), and developed by Mincer (1974) among

others. Human capital is pointed as the main determinant of the remuneration level in this theory. It is composed of such attributes as education, job experience, job tenure, skills, intelligence, etc. An individual who is better endowed with such characteristics will potentially receive a higher remuneration. Therefore, education is seen as an investment because it prepares the workforce in such a that their potential can be used to increase productivity (Nafukho *et al.*, 2004, see also Lucas, 1988 & 1990; Gajdos *et al.*, 2020).

The second theory is related to discrimination and is developed by Becker (1957). The discrimination theory refers to the situations where employees are perceived by the employer by attributes that have no impact on the work they do. Then they are evaluated less favourably by that employer than employees with different characteristics. Such attributes mainly include the employee's gender, race or age (Becker, 1957). This in turn results in restricting the access of discriminated workers to a better job position or paying higher wages, etc. (D'Amico, 1987).

Becker's approach is described in the literature as the “taste for discrimination” (Oettinger, 1996; Nyhus & Pons, 2012). However, as Oettinger (1996) points out, the economic literature is reluctant to explain the gender wage gap through differences in “tastes”. For this purpose, the concept of so-called statistical discrimination and informational models of discrimination is used (Phelps, 1972; Arrow, 1974; Aigner & Cain, 1977; Milgrom & Oster, 1987). Statistical discrimination theory assumes that employers have limited (imperfect) information about the skills of potential employees. Therefore, they use characteristics that are easily observable, such as gender or race, to assess an employee's productivity (Autor, 2003). Thus, no bias is assumed in statistical discrimination. It is specific to this approach that employers use average group characteristics to predict the characteristics of individual employees. Thus, no bias is assumed in statistical discrimination. Since employers use average group characteristics to predict the characteristics of individual employees (Schwab, 1986). Signalling theory should be mentioned here (Spence, 1973, 1974; Karasek & Bryant, 2012). This theory assumes that employers act under uncertainty when hiring an employee and that the hiring process is like a lottery. From the employer's perspective, the uncertainties of the hiring process can be better explained by personal attributes that are observable. These attributes are referred to as signals. Among such observable attributes, Spence includes race, gender, education, etc.

The population of workers differs not only in terms of job characteristics and individual abilities, but also in terms of characteristics that are difficult to measure and concern a key issue in the choice of a job or profes-

sion, namely preferences. Based on this observation, the theory of preferences is formulated and developed by Hakim (1998, 2004, 2006, see also Charles & Grusky, 2004). Different position on the labour market, and hence differences in pay may also be caused to some extent by preferences in lifestyle choices, particularly education and employment choices, which determine the labour market activity (Hakim, 2004). This is particularly the case for women, who are generally burdened with reconciling family and professional roles to a greater extent than men.

Earning determinants can be divided into three groups. The first group concerns general environment characteristics, like regional economic situation, situation on the local labour market, structure of the local labour market, government policies facilitating mothers' return to the labour market, etc. The second group is related to the workplace characteristics. We can mention here such features as economic sectors, public or private sector, activity of the trade unions, size of the enterprise among others. The last group includes the individual employee's attributes. They are for example occupation, the type and level of education, job seniority, age, type of job contract, full- or part-time job, sex, family social and economic status, preferences. Knowledge of the wages determinants is an important element of the labour market analyses. It makes it possible to assess the differentiation of labour market positions between different groups of employees (cognitive aspect) and allows to formulate the remuneration policies and strategies (practical aspect). As it was mentioned before, it is not possible to include in the quantitative analyses all (even known) factors affecting the level of remuneration. This is due to the difficulties in measurement of some characteristics and limitation of the availability of datasets. As a consequence, basically all studies related to this topic are limited to the analysis of the certain selected and available variables.

Gender as a factor differencing wages is widely discussed in the literature (Blau & Kahn, 2017; Blau & Winkler, 2017; Christofides *et al.*, 2013; Goraus *et al.*, 2017; Kompa & Witkowska, 2018; Kunze, 2005; Landmesser, 2019; Matuszewska-Janica, 2014; Weichselbaumer & Winter-Ebmer, 2005 and many others). The wage differences between men and women result mainly from sectoral and occupational segregation. Various studies show that interindustry wages also vary considerably (i.e. Dickens & Katz, 1987; Thaler, 1989). The overlapping of these situations makes the economic sector an important factor differentiating men and women wages. The analysis conducted for Poland indicates that this variable influences the level of wages of men than of women significantly (Matuszewska-Janica, 2020).

Other factors of gender income inequality are the limitation of working hours by women and female segregation into low-wage jobs. Women more often than men choose part-time work (Bardasi & Gornick, 2000; Hill *et al.*, 2004) and more often work in the public sector (Barón & Cobb-Clark, 2010). The increasing number of years of work experience among women has been observed since many decades (Blau & Kahn, 2017; Kunze, 2018). The statistics show that the female labour market activity rates have risen considerably. Women also remain professionally active for longer, which usually results increasing remuneration. It should also be noted that women much more rarely than men occupy managerial positions with high incomes (e.g. Cohen & Huffman, 2007, Kompa & Witkowska, 2018).

The gender pay gap is analysed using a variety of methods. Usually, the unadjusted wage gap is decomposed into explained and unexplained parts of the gap. The most popular method is the Oaxaca-Blinder decomposition (Oaxaca, 1973; Blinder, 1973) and its extensions. Other decomposition methods, applied in this context, are reported by Ñopo (2008) or Fortin *et al.* (2011) among others. Another popular technique of gender pay gap investigation is to analyse wage differences along the distribution of remuneration (e.g., Garcia *et al.*, 2001; Gardeazabal & Ugidos, 2005; Landmesser, 2017, 2019). These methods also allow us to identify the factors that contribute to the gender pay gap (Blau & Kahn, 2017; Chevalier, 2007). Indirectly, it also gives knowledge about the determinants of the level of remuneration. However, these techniques do not give a clear answer to the question whether the differences in the strength of the impact of factors are significant. In this article, we propose to solve that problem by comparing the parameters of the models, estimated separately for men and women.

Research methodology

In the studies conducted so far on the factors differentiating wages of women and men, the authors mainly used data from Structure of Earnings Survey (SES). In our research, we use Eurostat Labour Force Survey (LFS) individual data, because this database, unlike SES, contains information concerning the family situation¹ of the respondent, among other information.

¹ “Family variables”, such as the number of children and number of individuals aged 65 or older in the household or the marital status, etc., are important wages determinants (e.g., Korenman & Neumark, 1992; Waldfogel, 1997).

Remuneration in LFS is represented by the decile number of the monthly salaries paid out in the main workplace. Therefore, the ordered logit model is an adequate method of analysis (Grilli & Rampichini, 2014; Hausman & Ruud, 1987 among many others). The ordered logit model (OLM) is a regression model for an ordinal response variable (Grilli & Rampichini, 2014) and it is an extended specification of the binary model over a larger number of categories of the explained variable. The observed explained variable is an ordinal variable y_i which is a restricted notation of some unobserved continuous variable y_i^* . Whereby we assume that y_i^* is a linear function of the explanatory variables:

$$y_i^* = \mathbf{x}'_i \boldsymbol{\beta} + \varepsilon_i \tag{1}$$

where:

- $\boldsymbol{\beta}$ vector of models parameters $\boldsymbol{\beta} = [\beta_1, \beta_2, \dots, \beta_k]$;
- \mathbf{x}'_i vector of explanatory variables $\mathbf{x}_i = [x_{1i}, x_{2i}, \dots, x_{ki}]$;
- y_i^* explained variable which is a continuous latent (not measured) and it is represented by the observed ordinal variable y_i ;
- i number of observation;
- ε_i error term.

$$y_i = j \Leftrightarrow \kappa_{j-1} < y_i^* \leq \kappa_j \tag{3}$$

where:

- κ_j threshold points; $j = 1, \dots, J$ number of threshold points (number of categories of the variable y_i).

In the presented study $J = 10$, because the observed variable takes the values of the subsequent deciles of monthly wages (as is defined in the LFS database).

The ordered logit model describes the probability that the i -th observation of an observed variable y_i takes on a value equal to j :

$$p_{ij} = P(y_i = j) = \frac{\exp(\kappa_j - \mathbf{x}'_i \boldsymbol{\beta})}{1 + \exp(\kappa_j - \mathbf{x}'_i \boldsymbol{\beta})} - \frac{\exp(\kappa_{j-1} - \mathbf{x}'_i \boldsymbol{\beta})}{1 + \exp(\kappa_{j-1} - \mathbf{x}'_i \boldsymbol{\beta})} \tag{3}$$

Explanatory variables represent 14 features (see Table 1), belonging to the previously described groups, and they are measured using different scales. Nine of them are coded as binary variables for different variants of variables. The reference variants of variables are omitted in the models, but

they are presented in Table 1, together with the number of all variants distinguished for each characteristic.

Economic activity of the workplace ($NACE_{ij}$) represents the selected major groups taken from Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE rev. 2. Variants included in the analysis are as follows: j = (A) — agriculture, forestry, and fishing; (B) — mining and quarrying; (C) — manufacturing (reference variant); (D) — electricity, gas, steam and air conditioning supply; (E) — water supply, sewerage, waste management and remediation activities; (F) — construction; (G) — wholesale and retail trade, repair of motor vehicles and motorcycles; (H) — transportation and storage; (I) — accommodation and food service activities; (J) — information and communication; (K) — financial and insurance activities; (L) — real estate activities; (M) — professional, scientific and technical activities; (N) — administrative and support service activities; (O) — public administration and defence, compulsory social security; (P) — education; (Q) — human health and social work activities; (R) — arts, entertainment and recreation; (STU) — other service activities.

Occupation — job position is represented by the variable $ISCO_{ij}$ according to the current version of the International Standard Classification of Occupations (ISCO-08). The variants of $ISCO_{ij}$ represent the major groups of this classification: (1) — managers; (2) — professional; (3) — technicians and associate professionals; (4) — clerical support workers; (5) — service and sales workers; (6) — skilled agricultural, forestry and fishery workers; (7) — craft and related trades workers; (8) — plant and machine operators, and assemblers; (9) — elementary occupations (reference variant).

To reflect the impact of the field of education on the level of remuneration, we use the variable $EduF_i^j$, which is a set of 14 binary variables representing the following fields: $EduF_i^1$ — General programs and qualifications or unknown qualifications; $EduF_i^2$ — Teacher training and education science; $EduF_i^3$ — Humanities, languages and arts; $EduF_i^4$ — Foreign languages; $EduF_i^5$ — Social sciences, business and law; $EduF_i^6$ — Science, mathematics and computing (no distinction possible) or Mathematics and statistics; $EduF_i^7$ — Life science (including Biology and Environmental science); $EduF_i^8$ — Physical science (including Physics, Chemistry and Earth science); $EduF_i^9$ — Computer science or Computer use; $EduF_i^{10}$ — Engineering, manufacturing and construction; $EduF_i^{11}$ — Agriculture and veterinary; $EduF_i^{12}$ — Health and welfare; $EduF_i^{13}$ — Services. One should notice that Eurostat in LFS identifies fields of education only for

individuals under 34 or with at most 15 years after graduation. Thus, the reference variant $EduF_i^{14}$ involves a substantial group of individuals over 34 or with 15 years after graduation or individuals with not higher than secondary education. Such a definition of this variable does not fully represent the field of education of the i -th individual, but nevertheless it constitutes a certain point of reference.

Size of the workplace ($SIZE_{ij}$) is measured by the number of employees. The number of variants of this variable depends on the country and ranges from 2 to 6. The reference variant, i.e., the workplace with 1–49 of employees, is the same for all countries. Other variables regarding qualitative features have two or three variants and are described in Table 1. The variable (Edu_i) is ordinal, whereas the rest of them are quantitative variables.

Research is provided for 14 European Union member states², listed in Table 2. These countries were selected on an arbitrary basis. Half of them are post-communist countries being “new” members of EU (NM10), whereas the others are “old” members of UE belonging to the group EU15. Chosen countries represent different levels of economic development and standard of life. They also differ by population, geographic location, historically conditioned tradition, family policy, and legal regulations concerning the position of women in the labour market (such as quotas).

The ordered logit models are estimated by the maximum likelihood method (using GRETl), separately for male and female employees in each considered country. LFS microdata from 2014, concerning only individuals who achieved income from work in the period when the survey was made, created the estimation sample.

To find out if the impact of distinguished factors is the same for both genders, so-called Z test statistic is used. This test verifies the hypothesis about the equality of two parameters in regression models (estimated for men and women separately), i.e.

$$H_0 : \beta_i^1 = \beta_i^2$$

$$H_1 : \beta_i^1 > \beta_i^2 \quad \text{or} \quad H_1 : \beta_i^1 < \beta_i^2$$

and the test statistics is as follows (Cohen, 1983; Paternoster *et al.*, 1998):

² The same countries were analysed in the study (Witkowska *et al.*, 2019).

$$Z_i = \frac{b_i^1 - b_i^2}{\sqrt{S^2(b_i^1) + S^2(b_i^2)}} \sim N(0; 1) \quad (4)$$

where:

β_i^1 parameter by i -th variable in the model estimated for women;
 β_i^2 parameter by i -th variable in the model estimated for men;
 b_i^1, b_i^2 estimators of parameters β_i^1 and β_i^2 , respectively;
 $S(b_i^1), S(b_i^2)$ squared standard error of estimated parameters b_i^1 and b_i^2 respectively.

Results and discussion

This study is an extension of the analysis presented in (Witkowska *et al.*, 2019), which aimed at assessing the impact of selected factors on the level of remuneration of employees (regardless gender) from 14 distinguished European Union member states, indicating similarities and differences between them. Applying logit models of monthly wages obtained by employees in each country, we analysed the influence of such factors as: gender, type of economic activity (according to NACE classification), occupation (due to ISCO), level of education (due to ISCED), age class, size of the workplace, contractual working time, job tenure, type of the employment contract and number of children (in the age groups) in the household. We concluded that there are essential differences among analysed countries in the strength of the determinants' impact on remuneration, especially between states being NM10 and EU15 countries. However, there are also similar tendencies observed for education, position — occupation, and gender in all investigated countries.

Interesting results were obtained for variables dedicated to parenthood. In the majority of NM10 countries, the presence of children in the household does not influence the chance for higher remuneration. Whereas in Romania and Slovenia, and also in the United Kingdom and Ireland, the variables describing the number of children aged 8–14 years old have a negative and significant impact on wages, in Germany, France, Greece and Italy usually a significant and positive effect of these variables is observed.

The research presented in this paper concerns in-depth analysis including separate considerations provided for both genders and the incorporation of additional (to the previous study) factors, such as field of education, keeping supervisory position, localization of the workplace in terms of degree of urbanization and number of children and individuals aged at least 65 in the

households. The aim of the presented investigation is to find out if the impact of the analysed factors to remuneration is different for both genders and among the considered countries.

The obtained results are presented in tables³ containing parameter estimates and information about significant differences between parameters in the models estimated for male and female employees, which is verified applying Z test. All hypotheses are rejected at the significance level 0.05. Significant variables are denoted by * and significant differences between parameters are denoted by -, +. The former informs that parameter estimated for women is significantly bigger than for man, the latter otherwise.

Parameter estimates together with results of Z-test relating to the education level and job tenure are presented in Table 3. All parameters at the variable representing work experience are significantly higher than zero. This means that a longer job tenure increases the chances of getting a salary from a higher decile (*ceteris paribus*). Our results show significant differences in parameters standing by the variable representing job seniority in the models estimated for male and female employees for 7 countries. In Poland, Romania, and Germany, a longer job tenure gives a significantly higher chance of getting a salary from a higher decile in a group of women than in the group of men. Whereas in Spain, France, Greece and Italy the situation is opposite. In the rest of the considered countries, the impact of job tenure on incomes does not significantly differ between male and female employees. It should be also mentioned that in all models, the parameters standing by square of job tenure are significantly less than zero. Therefore, the impact of the length of employment on the amount of remuneration is non-linear (it increases only to some extend).

In our study, the level of education influences remuneration significantly and positively in all models. In other words, a higher level of education increases the chances of getting a salary from a higher decile (*ceteris paribus*). This statement is in line with the results obtained by other researchers who show that differences in years of education and actual work experience explain a relatively large part of the unadjusted gender wage gap for a large range of countries (Kunze, 2018). The level of education is one of the variables influencing the level of remuneration considerably. Its meaning is most often interpreted against the background of the theory of human capital (Griliches, 1997 among others). It is also worth noting that higher education is a factor that prolongs women's labour force participation (Bielawska, 2019) which favours higher wages.

³ Due to the extensive nature of our analysis, in this paper we refer to selected results, mainly concerning differences in determinants of men and women remuneration. Detailed results are available under request.

The differences between parameters, standing by the education level in the models estimated for male and female employees, are statistically significant for 10 countries. In Poland, Germany, and Italy, the higher level of education of women gives a significantly higher chance of getting a salary from a higher decile than in the case of men. Whereas the opposite situation is observed in Bulgaria, Lithuania, Latvia, Slovenia, France Ireland and UK. In Estonia, Romania, Spain, and Greece, the impact of education to wages is similar for both genders. The obtained results indicate that the level of education has significantly different intensity of impact on remuneration obtained by men and women in a bigger number of countries than job tenure. It is also visible that both factors, i.e., professional experience and education, influence wages obtained by women more than men only in Poland and Germany among the examined states.

In the case of Poland, such conclusion is confirmed also by the analysis conducted using SES data (Matuszewska-Janica, 2020). Such a result can be interpreted that in the case of Polish women, education is a more important factor in achieving higher income than in the case of men. Some authors point that the gender wage gap reduction can be explained by increases in educational attainment among women (e.g., Kunze, 2018). However, the crucial role as a wage determinant is played not only by the level but also the field of education (e.g., Chevalier, 2007).

The variables representing the field of education allow to provide the detailed analysis only for respondents who were under 34 at the time of the survey, or they had finished their education not earlier than 15 years before the survey, or for respondents with at least secondary education. However, it should be noted that each binary variable is significant in at least one model. Table 4 contains information about significant differences between the parameters estimated for the group of men and women separately, and it is visible that the majority (65%) of differences is insignificant. In 25 cases of significant differences (i.e., 14% of all verified hypotheses), the field of study influences wages of women stronger than men and in 37 cases (21% of all verified hypotheses) the opposite situation is observed.

Education in science, mathematics, etc. is the only variable with insignificant differences between the parameters estimated for males and females in all countries. It is also visible that life science is the field of education with significant differences between the parameters observed only in the two countries. The fields of education with the biggest number of significant differences between the parameters are: humanities, languages and arts (in 8 countries), social sciences, business and law (- 8), health and welfare (- 7) and services (- 7).

When a comparison of countries is provided, we notice that the biggest number of significant differences between parameters estimated for both genders is observed in Slovenia with 8 fields of education, and the impact of these variables to wages is significantly bigger for females than for male employees. The opposite situation is observed in Poland, where significant differences between parameters are observed for 7 fields. The third place is kept by Estonia and Ireland with 6 fields of education which in majority show that the influence of this variable to remuneration is significantly bigger for men than women. The smallest number of significant differences is observed in Bulgaria (in one field), Latvia and Spain (in two fields). Despite the imperfection of this variable, there is a visible difference in the impact of the field of education on higher earnings obtained by men and women.

It is worth mentioning that almost all parameters relating to the variables representing occupation and job position are significantly greater than zero. Therefore, employees from distinguished groups ISCO1–ISCO8 have a greater chance to obtain remuneration from the higher decile than individuals classified as elementary occupations (ISCO9). These variables seem to be the most significant among wage determinants next to the economic activity of the enterprise (e.g., Kim & Sakamoto, 2008; Behr & Pötter, 2010; Matuszewska-Janica, 2020).

The differences in the corresponding parameters for the analysed groups of men and women are presented in Table 5. It is visible that the differences between parameters are significant for the majority of all verified hypotheses, i.e., for 74 cases (66%), but the right-tailed alternative hypothesis is taken only in 20 cases (i.e., 18% of all rejected null hypotheses) whereas the left-tailed alternative hypothesis is taken in 54 cases (48%). In all countries, except Poland and France, the majority of the models' parameters estimated for male employees are significantly bigger than the ones estimated for females. In the Baltic states, Bulgaria, and Italy, such situation concerns all verified hypotheses. One may also notice that in all countries but Poland, parameters are usually significantly lower in models describing women's wages than in the models estimated for men in a high-ranked group of occupations (ISCO1–ISCO4), whereas the situation in low-ranked groups of occupations (ISCO7–ISCO8) is the opposite.

Employees from high-ranked groups (managers and professionals) usually earn significantly more than others. In other words, the results show that the difference between the average wages of the mentioned professional groups ISCO1–ISCO4 and the ISCO–9 group is on average significantly lower in the group of women than in the group of men. For the ISCO 5–ISCO–8 groups, differences between parameters are insignificant in 30

cases out of 56, but among significant differences, 16 cases out of 26 show that women are more likely to be paid from the higher decile of earnings than men. Countries with positive differences in at least two of the ISCO groups among ISCO5 — ISCO8 are: Romania, Spain, France, and Italy, whereas only one ISCO group showed positive differences in Poland (ISCO5), Slovenia (ISCO6), Greece and UK (ISCO8). In the remaining five countries, these differences are usually insignificant or negative. In Poland, parameters standing by the variables ISCO1-ISCO5 are significantly higher in the female subsample which is in line with the conclusion that in Poland occupation has greater importance for females than for men employees (Matuszewska-Janica, 2020).

The chance of receiving a salary from the higher decile is much lower in the case of part-time workers than in the case of full-time employees (see Table 6). This is an obvious situation in the case of monthly wages, and it is the case in all the analysed countries with the exception of Romania (Ermisch & Wright, 1993; Bardasi & Gornick, 2008 present similar results). The influence of this variable to wages is significantly lower for women than men in eight countries: Estonia, Lithuania, Slovenia Germany, France, Ireland, Italy, the UK, whereas the opposite situation is observed in Poland. This situation may be caused by the diversified structure of men and women working part-time and full-time among EU countries. In addition, part-time employees can work with different intensities (the time worked can vary among respondents working part-time considerably).

Temporary work is also a premise for lower wages. In almost all the analysed samples, the parameters standing by this variable are significantly lower than zero. The exceptions are men in Romania and Greece (parameters are insignificant) and women in Romania (parameters are significantly higher than zero). Usually, temporary workers are people with lower-paid jobs. Taking into account the differences in parameters between the groups of men and women, less favourable situation in the case of women is diagnosed in the case of Slovenia, Germany, Spain, France, Greece, and Italy. Women with temporary contacts are more likely than men to earn wages from the higher decile only in Romania. In other countries, these differences are insignificant.

Supervisory position is significantly better remunerated in all countries except Estonia (for both genders the parameters by this variable are insignificant). Significant differences between the parameters estimated for men and women appear only in Slovenia and Italy, where the impact of this variable to wages is higher in the case of women than men.

Our research confirms the existence of significant differences of wages among economic sectors⁴. The differences in wages among countries are primarily influenced by the general economic situation and economic activity's structure, which are specific for each country. In turn, the income diversity among economic sectors results from the fact that different employees' qualifications are required, which are "valued" differently by employers.

It is also obvious that according to the different gender proportion of employees in the economic branches, this variable affects the remuneration of men and women variously. The results obtained for the variables representing economic activity, presented in Table 7, support this statement. It is visible that number of significant differences between parameters estimated for male and female employees essentially varies among economic activities. In general, significant differences are observed in 98 cases (i.e., 39% of all verified hypotheses), and the numbers of null hypothesis rejections in favour of right and left tailed alternative hypotheses are nearly equal. The biggest number of significant differences between parameters is observed for transport and storage (in 13 countries) and wholesale and retail trade (11), whereas for water supply all differences are insignificant, and only one country (UK) shows differences in the parameters for information and communication. Economic branch has a significantly bigger impact on women's wages than for men's ones for wholesale and retail trade (in 10 states), while there are no such effects in construction or accommodation and food services.

With regard to the analysed countries, significant differences between parameters are observed for the UK the most often (for 11 economic activities), while for Latvia there are only 3 sectors. It is not possible to make a clear judgement on whether the impact of the inter-industry effect on wage levels is more favourable for women or for men since it is strictly connected with the type of economic activity.

The impact of urbanisation on men and women wages is presented in Table 8. Parameters are negative in the majority of models, which means that in cities (which is the reference variant) the chances for higher remuneration are bigger than in localizations with lower degree of urbanization. Indirectly, this result is also confirmed by the differences in human capital represented in rural and urban areas, in favour of the urban ones (Wosiek, 2020; Rodríguez-Pose & Vilalta-Bufí, 2005). The higher representation of individuals with higher education in urban areas means that the expected

⁴ Such conclusions are presented by Dickens and Katz (1986), Krueger and Summers (1988), Thaler (1989), Malkina (2019), Chevalier (2007), Kunze (2008), Matuszewska-Janica (2020) among others.

average wage in these areas will also be higher. However, there are some cases when parameters, standing by the variables representing level of urbanization, are significantly positive. It happens only for female employees from towns and suburbs in Germany, Greece, and Italy and from rural areas in Italy. Women, working in enterprises located in towns or suburbs, may expect to be paid more than men in Estonia, Slovenia, Germany, Italy, Ireland and the UK, whereas the opposite situation is observed in Latvia. In turn, in rural areas this localization is more in favour of women in Estonia, Romania, Germany, France, Italy, Greece, and Ireland, but it is in favour of men in Lithuania.

The size of the workplace also significantly influences remuneration levels. Usually, the greater number of employees, the higher the wages are on average (Mellow, 1982; Oi & Idson, 1999; Schmidt & Zimmermann, 1991 among others). Our results confirm such a tendency⁵. However, the obtained results do not point to regularities in the differences in the impact of the workplace size on men and women wage levels among analysed countries. Previous research provided for Poland showed that size of the workplace has a bigger importance in the case of male employees than females (Matuszewska-Janica, 2020).

In our research, we also consider the family situation of employees, which is represented by three variables: marital status, the number of children in the household and the number of individuals aged 65 or older in the household. The results concerning these variables are presented in Table 9.

In the group of women, the parameters concerning the number of children in the household are usually significantly higher than zero (except Romania and Greece), which means that if the number of children under 15 in the household increases, working women are used to be classified to the higher decile of remuneration. In the group of men, analysed parameter is significantly higher than zero in Poland, Latvia, Germany, France, and Italy, whereas lower than zero in Romania and Slovenia.

The significance differences in the parameters of the models estimated for men and women are observed for 11 countries. In Poland and France, working women are less likely to be paid from a higher decile with the increasing number of children than men. The opposite situation is observed in 9 countries. In other words, our research detects the phenomenon of maternity being connected with the lower remuneration⁶ only in two countries. This situation may be the consequence of the fact that mothers decide to

⁵ We omit presentation of the detailed results because size of the workplace is defined in different way for different countries (see Table 1).

⁶ This phenomenon is called is called “motherhood penalty” (Gash, 2009; Gough & Noonan, 2013; Budig & Hodges, 2014 among many others).

stay in the labour market when they are well-paid, i.e., receive higher compensation for the lost benefits of staying at home with their children (Klasen & Pieters, 2012). Eberharter (2001) points that women living in high-income households limit their labour force participation in contrast to those from low-income households.

Variable, describing the number of persons aged at 65 or older in the household is included in our research because of ageing of European societies. This factor is not often included in models describing earnings. However, it is well-known that elder people require care which is usually provided by close relatives and friends. It is also known that the majority of carers either give up their jobs or look for “care friendly” one which is usually low-paid job (Viitanen, 2010; Bauer & Sousa-Poza, 2015; Witkowska & Kompa, 2019, 2020; Witkowska 2019). This phenomenon is visible in the majority of analysed countries since this variable is significant and has the negative impact to remuneration. Only in Germany its influence is significantly positive for both genders and in Romania this impact is positive for male employees. Significant differences in parameters in the models estimated for men and women are observed for 7 countries. In Poland and Germany, parameter standing by the variable describing the number of individuals „65+” in the household is significantly bigger in the models estimated for women than for men, whereas in Estonia, Lithuania, Slovenia, France and the UK situation is opposite. Results obtained for the number of the elderly are opposite to the number of children under 15 in the household.

Unmarried individuals usually earn significantly less than married or widowed, divorced, or legally separated, i.e., the reference variant of this variable. The opposite situation is observed only in case of men from Estonia and Latvia. In 10 countries (out of 14) these differences between the parameters evaluated for male and female employees are more favourable for men (women singles have a much lower chance of higher pay than in the group of men). The opposite situation is observed in Poland, and differences are insignificant in Lithuania, Slovenia, and Spain.

Conclusions

The aim of our research is the identification of determinants of male and female remuneration and to find out factors affecting both genders’ wages in different ways. Investigation is conducted for 14 EU states which lets us analyse the situation on the labour market in each country individually. In addition, different aspects concerning employers and employees, which are

divided into four thematic groups, are taken into account. The first group pertains to the human capital. It encompasses such variables as the level of education, job tenure and field of education. The second group includes variables describing employment conditions, i.e., type of occupation, supervisory position, type of employment contract, and contractual working time. The third group of variables concerns workplace, which is identified by economic sector, size of the workplace and degree of urbanisation of the workplace location. The last group includes variables dedicated to the family situation of employees, which is characterised by marital status, number of children aged less than 15 years old, and individuals aged 65 or older in the household.

The presented results indicate that many factors have significantly different intensity of impact on the level of men and women wages. However, significant differences between the parameters estimated for both genders are visible for the fourth group of variables the most often, i.e. in 2/3 cases, then for the second group in 49% of cases, the first one in 40% and in the third group in 39%.

Among the four distinguished groups of factors, the differences of the impact intensity are more favourable for women than for men (in 61 cases) more often than the opposite (48 cases) only for variables from the third group of determinants. The parameters standing by the variables are significantly bigger for male than for female employees in 48 cases among 84 for human capital factors; 74 cases among 97 if employment condition is considered, 61 cases among 109 for workplace characteristics and 17 cases among 28 for family situation.

Analysing the differences observed for each country, one may notice that only in Romania and Slovenia is the number of determinants, which have a significantly stronger impact on remuneration increase in the case of women than men bigger. The opposite situation is observed among other considered countries. In Spain and France, the number of factors more favourable for women than for men is the smallest (i.e., 3 among 17 determinants and 6 among 19, respectively). A similar intensity of distinguished factors influence to remuneration among the biggest numbers of determinates is observed in Bulgaria and Latvia, then in Spain and Lithuania, whereas Germany, Italy, and the UK are situated on the opposite side.

The situation of women in the labour market is the subject of numerous public debates and scientific studies, also improving their position as employees is a part of the EU strategies. Consequently, numerous political actions have been taken in this direction, both at the EU and the national levels. This study provides a better understanding of the factors affecting women's and men's wage levels. Taking into account the fact that numerous

studies show that women and men represent diverse groups of employees (according to their characteristics), we can find out how worker profiles (considering individual and employer characteristics) are related to wage formation (as it is pointed out in the report *Wages determinants in the European Union. Evidence from Structure of Earnings Survey. 2020 Edition*). The obtained results indicate that in this field there are significant differences in the determinants of women's and men's wages between EU countries. This, in turn, will imply that these differences should be considered when assessing national wage policies or equal opportunities in the labour market.

The main limitation of the analysis is the way of variables (describing the wage level) coding. Eurostat, in the EU-LFS (microdata), provides the wage values of respondents only as decile number. Therefore, we treat this variable as measured on an ordinal scale, which significantly limits the tools available in the analysis. Further, in the LFS the dependent variable (salary level) refers to monthly wages level, whereas in wage analyses, using wage levels per hour gives better results. However, when the dependent variable is coded on an ordinal scale, such conversion is not possible.

Further research will consider the intensity of impact of specific factors influencing men's and women's wages and its connection with the size of the pay gap.

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Annex

Table 1. Variables included in the models

No.	Variable	Group of variables	Num. of variants	Reference variant
1.	$NACE_{ij}$	Economic activity (NACE rev. 2)	19	Manufacturing (C)
2.	$ISCO_{ij}$	Occupation (ISCO-08)	9	Elementary occupations (ISCO 9)
3.	$FTPT_{ij}$	Contractual working time (full-time employment or part-time employment)	2	Full-time employment
4.	$TEMP_{ij}$	Type of employment contract (undefined duration or temporary duration)	2	Indefinite duration
5.	Edu_F_{ij}	Field of education (for respondents up to 34 years old)	14	Education at most ISCED3 or respondent elder than 34
6.	$SIZE_{ij}$	Size of workplace	2-6	Workplace below 50 employees
7.	$Superv_{ij}$	Supervisory position (yes/no)	2	Supervisory position = yes
8.	$URBA_{ij}$	Degree of urbanisation (cities/towns or suburbs/rural area)	3	cities
9.	$Maritalst_{ij}$	Marital status (single/married or widowed, divorced or legally separated)	2	Married or widowed, divorced or legally separated
10.	Edu_i			Ordinal variable
11.	Job_ten_i	Job tenure in years		Quantitative variable
12.	$Sqjob_ten_i$	Square of job tenure		Quantitative variable
13.	$HHNB14_i$	Number of children in the household		Quantitative variable
14.	$HHNBOLD_i$	Number of individuals aged 65 or older in the household		Quantitative variable

Table 2. List of countries with abbreviations and number of observations in each sample

NM10		No. of obs.	EU15		No. of obs.
Bulgaria (BG)	10529	Germany (DE)	197250		
Estonia (EE)	10667	United Kingdom (UK)	24029		
Lithuania (LT)	16899	Ireland (IE)	20099		
Latvia (LV)	14608	France (FR)	21426		
Poland (PL)	46013	Italy (IT)	151537		
Romania (RO)	62244	Spain (ES)	29719		
Slovenia (SI)	21480	Greece (EL)	34510		

Table 3. Parameters estimated for education and job tenure and significant differences between them in male and female subsamples

Country	Education			Job tenure		
	Female	Male	Diff.	Female	Male	Diff.
PL	0.43*	0.28*	+	0.06*	0.04*	+
BG	0.28*	0.38*	-	0.05*	0.06*	
EE	0.27*	0.30*		0.03*	0.03*	
LT	0.25*	0.41*	-	0.06*	0.06*	
LV	0.29*	0.43*	-	0.04*	0.03*	
RO	0.26*	0.26*		0.06*	0.03*	+
SI	0.56*	0.68*	-	0.08*	0.09*	
DE	0.57*	0.49*	+	0.07*	0.05*	+
ES	0.25*	0.25*		0.09*	0.11*	-
FR	0.46*	0.51*	-	0.07*	0.09*	-
GR	0.34*	0.32*		0.09*	0.14*	-
IE	0.28*	0.32*	-	0.06*	0.07*	
IT	0.34*	0.29*	+	0.05*	0.06*	-
UK	0.40*	0.46*	-	0.05*	0.06*	

Table 4. Significant differences between parameters standing by variables representing fields of education in male and female subsamples

Country	EduF_1	EduF_2	EduF_3	EduF_4	EduF_5	EduF_7	EduF_8	EduF_6	EduF_9	EduF_10	EduF_11	EduF_12	EduF_13	+	.	sum
PL	-	-	-							-	-	-	-	0	7	7
BG		-												0	1	1
EE			-	-					-	+	+		-	2	4	6
LT			+		+		-			+			+	4	1	5
LV	-					+		x						1	1	2
RO			-	+					x			+		2	1	3
SI		+		+	+		+			+	+	+	+	8	0	8
DE	+				-					+		+	+	4	1	5
ES				x					-			+		1	1	2
FR			-	-	-				-					0	4	4
GR		+	-	-	-							+		2	3	5
IE	-		-			-	-					+	-	1	5	6
IT				-	-		-						-	0	4	4
UK	-	-	-		-									0	4	4
+	1	2	1	2	2	1	1	0	0	4	2	6	3	25	37	62
-	4	3	7	3	6	1	3	0	3	1	1	1	4	37		
sum	5	5	8	5	8	2	4	0	3	5	3	7	7	62		

Note: x – parameter was not estimated because of lack of data.

Table 5. Significant differences between parameters standing by variables representing the level of job position estimated in male and female subsamples

Country	ISCO 1	ISCO 2	ISCO 3	ISCO 4	ISCO 5	ISCO 6	ISCO 7	ISCO 8	+	-	sum	
PL	+	+	+	+	+		-			5	1	6
BG	-	-	-	-	-					0	5	5
EE	-	-	-	-	-					0	5	5
LT	-	-								0	2	2
LV	-	-	-		-	-		-		0	6	6
RO	-	-	-	-		+	+	+		3	4	7
SI	-	-	-	-		+				1	4	5
DE	-	-	-	-		-		+		1	5	6
ES	-	-	-	-	+		+			2	4	6
FR				-	+	-	+	+		3	2	5
GR		-	-	-				+		1	3	4
IE	-	-	-	-	-					0	5	5
IT	-		-	-	+	-	+	+		3	4	7
UK	-	-	-	-				+		1	4	5
+		1	1	1	1	4	2	4	6	20	54	74
-		11	11	11	11	4	4	1	1	54		
sum		12	12	12	12	8	6	5	7	74		

Table 6. Parameters estimated for part-time work, temporary work and supervisory position, and significant differences between them in male and female subsamples

Co.	Part-time work			Temporary work			Supervisory position		
	F	M	Diff	F	M	Diff	F	M	Diff
PL	-2.92*	-3.43*	+	-0.67*	-0.62*		0.88*	0.91*	
BG	-2.78*	-3.10*		-0.71*	-0.53*		0.31*	0.41*	
EE	-3.19*	-2.68*	-	-0.73*	-0.48*		0.38	0.35	
LT	-3.55*	-3.26*	-	-0.45*	-0.46*		0.58*	0.62*	
LV	-2.34*	-2.57*		-0.91*	-1.14*		0.43*	0.47*	
RO	0.81*	0.50*		0.52*	-0.10	+	0.47*	0.49*	
SI	-3.26*	-2.33*	-	-0.93*	-0.67*	-	0.91*	0.78*	+
DE	-1.84*	-1.75*	-	-1.51*	-1.05*	-	0.66*	0.67*	
ES	-4.12*	-3.97*		-0.38*	-0.09	-	0.60*	0.58*	
FR	-3.03*	-2.48*	-	-1.15*	-0.94*	-	0.53*	0.42*	
GR	-3.17*	-3.15*		-0.35*	0.02	-	x	x	x
IE	-3.15*	-2.91*	-	-0.46*	-0.52*		0.67*	0.74*	
IT	-2.91*	-2.70*	-	-0.73*	-0.64*	-	0.74*	0.61*	+
UK	-3.38*	-2.73*	-	-0.39*	-0.32*		0.86*	0.79*	

Note: x - parameter was not estimated because of lack of data. F – female, M – male.

Table 7. Significant differences between parameters standing by the variables representing economic activity estimated for male and female subsamples

Econ.activ NACE	PL	BG	EE	LT	LV	RO	SI	DE	ES	FR	GR	IE	IT	UK	+	-	Sum +/-
A	+		-	-		-			-	+				+	3	4	7
B	-	+		-		-					-				1	4	5
D							+				+			+	3		3
E																	0
F	-								-							2	2
G	-		+	-	+	+		-	-	-		+	-	+	5	6	11
H	-	+	+	+	+	+		-	-	-	+	+	+	+	10	3	13
I				-			-	-	-		-			-		6	6
J														+	1	0	1
K					+			+						+	3	0	3
L		-	+								+				2	1	3
M											+	+			2	0	2
N	+	-	-			-	-	-				+	+	+	4	5	9
O	-	+		-		+	+	+			-		-		4	4	8
P			+	-				-	-	-			-	+	2	5	7
Q		+					-	-	-				-		1	4	5
R	-		+					-	-		-	+	+	+	4	4	8
STU						-	+				+	-		+	3	2	5
+	2	4	5	1	3	3	3	2	0	2	5	5	3	10	48	50	
-	6	2	2	6	0	4	3	7	7	3	4	1	4	1	48		
Sum	8	6	7	7	3	7	6	9	7	5	9	6	7	11	50		

Table 8. Parameters estimated for different levels of urbanisation and significant differences between them in male and female subsamples

Country	Urbanisation towns or suburbs			Urbanisation rural area		
	F	M	diff	F	M	diff
	PL	-0,19*	-0,14*		-0,32*	-0,31*
BG	-0,60*	-0,61*		-0,87*	-0,97*	
EE	-0,12	-0,30*	+	0,05	-0,14*	+
LT	-0,15*	-0,06		-0,45*	-0,26*	-
LV	-0,20*	0,04	-	-0,15*	-0,02	
RO	-0,11*	-0,15*		-0,22*	-0,47*	+
SI	0,10	-0,06	+	-0,06	-0,17*	
DE	0,04*	-0,20*	+	-0,16*	-0,42*	+
ES	-0,09*	-0,16*		-0,29*	-0,22*	
FR	-0,08	-0,13*		-0,09*	-0,24*	+
GR	0,07*	0,01		0,14*	-0,08*	+

Table 8. Continued

Country	Urbanisation towns or suburbs			Urbanisation rural area		
	F	M	diff	F	M	diff
IE	-0,10	-0,26*	+	-0,11*	-0,33*	+
IT	0,08*	-0,02	+	0,08*	-0,02	+
UK	0,06	-0,05	+	0,00	-0,11*	

F – female, M – male.

Table 9. Parameters estimated for family variables and significant differences between them in male and female subsamples

Co.	Number of Children			Number of the Elder			Marital status		
	F	M	diff	F	M	diff	F	M	diff
PL	0.02	0.1*	-	-0.11*	-0.19*	+	-0.11*	-0.42*	+
BG	0.15*	0.02	+	-0.03	-0.08		-0.19*	0.07	-
EE	0.22*	0.01	+	-0.51*	-0.26*	-	0.00	0.15*	-
LT	0.07*	0.06		-0.25*	-0.11*	-	-0.17*	-0.08	
LV	0.22*	0.12*	+	-0.04	-0.05		-0.02	0.15*	-
RO	-0.07*	-0.15*	+	0.03	0.05*		-0.25*	-0.13*	-
SI	0.13*	-0.17*	+	-0.11*	0.02	-	-0.15*	-0.23*	
DE	0.36*	0.03*	+	0.17*	0.06*	+	-0.98*	0.00	-
ES	0.04*	0.03		-0.1*	-0.13*		X	X	
FR	0.06*	0.13*	-	-0.49*	-0.29*	-	-0.41*	-0.05	-
GR	-0.03	-0.03		-0.01	-0.08*		-0.73*	-0.37*	-
IE	0.11*	-0.01	+	-0.41*	-0.34*		-0.33*	-0.06	-
IT	0.17*	0.09*	+	-0.11*	-0.14*		-0.51*	-0.04*	-
UK	0.11*	0.00	+	-0.11*	0.00	-	-0.56*	-0.16*	-

Note: x - parameter was not estimated because of lack of data; F – female, M – male.