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Factors affecting men's and women's earnings in Poland

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ABSTRACT

The situation of women in the labour market is subject to European Union policy. This is due to prevention of discrimination and promotion of sustainable growth and development. There is a large body of literature describing national and regional labour markets; however, research on the situation in post-communist countries is not provided so often. The goal and contribution to the existing literature is to fill the gap concerning investigation for the Polish labour market. The aim of the research is to identify determinants influencing wages in Poland and to find out if wages obtained by men and women depend on the same factors. Analysis is provided applying statistical analysis and ordered logit models based on the individual data from the Polish Labour Force Survey. The main determinants of wages in Poland are: gender, age or job seniority, level of education, size of firm and occupation. However, the influence of these factors in the following periods and samples (containing all, female and male employees) may be different. Women earn less than men in all education classes and in all NACE branches (NACE - Statistical Classification of Economic Activities in the European Community) branches and this disparity has increased over time. The most important factor of gender income inequality is female segregation into low-wage jobs.

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1. Introduction

Central and Eastern European states have been transforming their political and economic structures since 1989, when the radical set of reforms started in Poland (Keane & Prasad, 2006). The collapse of the centrally planned economies and the introduction of market reforms influenced the overall situation in all transitional states. The sudden exposure to competition from developed countries, together with the breakdown of traditional export markets, destroyed the prevailing national economies. The privatisation of state owned enterprises and implementation of market mechanisms were the main goals of the reforms introduced in post-communist countries.

It is worth mentioning that one of the main principles in centrally planned economies was full employment, i.e., lack of official unemployment. It caused that the labour markets

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in all communist countries were characterised by the excess demand for labour, low productivity, low mobility and occupational choice and distorted wage structure (Blanchflower, 2001; Freeman, 1994). Therefore, transition to a market oriented economy involved significant changes in the labour market. Another characteristic of the labour markets in the Soviet-bloc states was a high involvement of women in the labour force, which essentially declined when transformation of the national economies started. For instance, in Poland, the employment rate is still lower than it was in the late 1980s and in 2015 it was 67.8%, which is below the European Union (EU-28) average.¹

During transition, constraints on layoffs and redundancies were significantly reduced, thus unemployment appeared and there has been massive inter-sectoral reallocation of labour. The rapid rise of the private sector, which is far less unionised than the public sector and much less subject to regulations in terms of wage setting, has also resulted in greater labour market 'flexibility' in many dimensions.

After 25 years of economic transformation, the question of whether the situation in the labour market in Poland is similar to in the well-developed countries seems to be the natural issue, especially as the literature concerning the labour market in the post-communist states is not as rich as for other countries and is dominated by research concerning the early transition period. Therefore, the aim of our research is:

- to identify determinants that affect earnings in Poland,
- to find out if wages obtained by men and women depend on the same factors and
- to check if the wage determinants change in time.

This investigation applied statistical analysis covering 2001–2015 and ordered logit models, which are estimated by maximum likelihood method employing individual data from the Polish Labour Force Survey (PLFS) 2001–2009. The abovementioned goals are important to discover the objective reasons of gender wage inequalities in Poland. Our original research, which are conducted using individual data from PLFS, shows the structure of the labour market and wages in Poland. The investigation is provided in several planes, i.e., economic branches, occupational groups and level of education.

The paper consists of four sections. The first one contains a literature review regarding wages and gender inequality. The second section is dedicated to the description of the labour market in Poland in the years 2000–2015. Variables and data that are used to construct and estimate ordered logit models are presented in the third section. The fourth section contains a discussion on the results obtained applying the ordered logit models estimated for the selected years of analysis.

2. Literature review

The situation of women in the labour market is a subject of United Nations (UN) and European Union (EU) policy, as well as one of the goals formulated by governments in all developed countries. Prevention of discrimination against women has been included in many documents by the UN and EU (e.g., *Strategy for equality between women and men 2010–2015*). Gender discrimination may take a variety of forms (Kot, 1999, p. 225–226; Livanos & Pouliakas, 2009; McConnell & Brue, 1986, p. 290): wage discrimination,

discrimination in hiring, occupational segregation, educational gender segregation (human capital discrimination) when availability to different forms of training and education is not equal for both genders, thus reducing human capital.

A growing area of research attempts to collect direct evidence on gender discrimination in the labour market in two main ways. First, some studies have examined whether female workers earn less than comparable male workers within the same establishments and narrowly defined occupational categories. Second, a number of studies attempt to measure productivity of female and male workers directly to determine whether gender pay differences can be directly linked to productivity differences. The research presented by Gardeazabal and Ugidos (2005) and Young and Wallace (2009) could be two good examples. The main contributor to the gender pay gap is female segregation into low-wage occupations (Jurajda & Harmgart, 2007; Simón, 2010) and low-wage sectors (Matuszewska-Janica, 2014; Tzannatos, 1999).

The empirical results (Christofides, Polycarpou, & Vrachimis, 2010) show that a large part of the wage gap is not explained by employing features (i.e., age, education, marital status, number of children, child care details, working status, etc.). It is also visible that, in several countries, the unexplained gap is larger than the total, suggesting that female characteristics are superior to the male ones. Part of the literature shows that wage differentials are mainly explained by the female segregation into low-wage jobs (Daly, Kawaguchi, Meng, & Mumford, 2006); however, the existence of significant inter-industry wage differentials in all countries for both genders has also been documented, see Gannon, Plasman, Rycx, and Tojerow (2007) as an example. There are also studies that support the idea that gender pay gaps are typically bigger at the top of the wage distribution and that the gender pay gap differs significantly across the public and private sector wage distribution of each country (Arulampalam, Booth, & Bryan, 2004).

Witkowska, Kompa, and Matuszewska-Janica (2013) report an investigation regarding identification of factors affecting the gender earning gap in the EU member states, employing Structure of Earning Survey 2006 metadata. The authors conclude that increasing of the feminization rate and wage proportion in the certain branch (in comparison to the average earnings in the whole economy) causes an increase of the gender pay gap in the analysed sector. They also notice that gender earning disparities are generally smaller in post-communist countries in comparison to 'old' EU members. The relationship among wages, productivity and unemployment in new EU states is examined by Nikulin (2015). She found that there is no statistically significant correlation between wage and unemployment ratio in the majority of analysed countries. It was also shown that the trajectory of wage, productivity and unemployment rate in new EU member countries is diversified.

It is known that earnings also depend on the positions, especially in management of different levels, and employees' professional activity, including innovations. Therefore, interesting research concerning gender in creation of innovations is presented in Okoń-Horodyńska, Zachorowska-Mazurkiewicz, Wisła, and Sierotowicz (2015) since it shows the increasing role of women as the inventors of patents in the business enterprise sector of the leading EU countries in the long-term.

In the conclusion of the report on structure and changes in wage distribution in Poland in the years 1996–2006 (Marcinkowska, Ruzik, Strawiński, & Walewski, 2008), it is said that so-called 'skill-biased technical change', together with changes of the bargaining power of employees, have played an increasing role in wage setting, while the influence of factors

concerning economic branches decreased and concerning regions remained stable. The major underlying causes of inequality growth during transition in Poland are the change from centrally-planned wage setting to decentralised wage setting and radical structural and technological changes of the economy shifting labour demand from the public sector to private sector and from manual workers to professionals and highly-qualified workers.

Based on profound analysis made for the years 1989–2010, Brzeziński, Jancewicz, and Letki (2012) claim that both individual and household based indexes show that labour market participation declined in Poland. At the same time, all data sources agree that there was a substantial increase in earnings inequality. However, educational attainment has improved significantly over the last decade, i.e., the share of tertiary graduates almost doubled in Poland since 1997 (rising from 7.7% to 13.8% in the year 2008).

Śliwicki and Ryczkowski (2014) state that women in Poland receive on average from 10.1% to 14.6% lower wages in comparison to men, because of potential discrimination. However, the level of virtual discrimination might be a little lower due to sociological, psychological and social factors that were not considered for the decomposition.

Cukrowska (2014) proved that, although women have, on average, higher education than men, the former obtain lower salaries. The author claims that women accept lower wages because their self-valuation and self-esteem are lower than men's. This under-valuation may result from the anxiety that if women demand more they might not find a job. Due to research made by Kopycińska and Kryńska (2016), wage discrimination of women in Poland results mainly from shared values, cultural norms and traditional roles in society, which originate from the Christian-catholic tradition which is dominant in Poland. The authors claim that this discrimination is accepted by the vast majority in society.

3. Labour market in Poland

The aim of this section is to describe the structure of the labour market in Poland and changes which have been observed in the investigated period. The analysis of the Polish labour market is provided for the years 2000–2015 and considers employment and gender wage differences observed for the distinguished economic branches, the occupational groups and the level of education (see Tables 1–5).

Considering the structure of employment (Table 1), it can be noticed that 20–28% of Polish employees have been working in manufacturing, 14–15% in wholesale and retail trade, etc., 8–11% in education and 6–10% in health and social work. The most feminised NACE branches in Poland are:

- (1) health and social work: 81–83%;
- (2) education: 73% in 2000, 78% in 2010 and 78.6% in 2015;
- (3) financial intermediation: 68–70%; and
- (4) accommodation and food service activities: 66–68%.

According to the data in Table 2, professionals create the biggest occupational group containing 25% of all employees. The biggest share of women (57–67%) is among the professionals, service workers, clerks and the elementary occupations. In analysed time span, the highest increase of women's participation (nearly 10%) is observed for public government representatives, senior officials and managers, while the biggest decrease is visible for skilled

Table 1. Structure of employment by NACE codes of branches.

Economic NACE branches	Employment evaluated as the percentage share of:							
	All employees in the whole economy					Women employed in the branch		
	2001	2003	2006	2009	2015	2000	2010	2015
Agriculture, forestry and fishing	2.6	2.6	2.4	2.4	11.5	23.8	25.8	39.9
Mining and quarrying	3.5	1.8	2.1	1.6	1.5	×	×	9.8
Manufacturing	27.6	25.2	26.4	28.0	19.7	33.8	32.1	32.7
Electricity, gas and water supply	2.7	2.3	1.9	1.8	2.1	×	×	23.2
Construction	5.4	6.0	6.8	9.0	7.3	11.4	12.1	6.8
Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods	14.8	13.9	13.7	15.4	14.4	51.9	53.8	56.2
Transport, storage and communication	1.2	2.0	2.4	6.9	5.6	29.2	29.4	21.0
Accommodation and food service activities	5.5	6.7	7.6	2.4	2.1	66.1	65.3	68.4
Financial intermediation	1.6	2.2	2.1	2.3	2.4	69.8	70.3	67.8
Real estate, renting and business activities	4.5	5.0	5.2	1.2	1.1	44.5	48.1	46.9
Public administration and defence, compulsory social security	8.0	8.6	7.8	9.0	6.6	44.9	62.5	49.2
Education	8.7	11.5	10.4	10.9	7.7	73.2	77.5	78.6
Health and social work	10.3	8.9	7.9	8.0	5.9	82.5	82.8	81.2
Other community, social & personal service activities	3.4	3.3	3.5	1.1	1.5	53.1	57.6	63.6

Source: Own elaboration on the basis of PLFS and GUS - Polish Central Statistical Office (Rocznik Demograficzny, 2011).

Table 2. Structure of employment by large occupational groups by ISCO.

Large occupational groups by ISCO	Average share of employees	Share of women in the distinguished groups			
		Years			Change 2012/2008
		2008	2010	2012	
Total employment in millions		3.9	4.0	4.0	2.11%
Total employment as a percentage	100.0	49.0	50.1	49.8	1.78%
Public government representatives, senior officials and managers	7.5	40.9	44.9	44.9	9.75%
Professionals	25.4	66.7	67.5	67.1	0.62%
Technicians and associate professionals	11.7	59.8	56.1	55.8	-6.67%
Clerks	9.5	63.8	64.0	63.2	-0.96%
Service, shop and market sales workers	9.8	66.0	62.9	66.3	0.33%
Skilled agricultural and fishery workers	0.2	49.0	25.0	24.9	-49.11%
Craft and related trades workers	15.0	18.9	18.2	17.0	-10.35%
Plant and machine operators and assemblers	11.7	17.9	16.8	15.3	-14.59%
Elementary occupations	9.3	56.9	60.4	59.6	4.74%

Source: Own elaboration on the basis on the reports prepared by GUS.

agricultural and fishery workers (by 49%) and for plant and machine operators and assemblers (by 15%).

Comparison of the average wage structure by economic sectors as a percentage of average wages for the whole economy for each investigated period (Table 3) let us distinguish

Table 3. Structure of average wages by NACE codes of branches.

Economic branches	Average wages as a % of the average wage in the whole economy				Average women's wages as a % of the average men's wage in the branch				
	2001	2003	2006	2009	2001	2003	2006	2009	2014
Private farms in agriculture	91.6	92.5	66.9	66.5	100.5	99.8	78.0	76.2	×
Agriculture, forestry & fishing, excluding private farms	55.5	72.8	94.3	92.8	118.6	125.2	100.4	89.1	×
Mining and quarrying	151.6	151.2	141.5	131.8	89.8	79.8	76.4	86.8	78.5
Manufacturing	93.6	94.4	94.1	98.2	75.8	82.1	76.8	79.5	79.1
Electricity, gas & water supply	117.8	122.5	126.4	126.2	108.7	90.2	75.9	95.3	99.3
Construction	93.2	104.7	101.6	105.7	86.2	105.9	102.9	102.2	111.4
Wholesale & retail trade, repair of motor vehicles, motorcycles & personal and household goods	87.6	85.6	81.2	85.9	74.0	72.2	80.7	77.4	71.2
Transport, storage and communication	105.1	110.9	119.0	110.7	97.9	82.5	94.5	88.0	102.8
Accommodation and food service activities	66.8	74.7	74.4	79.1	93.5	95.5	88.3	74.5	88.1
Financial intermediation	233.1	136.2	136.5	119.9	137.7	79.4	67.0	81.7	63.3
Real estate, renting and business activities	98.7	100.2	99.0	99.1	85.2	90.4	80.0	92.2	85.5
Public administration and defence, compulsory social security	123.8	126.6	124.4	117.5	85.8	83.7	81.2	80.9	84.0
Education	109.2	99.3	106.7	101.6	115.4	91.3	84.9	92.0	94.9
Health and social work	85.1	91.7	87.0	96.6	78.5	83.4	81.3	83.5	82.6
Other community, social and personal service activities	81.1	78.8	73.6	71.8	67.6	77.7	77.5	79.6	69.8
All NACE branches	100.0	100.0	100.0	100.0	84.6	83.9	81.4	83.2	92.3

Source: Own elaboration on the basis of PLFS.

Table 4. Structure of average wages by large occupational groups by ISCO.

Name of large occupational group by ISCO	Year				Change 2012/2008
	2008	2010	2012	2014	
Public government representatives, senior officials and managers	223.4	207.3	209.0	204.0	16.06%
Professionals	123.1	122.1	122.5	123.4	27.36%
Technicians and associate professionals	103.4	103.1	99.8	100.9	24.06%
Clerks	84.0	84.1	82.1	79.8	20.79%
Service workers and shop & market sales workers	57.5	59.5	58.2	59.1	30.74%
Skilled agricultural and fishery workers	61.3	62.2	67.6	64.8	34.50%
Craft and related trades workers	82.7	78.2	79.8	80.2	23.26%
Plant and machine operators and assemblers	84.2	84.8	83.0	82.3	24.13%
Elementary occupations	58.7	58.5	57.5	58.4	26.46%

Source: Own elaboration on the basis on the reports prepared by GUS.

branches with the highest earnings: mining and quarrying, electricity, gas and water supply, financial intermediation and public administration. These branches employed 18.2% of all employees in 2014 and only the two former are highly masculine sectors. However, in the two remaining sectors, financial intermediation and public administration, women earn 36.7% and 16%, respectively, less than men.

It is also visible that women earned less than men in the analysed years and the gender earning gap has been increasing in the majority of branches. However, there are some branches where the gender pay gap decreased in 2014 in comparison to 2001, and single

index numbers show changes from 3% to 29%. This is the situation in construction, health and social work, transport and storage, manufacturing and other community, social and personal services. Women earned more than men in construction continuously from the year 2003 and in some periods in education, financial intermediation, transportation and agriculture, forestry and fishing.

Analysing PLFS data, we notice that women earned from 15% (in 2001) to 18% (in 2006) less than men when the whole economy was considered, although some improvement has been noticed since, in 2014, the gender pay gap was 8%. In the most feminised economic branches, average wages (except education) are below the average earning calculated for the whole economy. Therefore, a sectoral segregation to lower wage sectors against women exists in Poland.

Taking into account occupational groups, one may note that public government representatives, senior officials and managers earn twice the average wages, while professionals only earn 22–23% more. Average wages evaluated for all occupational groups increased in the year 2014 in comparison to 2008 by 27%. The biggest increase is observed for skilled agricultural and fishery workers and for service workers and (shop and market) sales workers, by 34.5% and 31%, respectively. However, public government representatives, senior officials and managers earning increased only by 16% and clerks by 21% (in the year 2012 in comparison to 2008).

Data presented in Table 5 compare wages of women, which are smaller than average, and men's earnings for all occupational groups. The smallest discrepancy seems to be among clerks and service workers and shop and market sales workers. It is also visible that the situation has been improving and the gender pay gap is decreasing for all professions except technicians and associate professionals.

Taking into consideration earnings obtained by both genders at a certain level of education (Table 6), the comparison shows even bigger gender earning disparities than it is visible in analysis provided by NACE branches. Women with basic vocational and lower education earn even less than a half of men's average incomes. Women with university education obtain salaries lower than men by 5–31%. It seems to be an important issue, as women in Poland are better educated than men, since 48% (in 2002) and 57% (in 2010) of women have tertiary, post-secondary or secondary education while, among men, this fraction equals 39% and 48%, respectively. However, basic vocational education, which might

Table 5. Structure of average women's wages by large occupational groups by ISCO.

Name of large occupational group by ISCO	Wages as a % of the average wage in the whole economy				Wages as a % of the average men's wage by occupational groups			
	2008	2010	2012	2014	2008	2010	2012	2014
Years	2008	2010	2012	2014	2008	2010	2012	2014
Total	89.5	91.9	90.9	90.5	81.3	85.0	83.3	82.9
Public government representatives, senior officials and managers	80.3	82.6	82.9	83.3	70.6	72.2	72.6	73.1
Professionals	89.7	92.0	90.6	89.4	74.4	78.9	76.1	74.9
Technicians and associate professionals	90.9	89.1	88.4	87.9	80.0	78.3	77.1	76.6
Clerks	98.7	99.2	99.3	99.3	96.4	97.9	98.1	98.3
Service, shop & market sales workers	94.3	95.1	95.2	95.2	84.7	87.6	87.0	86.6
Skilled agricultural and fishery workers	88.3	83.3	95.7	96.1	83.6	77.7	94.7	95.0
Craft and related trades workers	65.5	71.4	70.3	72.6	60.6	67.1	66.3	68.8
Plant & machine operators & assemblers	80.3	79.2	80.8	84.3	76.9	76.0	78.0	81.7
Elementary occupations	89.0	90.2	90.1	92.7	77.7	78.5	78.6	83.6

Source: Own elaboration on the basis on the reports prepared by GUS.

Table 6. Comparison of average women's and men's wages by level of education.

Level of education	Average women's wages as a percentage of the average men's wage in certain year				Population structure by education level aged 13 and more in percentage			
					Males		Females	
	2001	2003	2006	2009	2002	2010	2002	2010
Tertiary	95.50	71.30	70.40	83.40	10.22	16.06	11.85	22.19
Post-secondary and vocational secondary	69.60	79.10	76.60	68.40	28.69	31.92	35.86	35.12
General secondary	104.10	86.00	78.60	64.10	30.82	28.06	17.39	16.31
Basic vocational	70.30	74.20	68.60	50.00	1.85	6.17	1.68	4.60
Lower secondary, primary & incomplete primary	75.80	83.10	78.50	47.80	26.22	17.79	33.23	21.79

Source: Own elaboration on the basis of PLFS and GUS (Rocznik Demograficzny, 2011).

be attractive in the labour market, appears more often among men (31% in 2002 and 28% in 2010) than women (17% in 2002 and 16% in 2010).

Interesting results are obtained from the Polish Earning Survey, provided among 25,000 enterprises (Sedlak, 2016; Wabik, 2014). The investigation was conducted among 122,499 respondents in 2013 and among 161,224 respondents in 2015. The majority of interviewees were young people, i.e., 35 years old or less (61% in 2013 and 68% in 2015), and there were 72.2% respondents with tertiary education in 2013 and 69.2% in 2015. The wages of employees with tertiary education were, on average, doubled in comparison to the employees with primary education. Higher wages were found in foreign firms than in enterprises with Polish capital.

4. Description of variables and data

In our investigation, we apply individual data from the Polish Labour Force Survey in which the household is the investigated unit, and the selected sample of households represents the structure of the population. Thus, PLFS also contains records concerning people of pre- and post-working age, as well as unemployed. Therefore, to create a database for further investigation we deleted records concerning respondents who: are not employed, did not declare their income or did not provide information about the size of their main place of work.

According to the literature review, wages depend on different factors which describe either respondents' features or employment characteristics. In our research, we employ 12 explanatory variables, which are selected arbitrarily since they are often used in the research concerning wages (e.g., Newell & Socha, 2007; Witkowska, 2013, 2014). The majority of features are defined as qualitative ones; therefore, the variables representing these characteristics are defined as sets of dummies. The description of all features' variants is presented below, and the reference dummy variables are underlined, since the definition of the reference variant of the feature is necessary for the interpretation of the parameter estimates. Explanatory variables are defined as the following:

- (1) Gender is represented by a dichotomous dummy category describing women or men.
- (2) Occupation is described by 10 dummy variables selected due to the International Standard Classification of Occupations, ISCO-08: (a) army, (b) managerial, (c) professional, (d) technical, (e) clerical, (f) sales and services, (g) farmers, fishers, etc., (h) industry workers, (i) skilled workers or (j) unskilled workers.

- (3) Level of education is represented by five dummies distinguished according to the International Standard Classification of Education, ISCED 97: (a) tertiary, (b) post-secondary and vocational secondary, (c) general secondary, (d) basic vocational and (e) lower secondary, primary and incomplete primary.
- (4) Place of residence, which is defined as size classes determined by the numbers of inhabitants. A set of dummy categories describes four classes: (a) more than 100,000 citizens, (b) from 50–100,000 citizens (c) from 10–50,000 citizens and (d) less than 10,000 citizens and countryside.
- (5) Marital status is represented by a dichotomous dummy: married or otherwise.
- (6) Relationship with the head of the household is a dichotomous dummy: household head or otherwise.
- (7) Age is represented by two quantitative variables: age in years (age) and squared age (age²).
- (8) Ownership type of respondent's main place of employment is a dichotomous dummy since we distinguished private and public enterprises (institutions).
- (9) Size of the respondent's main place of employment, given in the number of employees. It is a set of dummies representing five classes of enterprises: (a) less than 10 employees, (b) from 10–19 employees, (c) from 20–49 employees, (d) from 50–99 employees and (e) more than 100 employees.
- (10) The type of employment contract is represented by four distinguished dummies: (a) permanent job, (b) temporary job such as training or for students, (c) temporary job because there is no other (permanent) job and (d) temporary job because it is convenient for the respondent.
- (11) Additional job is a dichotomous dummy describing if the respondent has an additional job or otherwise.
- (12) Job seniority in years is a quantitative feature and represents the years in service in the certain work place.

Variables (1)–(7) represent employees' features, while variables (8)–(12) represent conditions of employment.

In our research, the dependent variable describes net incomes from the main place of employment, obtained by the respondents in the month prior to the month when the survey was conducted. Wages, denominated in Polish currency – PLN, are classified into five intervals²: (a) less than 1000 PLN, (b) from 1000–1400 PLN, (c) from 1400–1800 PLN, (d) from 1800–2200 PLN or (e) more than 2200 PLN. Therefore, to find out the determinants influencing wages on the Polish labour market we employ ordered logit models, since the ordered logit model is a regression model for an ordinal response variable.

Qualitative choice models in which the dependent variable takes more than two values are known as multiple outcome models and they may be sub-divided into those involving ordered and unordered outcomes. Logit models with ordered outcomes are known as ordered logit models (see Borooah, 2002).

5. Model estimates

To check if wage determinants change in time we compare parameter estimates of the econometric models describing wages in the Polish labour market in the years 2001, 2003,

2006 and 2009, assuming that the structure of the labour market changes essentially in a longer period than 1 year. The models describing wages are estimated applying maximum likelihood method, using the statistical package GRETTL.

The models are estimated for all respondents (general models) and separately for men and women (partial models), which simplifies gender wage gap analysis in which the variable describing gender is missing. Such an approach is proposed by Juhn, Murphy, and Pierce (1991) and is often used in gender disparities analysis (e.g., Blau & Kahn, 2001; Grajek, 2001; Newell & Reilly, 2001).

In order to select the best specification of the models of wages we constructed more than 30 models with different sets of the explanatory variables.³ These tentatively constructed models are estimated using data from the year 2009. The criteria of the model selection were based on goodness of fit parameters and were as follows:

- the significance of at least one variant of the feature described by the set of dummies,
- the information criteria,
- so called count R^2 , which informs about the fraction of the correctly predicted outcomes and
- log-likelihood ratio (or LR).

The results of 12 estimation models describing wages are presented in Tables. One should notice that there is a lack of some variables in the models estimated using data from years 2001 and 2003. Such a situation appears because PLFS questionnaires were different for analysed years⁴. Table 7 compares parameter estimates of general models, while Tables 8 and 9 contain parameters estimated for the investigated periods in partial models.

Analysing estimated models, it is visible that, from the point of view of count R^2 , models estimated on samples from the year 2009 seem to be less accurate in comparison to the ones estimated for other years, which may be a signal that specification of the model should be changed (for instance by adding other variables). It is also visible that the fitting measures of the models estimated for women seems to be the best, while the ones estimated for men were the worst.

Taking into account explanatory variables in general models (Table 7), we see that all of them are statistically significant, except single variants of some descriptors. Only two dummies describing (1) the employees living in cities with 5*104–105 inhabitants and (2) the temporary employment (because the respondent cannot find permanent job) that is a variant of the variable: employment contract, do not influence significantly wages in any year and model.

The majority of variables, in the models estimated for the whole sample, are characterised by expected signs and values of the parameter estimates. The log odds of higher monthly wages decrease for women (vs men) by 0.985, 0.950, 1.138 and 1.166 in the years 2001, 2003, 2006 and 2009, respectively, i.e., women earn less than men in all years of analysis and discrepancy between monthly wages seems to be bigger in the years 2006 and 2009 than in the first years of investigation. A higher level of education gives better chances for higher incomes; however, the parameter estimates standing by university education are the biggest in 2006 in the general model and in the model estimated for women, while in the case of the models estimated for men the highest value of this parameter estimate is visible in 2003.

Table 7. Ordered logit models estimates: General models.

Variables		2001	2003	2006	2009
Gender	Female	-0.985***	-0.950***	-1.138***	-1.166***
Age	Age	0.090***	0.010***	0.118***	0.096***
	Age ²	-0.001***	-0.002	-0.002***	-0.002***
	Education level				
Education level	University	1.670***	1.888***	2.188***	1.566***
	Post-secondary or vocational	0.499***	0.892***	1.001***	0.774***
	General secondary	0.771***	1.138***	1.212***	0.737***
Ownership	Lower vocational	×	0.324***	0.449***	0.297***
	Private	0.338***	-0.003	0.128**	0.182***
Place of residence	> 100*10 ³	0.586***	0.414***	0.478***	0.452***
	50–100*10 ³	0.093	0.077	0.099	0.034
	10–50*10 ³	0.100	-0.034	0.078	-0.007
Size of the firm	< 10	-1.001***	-1.104***	-0.961***	-1.036***
	11–19	-0.797***	-0.811***	-0.695***	-0.673***
	20–49	-0.531***	-0.608***	-0.380***	-0.568***
	50–99	-0.239***	-0.397***	-0.436***	-0.482***
	Occupation				
Occupation	Army	×	3.297***	3.321***	3.399***
	Managerial	3.270***	3.386***	3.027***	2.906***
	Professional	1.967***	2.196***	1.991***	2.007***
	Technical	2.033***	1.836***	1.866***	1.703***
	Clerical	1.545***	1.501***	1.334***	1.001***
	Sales & services	0.838***	0.760***	0.491***	0.471***
	Farmers, fishers, etc.	1.295***	0.340	1.201***	0.234
	Industry workers	1.276***	1.301***	1.201***	0.966***
	Skilled workers	1.398***	1.465***	1.345***	1.089***
	Marital status				
Marital status	Household head	0.341***	0.401***	0.316***	0.266***
	Type of contract	0.700***	0.742***	0.561***	0.407***
Type of contract	Permanent	1.756***	1.461***	0.922***	0.801***
	Temporary-study	0.656*	0.102	0.085	-0.487***
	Temporary-no other job	0.180	-0.033	0.071	0.049
Job seniority					
Job seniority	×	×	0.036***	0.041***	
Additional job					
Additional job					
Log-likelihood					
Log-likelihood					
Akaike criterion					
Akaike criterion					
Count R ²					
Count R ²					
LR Chi ²					
LR Chi ²					
Number of observations					
Number of observations					

Note: Symbol × denotes lack of variables, Significance level: $\alpha = 0.01^*$, $\alpha = 0.05^{**}$, and $\alpha = 0.001^{***}$.

Source: Own elaboration.

In the private companies, monthly salaries in the general model seem to be higher than in the public one in the years 2001, 2006 and 2009. For inhabitants of the biggest cities (with more than 100,000 inhabitants), odds of higher monthly incomes increases in comparison to the employees from towns with less than 10,000 citizens and in the countryside and it is the only statistically significant variant of the variable describing classes of the place of residence in all presented models.

Taking into consideration general models, bigger (i.e., with at least 100 employees) enterprises offer higher wages, since parameters standing by all variants of the variable, describing size of the enterprise, are significantly smaller than zero. Occupation, except the variant describing farmers and fishers in 2003 and 2009, affects significantly and positively earnings, together with the type of employment contract, the fact of being married and being the household head. Parameters standing by age and squared age are significant with expected signs. Job seniority influences positively earnings in the years 2006 and 2009,

Table 8. Ordered logit models estimates: Models for men.

Variables		2001	2003	2006	2009
Age	Age	0.061***	-0.007**	0.098***	0.079***
	Age ²	-0.001***	-0.001	-0.002***	-0.002***
Education level	University	1.530***	1.881***	1.754***	1.441***
	Post-secondary or vocational	0.429***	0.855***	1.015***	0.865***
	General secondary	0.470***	0.871***	1.018***	0.777***
	Lower vocational	×	0.330**	0.501***	0.385***
Ownership	Private	0.077	-0.209***	0.080	0.024
Place of residence	> 100*10 ³	0.648***	0.489***	0.499***	0.500***
	50–100*10 ³	0.083	0.103	0.115	0.095
	10–50*10 ³	0.125	0.056	0.125*	0.006
Size of the firm	< 10	-1.108***	-1.226***	-1.147***	-1.024***
	11–19	-0.883***	-1.000***	-0.856***	-0.806***
	20–49	-0.752***	-0.655***	-0.594***	-0.570***
	50–99	-0.363***	-0.561***	-0.526***	-0.509***
Occupation	Army	×	2.751***	2.911***	2.973***
	Managerial	3.238***	3.097***	2.843***	2.513***
	Professional	1.739***	1.725***	2.185***	1.693***
	Technical	2.086***	1.495***	1.592***	1.494***
	Clerical	1.221***	0.872***	0.722***	0.460***
	Sales & services	1.180***	0.916***	0.287*	0.255**
	Farmers, fishers, etc.	1.182***	-0.302	1.131***	-0.018
	Industry workers	1.272***	1.116***	1.094***	0.895***
	Skilled workers	1.330***	1.132***	1.154***	0.973***
	Marital status		0.380***	0.549***	0.327***
Household head		0.803***	0.920***	0.720***	0.418***
	Type of contract	Permanent	1.657***	0.860**	0.582**
	Temporary-study	0.372	-0.481	-0.134	-0.673***
	Temporary-no other job	0.310	-0.465	-0.182	-0.104
Job seniority	×	×	0.034***	0.039***	
Additional job		-0.072	-0.205**	-0.326***	-0.357***
Log likelihood		-5356	-4711	-5,850	-9,179
Akaike criterion		10,777	9,490	11,770	18,427
Count R ²		62.5	59.0	50.0	40.1
LR Chi ²		3,003***	2,911***	3,105***	4,340***
Number of observations		5,715	4,734	4,917	6,775

Note: Symbol × denotes lack of variables, Significance level: $\alpha = 0.01^*$, $\alpha = 0.05^{**}$, and $\alpha = 0.001^{***}$.

Source: Own elaboration.

while it is difficult to interpret negative signs of the variable describing the appearance of the additional job.

In Table 10 we summarise parameter estimates of all models. Wage determinants and in what way they affect monthly incomes in general models are similar to the models estimated separately for men (Table 8) and women (Table 9); however, there are some differences (see Table 10). Working in the private sector increases odds of higher incomes of women in all years and in the general models, except the one estimated for the year 2003 (when this variable is insignificant); however, the parameter standing by this variable does not differ from zero in models estimated for men employees for all years except 2003, when employment in the private sector decreases the odds of higher incomes by $\exp(0.209) = 1.23$. The size of the institution of employment influences wages in all general models and the ones estimated for men, while, in the case of the sample containing female employees, this factor is insignificant in the years 2001 and 2003.

Generally speaking, unskilled workers obtain the lowest wages; however, there are some exceptions. Work in sales and services usually increases the odds of higher earnings in

Table 9. Ordered logit models estimates: Models for women.

Variables		2001	2003	2006	2009
Age	Age	0.123***	0.036***	0.151***	0.104***
	Age ²	-0.001***	-0.002	-0.002***	-0.002***
Education level	University	2.010***	1.811***	2.263***	1.515***
	Post-secondary or vocational	0.689***	0.758***	0.729***	0.466***
	General secondary	1.076***	1.116***	1.071***	0.509***
	Lower vocational	×	0.053	0.124	0.097
Ownership	Private	1.049***	0.495***	0.338***	0.488***
Place of residence	> 100*10 ³	0.506***	0.319	0.474***	0.374***
	50–100*10 ³	0.119	-0.021	0.028	-0.070
	10–50*10 ³	0.037	-0.210	0.024	-0.019
Size of the firm	< 10	-0.735***	-0.837***	-0.843***	-1.231***
	11–19	-0.667***	-0.542***	-0.586***	-0.625***
	20–49	-0.247**	-0.474***	-0.190**	-0.631***
	50–99	-0.045	-0.102	-0.376***	-0.485***
Occupation	Army	×	×	4.677***	22.415
	Managerial	3.511***	4.009***	3.542***	3.648***
	Professional	2.178***	2.903***	2.182***	2.450***
	Technical	2.067***	2.465***	2.207***	2.068***
	Clerical	1.756***	2.237***	1.856***	1.533***
	Sales & services	0.079	0.479	0.758***	0.788***
	Farmers, fishers, etc.	1.704**	1.676**	0.928	1.385**
	Industry workers	0.742***	0.691**	0.627***	0.551***
	Skilled workers	1.568***	2.420***	1.466***	0.947***
	Marital status	Household head	0.338***	0.195**	0.272***
Type of contract	Permanent	0.598***	0.497***	0.406***	0.384***
	Temporary-study	2.167***	3.343***	1.873***	1.118***
	Temporary-no other job	1.407**	2.085**	0.858*	-0.199
Job seniority	×	×	0.032***	0.042***	
Additional job	0.093	0.105	0.165	-0.137	
Log likelihood		-3,344	-3,282	-4,101	-7,509
Akaike criterion		-6,752	-6,630	-8,273	15,088
Count R ²		76.2	72.2	64.1	44.5
LR Chi ²		-2,504***	-2,676***	-3,185***	-4,873***
Number of observations		-5,214	-4,554	-4,581	-6,144

Note: Symbol × denotes lack of variables, Significance level: $\alpha = 0.01^*$, $\alpha = 0.05^{**}$, and $\alpha = 0.001^{***}$.

Source: Own elaboration.

comparison to the unskilled workers' salaries in all models, except the ones estimated for women in the years 2001 and 2003. A similar situation is observed for the female employees in military service in 2009. Also, incomes obtained by farmers, fishers, etc. do not exceed unskilled workers' wages in the models estimated for the general sample and the sample of women in the years 2003 and 2009.

The type of contact seems to be a significant variable; however, only a permanent job increases odds of higher wages vs reference variable in all models. Other variants of this variable have different signs of parameter estimates, i.e., 'temporary job as training or for students' are characterised by positive parameters for women in the years 2001, 2003 and by negative parameters for models estimated for the whole sample and the sample containing male employees in 2009, while 'temporary job because there is lack of permanent one' is significant with a positive influence only for women in 2006 and 2009. The variable 'additional job' is either insignificant or has a negative influence that is difficult for interpretation unless it is claimed that the decision about an additional job is made by employees with relatively smaller incomes in the main place of employment.

Table 10. Factors influencing wages in partial models in analysed years.

Variables		2001			2003			2006			2009		
		G	M	W	G	M	W	G	M	W	G	M	W
Gender	Female	-	×	×	-	×	×	-	×	×	-	×	×
Age	Age	+	+	+	+	+	+	+	+	+	+	+	+
	Age ²	-	-	-	0	0	0	-	-	-	-	-	-
Education level	University	+	+	+	+	+	+	+	+	+	+	+	+
	Post-secondary or vocational	+	+	+	+	+	+	+	+	+	+	+	+
	General secondary	+	+	+	+	+	+	+	+	+	+	+	+
	Lower vocational	×	×	×	+	+	0	+	+	0	+	+	0
Ownership	Private	+	0	+	0	-	+	+	0	+	+	0	+
Place of residence	>100*10 ³	+	+	+	+	+	0	+	+	+	+	+	+
	50–100*10 ³	0	0	0	0	0	0	0	0	0	0	0	0
	10–50*10 ³	0	0	0	0	0	0	0	0	0	0	0	0
Size of the firm	<10	-	-	-	-	-	-	-	-	-	-	-	-
	11–19	-	-	-	-	-	-	-	-	-	-	-	-
	20–49	-	-	-	-	-	-	-	-	-	-	-	-
	50–99	-	-	0	-	-	0	-	-	-	-	-	-
Occupation	Army	×	×	×	+	+	×	+	+	+	+	+	0
	Managerial	+	+	+	+	+	+	+	+	+	+	+	+
	Professional	+	+	+	+	+	+	+	+	+	+	+	+
	Technical	+	+	+	+	+	+	+	+	+	+	+	+
	Clerical	+	+	+	+	+	+	+	+	+	+	+	+
	Sales & services	+	+	0	+	+	0	+	0	+	+	+	+
	Farmers, fishers, etc.	+	+	+	0	0	+	+	+	0	0	0	0
	Industry workers	+	+	+	+	+	+	+	+	+	+	+	+
	Skilled workers	+	+	+	+	+	+	+	+	+	+	+	+
	Marital status	+	+	+	+	+	+	+	+	+	+	+	+
Household head	Household head	+	+	+	+	+	+	+	+	+	+	+	+
	Type of contract	Permanent	+	+	+	+	+	+	+	+	+	+	+
		Temporary-study	0	0	+	0	0	+	0	0	0	-	-
Temporary-no other job		0	0	0	0	0	0	0	0	+	0	0	+
Job seniority	×	×	×	×	×	×	+	+	+	+	+	+	
Additional job	0	0	0	0	-	0	-	-	0	-	-	0	

Note: By zero we denote a situation when the variable is statistically insignificant at the significance level at least $\alpha = 0.05$; by '+' the positive value of the parameter standing by the significant variable, and by '-' otherwise. Models estimated: (1) for the whole sample are denoted by G (general model), (2) for the sample including male employees by M, and (3) for the sample containing female employees - by W.

Source: Own elaboration.

6. Conclusions

In our research, we analyse the situation at the Polish labour market in the years 2000–2015. We investigate the structure of employment and wages in different economic branches, large occupational groups and according to the level of education. Our analysis shows that women in Poland usually work in branches where average wages are lower. Earning inequality is also visible at every level of education and disproportion between incomes obtained by men and women is getting greater in the following years. This disproportion is the smallest among employees with the tertiary education and the biggest (in the year 2009) for the lowest level of education. However, one must realise that, in Poland, women are in general better educated than men, thus human capital discrimination does not exist.

Statistical analysis of PLFS data shows that women earn less than men in all education classes and in all NACE branches and this disparity has been increasing in time (except the construction and transport sectors). Since in 2001 there were some branches where women's

wages were more comparable with the ones obtained by men, for instance in agriculture, accommodation and food service activities, real estate, renting and business activities. In some of them, e.g., financial intermediation, agriculture and education, women earned more than men in 2001, while in 2014 the situation became the opposite. Also, differences in wages for the same level of education were smaller than in 2009. The same conclusions can be derived from the logit models estimated for the samples containing all employees. The main factor of gender income inequality seems to be female segregation into low-wage jobs.

Econometric analysis lets us claim that the main determinants of wages in Poland are: gender, age or job seniority, level of education, size of firm and occupation in all analysed years. However, the influence of these factors in the following periods and models estimated on the basis of different samples (general or partial models) may be different. Parameter estimates of general models confirm that women earn less than men and an increase of age or job seniority causes an increase of wages in all models.

Due to estimated models, employees with university, post-secondary, secondary and vocational education have chances to obtain higher wages than the ones having only lower secondary, primary or incomplete primary influences. However, significant chances of higher incomes for employees with lower vocational education does not concern women in the years 2002, 2006 and 2009 (in the models estimated for 2001, variables representing education were omitted, because of lack of such data in PLFS).

All types of occupation, except some cases (such as: 'sales & services' in the models estimated for women in 2001 and 2003 and men in 2006, together with 'farmers, fishers, etc.' in the models estimated for the whole samples and men in 2003 and 2009, as well as the model estimated for females in 2006, and 'army' in the model estimated for females in 2009) earn more than unskilled workers. Also, respondents living in cities with at least 100,000 inhabitants earn better than citizens from countryside and towns with a population less than 10,000. In all years of analysis, employees from the institutions employing less than 100 employees have smaller salaries than the reference group (with the exception of models estimated for women in 2001 and 2003). It is worth mentioning that working in the private sector in all considered years increases the odds of higher wages in comparison to public institutions for women. A similar situation is for variables describing temporary jobs because 'there is no other job' in the models estimated for women using data from 2006 and 2009 and because of study or training in the models describing wages of female employees in the years 2001 and 2003. Whereas in the models estimated for men the parameter standing by the variable describing ownership usually insignificantly differs from zero, except 2003 when it is negative. A similar situation is observed for the variable additional job, since, for models estimated on the data concerning men, parameter estimates are significantly negative in all years except 2001.

Taking into consideration changes which took place during the whole period of analysis, we notice that the majority of distinguished determinants, that influence wages, stayed the same in all years. However, some parameter estimates show a tendency to decrease (e.g., parameters standing by certain types of occupation: 'clerical, sales & services', 'farmers, fishers, etc.' in the models concerning female employees) or increase (e.g. parameters standing by 'sales & services' in the models estimated for men) during the analysed time span. There are two types of job contract which change the way of affecting wages in the considered period. The variable describing 'temporary job as training or for students' became insignificant in the models concerning women's earnings in the years 2006 and 2009 and it became statistically significant for the model estimated for men in 2009. Also, the variable

representing ‘temporary job because there is no other (permanent) job’ became significant for female employees in 2006 and 2009. An additional job does not influence wages obtained by women, although this variable started to be statistically significant in models estimated for male employees for the years 2003, 2006 and 2009.

Notes

1. From Eurostat data, this average was 70.1 in 2015 ([http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Employment_rate,_age_group_20%E2%80%9364,_2005%E2%80%932015_\(%25\)_YB16_III.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Employment_rate,_age_group_20%E2%80%9364,_2005%E2%80%932015_(%25)_YB16_III.png)).
2. The mentioned above intervals are defined by the Polish Central Statistical Office. It may be assumed that (a) the incomes given by the respondents in PLFS are net wages and (b) 100PLN = 25 euro, thus the respondents from the lowest income group earn less than 250 euro, while those from the highest earn more than 550 euro.
3. Discussion about different specifications of the models, including all the above described variables and also some additional variables, like squared job seniority, and dummy variables describing the economic sector containing four variants of this feature: agriculture, industry, services and others, is presented in Witkowska (2014). It is worth mentioning that both mentioned variables were insignificant in all estimated models.
4. Thus, it may be that some features may be missing for the certain year of investigation.

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References

- Arulampalam, W., Booth, A. L., & Bryan, M. L. (2004). *Is there a glass ceiling over Europe? Exploring the gender wage gap across the wages distribution* (IZA Discussion Paper No. 1373). Bonn: Institute for the Study of Labour (IZA).
- Blanchflower, D. G. (2001). Unemployment, well-being and wage curves in eastern and central Europe. *Journal of Japanese and International Economics*, 15(4), 364–402. doi:10.1006/jjie.2001.0485

- Blau, F., & Kahn, L. (2001). *Understanding international difference in the gender pay gap* (NBER Working Paper 8200). National Bureau of Economic Research. Retrieved from nber.org/papers/w8200
- Borooah, V. K. (2002). *Logit and probit: Ordered and multinomial models*. Series: Quantitative Applications in the Social Sciences, Vol. 138. Thousand Oaks: SAGE
- Brzeziński, M., Jancewicz, B., & Letki, N. (2012). *GINI country report: Growing inequalities and their impacts in Poland*. Retrieved from http://archive.uva-aias.net/uploaded_files/publications/Poland.pdf
- Christofides, L. N., Polycarpou, A., & Vrachimis, K. (2010). *The gender wage gaps, 'sticky floors' and 'glass ceilings' of the European Union* (Discussion Paper No. 5044). Bonn: Institute for the Study of Labour (IZA).
- Cukrowska, E. (2014). Is It the labour market that undervalues women or women themselves? Evidence from Poland. *Quantitative Methods in Economics*, 15(1), 18–28.
- Daly, A., Kawaguchi, A., Meng, X., & Mumford, K. (2006). *The gender wage gap in four countries* (IZA Discussion Paper No. 1921). Bonn: Institute for the Study of Labour (IZA).
- Freeman, R. B. (1994). What direction for labour market reforms in Eastern and Central Europe? In O. J. Blanchard, K. A. Froot, & J. D. Sachs (Eds.), *The Transition in Eastern Europe* (pp. 1–36). Chicago and London: NBER and University of Chicago Press.
- Gannon, B., Plasman, R., Rycx, F., & Tojerow, I. (2007). Inter-industry wage differentials and the gender wage gap: Evidence from European Countries. *Economic and Social Review*, 38(1), 135–155.
- Gardeazabal, J., & Ugidos, A. (2005). Gender wage discrimination at quantiles. *Journal of Population Economics*, 18(1), 165–179.
- Grajek, M. (2001). *Gender pay gap in Poland* (Discussion Paper FS IV 01-13). Retrieved from <http://www.ssoar.info/ssoar/handle/document/11526>
- Juhn, C., Murphy, K., & Pierce, B. (1991). Accounting for the slowdown in black – white wage convergence. In M. Koster (Ed.), *Workers and their wages* (pp. 107–143). Washington, DC: AEI Press.
- Jurajda, S., & Harmgart, H. (2007). When do female occupations pay more? *Journal of Comparative Economic*, 35(1), 170–187.
- Keane, M. P., & Prasad, E. S. (2006). Changes in the structure of earnings during the polish transition. *Journal of Development Economics*, 80(2), 389–427.
- Kopycińska, D., & Kryńska, E. (2016). Wage inequalities between men and women in Poland – a justified differentiation or accepted wage discrimination of women? *Economics and Sociology*, 9(4), 222–242. doi:10.14254/2071-789X.2016/9-4/14
- Kot, S. M. (Ed.). (1999). *Analiza ekonometryczna kształtowania się płac w Polsce w okresie transformacji* [Econometric analysis of wages in Poland in transition]. Warszawa/Kraków: PWN.
- Livanos, I., & Pouliakas, K. (2009). *The gender wage gap as a function of educational degree choices in an occupationally segregated EU Country* (IZA Discussion Paper No. 4636). Bonn: Institute for the Study of Labour (IZA).
- Marcinkowska, I., Ruzik, A., Strawiński, P., & Walewski, M. (2008). *Badanie struktury i zmian rozkładu wynagrodzeń w Polsce w latach 2000–2006* [Study of the structure and changes in the distribution of wages in Poland in the years 2000–2006]. Warsaw: Ministry of Family, Labour and Social Policy. Retrieved from <http://www.mpips.gov.pl/userfiles/File/Analizy/Raport%20badanie%20struktury.pdf>
- Matuszewska-Janica, A. (2014). Wages inequalities between men and women: Eurostat SES metadata analysis applying econometric models. *Quantitative Methods in Economics*, 15(1), 113–122.
- McConnell, C. R., & Brue, S. L. (1986). *Contemporary labour economics*. New York, NY: McGraw Hill Book.
- Newell, A., & Reilly, B. (2001). The gender wage gap in the transition from communism: Some empirical evidence. *Economic Systems*, 25(4), 287–304.
- Newell, A., & Socha, M. W. (2007). *The polish wage inequality explosion* (IZA Discussion Paper No. 2644). Bonn: Institute for the Study of Labour (IZA).

- Nikulin, D. (2015). Relationship between wages, labour productivity and unemployment rate in new EU member countries. *Journal of International Studies*, 8(1), 31–40. doi:10.14254/2071-8330.2015/8-1/3
- Okoń-Horodyńska, E., Zachorowska-Mazurkiewicz, A., Wisła, R., & Sierotowicz, T. (2015). Gender in the creation of intellectual property of the selected European Union countries. *Economics & Sociology*, 8(2), 115–125. doi:10.14254/2071-789X.2015/8-2/9
- Rocznik Demograficzny. (2011). [Demographic Yearbook 2011] Warszawa: Główny Urząd Statystyczny (GUS). Retrieved from http://www.stat.gov.pl/cps/rde/xbcr/gus/rs_rocznik_demograficzny_2011.pdf
- Sedlak, K. (2016). Podsumowanie Ogólnopolskiego Badania Wynagrodzeń w 2015 roku. [Summary of 2015 Nationwide Remuneration Survey]. Retrieved from <http://wynagrodzenia.pl/artukul/podsumowanie-ogolnopolskiego-badania-wynagrodzen-w-2015-roku>
- Simón, H. (2010). International differences in wage inequality: A new glance with European matched employer-employee data. *British Journal of Industrial Relations*, 48(2), 310–346.
- Śliwicki, D., & Ryczkowski, M. (2014). Gender pay gap in the micro level – Case of Poland. *Quantitative Methods in Economics*, 15(1), 159–173.
- Tzannatos, Z. (1999). Women and labour market changes in the global economy: Growth helps, inequalities hurt and public policy matters. *World Development*, 27(3), 551–569.
- Wabik, I. (2014). Wynagrodzenia osób z różnym wykształceniem w 2013 roku [Salaries of People with Varying Education Level in 2013]. Retrieved from <http://wynagrodzenia.pl/artukul/wynagrodzenia-osob-z-roznym-wyksztalaniem-w-2013-roku>
- Witkowska, D. (2013). Gender disparities in the labor market in the EU. *International Advances in Economic Research*, 19(4), 331–354. doi:10.1007/s11294-013-9431-2
- Witkowska, D. (2014). Determinants of wages in Poland. *Quantitative Methods in Economics*, 15(1), 192–208.
- Witkowska, D., Kompa, K., & Matuszewska-Janica, A. (2013). Gender earning differences in the European union member states. *European Journal of Management*, 13(4), 129–148.
- Young, M. C., & Wallace, J. E. (2009). Family responsibilities, productivity, and earnings: A study of gender differences among Canadian lawyers. *Journal of Family and Economic Issues*, 30(3), 305–319.