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DETERMINANTS OF WAGES IN POLAND[1]

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Abstract: The aim of our research is to identify determinants influencing wages in Poland in the years 2001, 2003, 2006 and 2009. We want to find out if there is any changes in time and if gender can be considered as significant factor influencing wages. Investigation is provided on the basis of data from the Polish Labor Force Survey, applying ordered logit models.

Keywords: labor market, wage determinats, ordered logit model

INTRODUCTION

There is no doubt that level of wages differ essentially even if the local labor market is considered since numerous forces operate as earning determinants. These might be roughly classified as economic, institutional, behavioral, and equity considerations. Wage decisions appear to be made by comparison to labor markets, so many of the determinants appear to be economic. Both the meaning and force of economic variables are interpreted by organization decision makers, and these determinants are tempered by institutional, behavioral, and ethical variables.

Riley (2012) analyzing situation in the UK, claims that there is a wide gulf in pay and earnings rates between different occupations in labor market. He mentions several factors that differentiate wages.

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1. Compensating wage differentials i.e. higher pay can often be a reward for risk-taking in certain jobs, working in poor conditions and having to work on holidays or in unsocial hours.
2. Equalizing difference and human capital. In a competitive labor market, wage differentials compensate workers for the opportunity costs and direct costs of human capital acquisition.
3. Different skill levels. The gap between poorly and highly skilled workers gets wider each year. Market demand for skilled labor grows more quickly than for semi-skilled workers. This pushes up pay levels. Highly skilled workers are often in inelastic supply and rising demand forces up the "going wage rate" in an industry.
4. Differences in labor productivity and revenue creation. Workers whose efficiency is highest and ability to generate revenue for a firm should be rewarded with higher pay (for instance sport stars can command top wages because of their potential to generate extra revenue from ticket sales and merchandising).
5. Trade unions and their collective bargaining power. Unions might exercise their bargaining power to offset the power of an employer in a particular occupation and in doing so achieve a mark-up on wages compared to those on offer to non-union members
6. Employer discrimination is a factor that cannot be ignored despite equal pay legislation

Wage determinants can be divided into three groups [Kot 1999, p. 142]: (a) human capital (i.e. level of education, job seniority, etc.), (b) situation on the labor market (e.g. supply for skilled workers, unemployment rate), and (c) other such as: gender, marital status, place of living, etc.

Identified factors, that affect wages, are used to construct "earnings function" which has been applied to a wide variety of problems such as [Willis 1986, p. 525], (a) studies of discrimination by race or sex (see [Cain 1986 p. 693]), (b) the estimation of the "value of life" from data on job safety [Thaler and Rosen 1975], or (c) compensation for increased unemployment probabilities [Abowd and Ashenfelter 1981]. The premier application, of course, was to the study of the effects of investment in schooling and on-the-job training on the level, pattern, and interpersonal distribution of life cycle earnings associated with the pioneering work on human capital by Becker (1964)[2].

The aim of our research is to identify determinants that affect earnings in Poland, in the years 2001 – 2009. Another issue is to find out if there is any changes in time and if gender can be consider as a significant factor influencing wages. Investigation is provided applying ordered logit models, that are estimated

[2] The standard human capital earnings function was developed by Mincer (1974).

by maximum likelihood method, employing individual data from the Polish Labor Force Survey (PLFS).

SITUATION IN POLAND AFTER 1989

In 1989 the radical set of reforms was introduced in Poland which were followed by other countries belonging to the former Soviet bloc [Keane and Prasad 2006]. The privatization of state owned enterprises and implementation of market mechanisms were the main goals of transformation in post-communist countries. The transition also involved significant changes in labor market institutions.

On the basis of profound analysis made for years 1989 – 2010, Brzeziński et al. (2012) claim that both individual and household based indices show that labor market participation declined. 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. The share of tertiary graduates almost doubled since 1997 (rising from 7.7% to 13.8% in the year 2008).

It seems that the single most important factor accounting for the inequality rise was the increase of earnings inequality caused by rising educational premium for highly-qualified workers employed in highly-skilled occupations coupled with the worsening of relative position of workers employed in low-paying occupations. The major underlying causes of inequality growth during transition in Poland are the change from centrally-planned wage setting to decentralized wage setting and radical structural and technological changes of the economy shifting labor demand from public sector to private sector and from manual workers to professionals and highly-qualified workers.

In the conclusion of the report on structure and changes in wage distribution in years 1996 – 2006, prepared by Marcinkowska et al. (2008), it is said that so called "skill-biased technical change" together with changes of the bargaining power of employees has played the increasing role in wage setting. While the influence of factors concerning economic branches decreased and concerning regions remain stable.

Newell and Socha (2005) analyze the changes in the distribution of wages in Poland in years 1992 - 2002. They find out that privatization was the main force tending to increase wage inequality, partly because it generated major increases in the relative wages of professional and managerial workers. The main force contracting the variance of wages was the decline, between 1992 and 1998 in labor market participation of those with low levels of education. Wage inequality seems to have increased since 2000. Suggestively, whereas privatization has continued, the decline in participation has halted. Newell and Socha (2007) have demonstrated that the private sector in Poland tends to pay more unequally than the state sector, and since there was a surge of privatization 1998-2002, this contributed to the rise in wage inequality. It is also true that inequality, in the forms of hourly wage variance and of regression wage premiums to education and occupation is consistently higher, and in the case of education premiums, rose more quickly in the private sector data.

Kean and Prasad (2006) examine the evolution of the structure of labor earnings in Poland over the period 1985–1996 using micro data from the Polish Household Budget Surveys. The relatively long span of the dataset allows them to trace out changes for an extended period leading up to and following the "big bang". They find that overall earnings inequality rose markedly during the transition period of 1989–1996. Kean and Prasad (2006) also conduct a detailed examination of the sources of the increase in earnings inequality. Prior to the transition, the wage structure in Poland was highly compacted, with wages of college-educated white-collar workers a little different from those of manual workers. A common view is that the rise of the private sector, in which there is competitive wage setting and, hence, a more unequal wage distribution, is the main source of increasing earnings inequality during transition.

In Poland, earnings inequality is indeed higher in the private sector (e.g., the log 90–10 earnings differential in 1996 was 1.19 in the private sector and 1.05 in the public sector), and the private sector share of (non-agricultural) employment increased from 5% in 1988 to 39% in 1996. Still, Kean and Prasad (2006) find that reallocation of labor from the public to the private sector accounted for only 39% of the total increase in earnings inequality (as measured by the change in the variance of log earnings).

The majority of the increase in earnings inequality during the Polish transition (52%) was due to increased variance of wages within both the public and private sectors. That is, earnings inequality within both the private and public sectors grew substantially, and by similar amounts. This is consistent with the view that even state-owned enterprises in Poland have engaged in substantial restructuring, as suggested by Pinto et al. (1993) and others. Consistent with their finding of increased earnings inequality within the public sector, Commander and Dhar (1998) report (p. 127) a substantial increase in the heterogeneity of wages across state owned enterprises between 1990 and 1994, with those that performed better in terms of sales offering higher wages. Kean and Prasad also find that educational wage premiums increased substantially. Nevertheless, the majority of the increase in overall earnings inequality (60%) in Poland is attributable to changes in within-group inequality. A striking result is that increases in within-group inequality were concentrated among workers with higher levels of formal education[3].

[3] This is quite different from the patterns documented for the U.S. and the U.K. of sharp increases over the last two decades in between-group inequality at all levels of education (see [Kean and Prasad 2006]).

ORDERED LOGIT MODELS

Economists have been paying increasing attention to study situations in which it is necessary to consider a discrete rather than a continuous set of choices, since in many cases the discrete character of variables or data availability (of continues or unobservable variables) require to apply qualitative response models. Binary discrete probability models describe the relation between one or more continuous determining variables and a single attribute. These simple models, probit and logit alike, account for a very large number of practical applications in a wide variety of disciplines, from the life sciences to marketing [Cramer 2011, p. 9]. Logit and probit models are basically the same, the difference is connected with the probability distribution - cumulative logistic or cumulative normal distribution, respectively.

Logistic or logit regression describes the probability of the possible outcomes as a function of the explanatory (predictor) variables. Logit model is a natural complement of the regression model when the dependent variable is categorical one (i.e. a class label - not continuous) e.g. it is a state which may or may not be obtained, or a category in a given classification. It is worth mentioning that both type of models have much in common since logit and regression models originally were designed for the analysis of data where the direction of causation is beyond doubt [Cramer 2001, p. 1].

Qualitative choice models in which dependent variable takes more than two values are known as multiple outcome models [Borooah 2002, p. 2] and they may be subdivided into those involving ordered and unordered outcomes. Models with both types of outcomes require different methods of analysis. Ordered models may be estimated by probit and logit methods which are known as ordered probit or ordered logit models, respectively. While models, where the outcomes are unordered, are most easily estimated by logit methods - multiple outcome models with unordered outcomes are referred to as multinomial logit models.

Logit model can be written as follows [Gruszczyński 2010, p. 62 - 63]:

$$p_i = F(\mathbf{X}_i^T \beta) = \frac{\exp(\mathbf{X}_i^T \beta)}{1 + \exp(\mathbf{X}_i^T \beta)} = \frac{1}{1 + \exp(-\mathbf{X}_i^T \beta)} \tag{1}$$

where F is cumulative logistic distribution function, $\mathbf{X}_i$ is a vector of explanatory variables and $\boldsymbol{\beta}$ is a vector of parameters.

However it is more convenient to model the expression $\ln\frac{p_i}{1-p_i}$ (that is called logit) as a linear function of explanatory variables that can be written as following:

$$\text{logit} = \ln\frac{p_i}{1-p_i} = \mathbf{X}_i^T \beta = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} \tag{2}$$

Probability models are - as rule - estimated from survey data, which provide large sample of independent observations with a wide range of variation of the explanatory variables. The preferred method of estimation is maximum likelihood[4] since maximum likelihood estimates (MLE) are consistent and asymptotically efficient [Cramer 2001, p. 17].

The value of the loglikelihood function for particular sets of parameter estimates[5] is useful when we wish to consider and test restrictions on the parameter vector **β** (for instance simplifying assumptions like zero coefficient or the absence of certain variables from the model). Provided the restricted model is nested as a special case within the general or unrestricted model, this can be tested by the loglikelihood ratio or LR test. In our investigation we apply likelihood ratio tests to verify null hypothesis H_0: $\beta_1 = \beta_2 = \ldots = \beta_k = 0$ versus alternative hypothesis H_1 saying that at least one parameter differs from zero, employing chi-squared statistics with *k* degrees of freedom [Gruszczyński 2010, p. 65, 128]:

$$LR = 2(\ln L_{UR} - \ln L_R) \tag{3}$$

where L_{UR}, L_R are values of the likelihood functions of the unrestricted (in our case investigated) model and restricted one (in our case the model containing constant only), respectively, *k* is a number of restrictions (i.e. explanatory variables).

For the model verification we also verify hypothesis of significance of each coefficient of the model to check if explanatory variables influence the investigated phenomenon. Parameters of logit model have similar interpretation as regression coefficients i.e. the sign of parameters defines the direction of the relation observed between variables. To interpret the results of the estimation results odds ratio $p_i/(1-p_i)$ can be used [Gruszczyński 2010, p. 67 - 68].

Goodness of fit in logit models[6] is evaluated on the basis of several measures such as: McFadden pseudo R^2:

$$R^2_{McFadden} = 1 - \frac{\ln L_{UR}}{\ln L_R} \tag{4}$$

or fraction of observations with correct predicted outcomes so called count R^2:

$$count\ R^2 = \frac{N_{cor}}{N} \cdot 100 \tag{5}$$

[4] Detailed discussion about ordered logit models construction and estimation can be found in Borooah (2002), Cramer (2001), Boes and Winkelmann (2009) and Gruszczyński (2010), among others.

[5] Loglikelihood ratio describes value of the natural logarithm of the likelihood function that is maximized in order to find MLE of the parameters.

[6] Broad discussion about goodness of fit measures can be found in [Gruszczyński 2002, p. 64 – 68] and [Gruszczyński 2010, p. 71 – 74, 128 – 135].

where N and N_{cor} are numbers of all and correctly predicted outcomes, respectively. Another group of measures contains information criteria that can be used to compare models with different specification[7].

DATA AND VARIABLE DESCRIPTION

In our investigation we employ individual data from the Polish Labor Force Survey (PLFS) from selected quarters in years: 2001, 2003, 2006 and 2009 since we assume that changes of factors affecting wages require time and they do not appear year by year. The years for our research are selected arbitrary however, to some extend, it was connected with data availability.

It is worth mentioning that in the Labor Force Survey the household is the investigated unit for the representative investigation. Therefore among PLFS data there are also records concerning people in pre- and post-working age, as well as unemployed. In addition some respondents do not answer all questions, especially they are not willing to inform about their wages. Therefore it is necessary to select records concerning only employed who answered the questions that create data which are to be used in the model building. There are 32,939 records in our samples that is 21.3% of all PLFS multidimensional observations.

Wages depend on different factors which describes either respondents' or employment characteristics. In our research we employ explanatory variables, that are selected arbitrarily however they are often used in the research concerning wages (e.g. [Newell and Socha 2007]; [Witkowska 2012]). The majority of variables are defined as qualitative therefore all variants of these variables are described below. The reference variants of qualitative variables are underlined since definition of the reference variant is necessary for interpretation of the parameter estimates. The selected employees' features are:

1. GEN – gender: *women* or *men*;
2. OCC – occupation: (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[8];
3. EDU - level of education: (a) tertiary, (b) post-secondary and vocational secondary, (c) general secondary, (d) basic vocational, (e) lower secondary, primary and incomplete primary[9];
4. RES - size class of the place of residence given in numbers of inhabitants: (a) *more than 100 thousands citizens*, (b) *from 50 to 100 thousands citizens*,

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[7] Program GRETL evaluates Akaike, Bayes-Schwarz and Hannan-Quinn criteria.

[8] Our classification corresponds to the International Standard Classification of Occupations ISCO-08.

[9] We use international standard classification of education ISCED 97.

(c) *from 10 to 50 thousands citizens*, (d) less than 10 thousands citizens and countryside;

5. MAR - marital status: *married* or not married;
6. REL -relationship with the head of the household: *household head* or not a household head;
7. AGE – age in years (*age*) and squared age (age^2), quantitative variable.

Conditions of employment are represented by following variables:

1. SEC - sector of employment: (a) *agriculture*, (b) *industrial*, (c) *services*, or (d) *others*;
2. OWN – ownership type of organization where the respondent is employed: *private* or public;
3. SIZ - size of respondent's organization given in number of employees: (a) less than 10 employees, (b) from 11 to 19 employees, (c) from 20 to 49 employees, (d) from 50 to 99 employees, (e) more than100 employees;
4. CON – type of the employment contract: (a) permanent job, (b) temporary job as training or for students, (c) temporary job because there is no other (permanent) job, (d) temporary job because it is convenient for the respondent;
5. ADD – additional job *yes* or no additional job;
6. SEN – job seniority in years (*job seniority*) and squared job seniority ($job\ seniority^2$), quantitative feature.

MODEL ESTIMATES

In our research the dependent variable describes earnings, obtained by respondents in the month prior to the month when survey had been conducted. Wages are given in five intervals[10]: (a) *less than one thousand PLN*, (b) *from 10 to 14 hundreds PLN*, (c) *from 14 to 18 hundreds PLN*, (d) *from 18 to 22 hundreds PLN* or (e) *more than 2.2 thousands PLN*.

When a dependent variable has more than two categories and the values of each category have a meaningful sequential order where a value is indeed "higher" than the previous one, then ordinal logit can be used. Therefore to find out the determinants influencing wages in the Polish labor market we employ ordered logit models that are estimated for each analyzed year separately, using maximum likelihood method.

[10] The mentioned above intervals are given by the Polish Central Statistical Office. In fact the majority of the PLFS data sets (that we used in our research) are represented by a set of binary variables describing the previously defined intervals. Another words all respondents (who defined amount of their monthly net salary in PLN) are classified into the wage classes.

Selection of the model specification

In order to select the best specification of the model, we estimate models with different sets of explanatory variables on the basis of data from the year 2009, employing all described above variables. In fact there are nine different specifications of the models, that are estimated applying maximum likelihood method[11] on the basis of the whole set of data (- general models, denoted as 1 ÷ 9) and subsamples containing only men (- models for men, denoted as 1M ÷ 9M) and women (- models for women, denoted as 1W ÷ 9W). Specification of models estimated for different samples is the same however in the models for men and women variable gender is missing.

Table 1. Specification of models

Explanatory variables	1	2	3	4	5	6	7	8	9
GEN - gender	+	+	+	+	+	+	+	+	+
AGE - age	+	+	+	+	+	+	-	-	-
AGE – age^2	-	+	+	-	-	-	-	-	-
EDU - education	+	+	+	+	+	+	+	+	+
OWN - type of enterprise	+	+	+	+	+	+	+	+	+
SEC - sector of employment	+	+	-	+	+	-	-	+	+
RES - size of the place of residence –no. of inhabitants	-	+	+	-	+	+	+	+	-
SIZ - size of employee’s firm	+	+	+	+	+	+	+	+	+
OCC - occupation	+	+	+	+	+	+	+	+	+
MAR - marital status	-	+	+	-	+	+	+	+	-
REL -relationship with the head of the household	-	+	+	-	+	+	+	+	-
CON – work contract	+	-	+	+	-	+	+	-	+
SEN – job seniority	+	-	+	+	-	+	+	-	+
SEN – job seniority^2	-	-	-	+	+	+	+	+	+
ADD –additional job	+	-	+	+	-	+	+	+	+

Source: own elaboration

The detailed information about model specifications is presented in Table 1 where symbol “+” means that certain variable is present in the model while “-“ means that it is omitted. Parameter estimates for selected models[12] are presented in

[11] We employ GRETL software, see Ślusarczyk (2013).

[12] One may notice that for the model selection five classes of the variable: place of residence (RES) are selected i.e. (d) *less than 10 thousands citizens* and reference variant of variable (e) *countryside*.

Tables 3 ÷ 6, the symbol × denotes lack of variables, stars – significance level: α=0.01 - *, α=0.05 - **, and α=0.001 - ***.

Table 2 contains major characteristics of the selected models (i.e. all models estimated for the whole sample and the best models estimated for subsamples of men and women) including mentioned above measures. As one can notice, regardless the set of explanatory variables models, estimated on the basis of the whole sample, do not essentially differ. However taking into consideration interpretation of the parameters (see Tables 3 ÷ 5) we select the model 3 to the further analysis. Since all models, except the one denoted as 3 has proper signs of the parameter standing by significant variables: *age*, *age*^{2}, and *job seniority*. Also each group of explanatory variables is statistically significant in this model. Although the model denoted as 7 is quite similar in specification (in comparison to the model 3, variables *age* and *age*^{2} are missing but it contains the additional variable: *job seniority*^{2}) but the model 7 has slightly worse statistical properties than the model 3.

Table 2. Models fitting parameters

Model	1	2	3	4	5	6
Log likelihood	-17071	-17119	-16816	-16965	-17226	-16808
Akaike criterion	34206	34306	33703	33997	34520	33688
Bayes-Schwarz criterion	34445	34560	33972	34243	34774	33957
Hannan-Quinn criterion	34286	34391	33793	34079	34605	33778
Number and fraction of correctly predicted outcomes	5316 (41.1)	5209 (40.3)	5360 (41.5)	5349 (41.40)	5209 (40.30)	5363 (41.50)
LR Chi^2	9107	9012	9619	9319	8798	9634
Model	7	8	9	1W	2W	3W
Log likelihood	-16858	-17219	-16997	-7591	-7659	-7509
Akaike criterion	33786	34505	34059	15243	15384	15089
Bayes-Schwarz criterion	34047	34759	34298	15452	15606	15324
Hannan-Quinn criterion	33873	34590	34139	15315	15461	15170
Number and fraction of correctly predicted outcomes	5334 (41.30)	5191 (40.20)	5304 (41.10)	2699 (43.9)	2645 (43.1)	2736 (44.5)
LR Chi^2	9534	8813	9255	4711	4574	4873
Model	4W	5W	6W	1M	2M	3M
Log likelihood	-7565	-7702	-7511	-9418	-9325	-9179
Akaike criterion	15194	15470	15091	18897	18716	18427
Bayes-Schwarz criterion	15409	15692	15327	19102	18941	18666
Hannan-Quinn criterion	15269	15547	15173	18968	18794	18510
Number and fraction of correctly predicted outcomes	2686 (43.7)	2629 (42.80)	2715 (44.20)	2614 (38.6)	2636 (38.9)	2717 (40.1)
LR Chi^2	4762	4488	4871	3860	4047	4340

Source: own elaboration

One may also notice in Table 2 that models estimated for women are characterized by the best properties among all constructed models while the ones estimated for men seem to be the least satisfactory. It is also visible that models denoted as 3M and 3W fit the data in the best way, that additionally justifies selection of the model specification denoted as 3 for the further analysis.

Table 3. Parameter estimates of the models estimated for the whole sample: models 1÷3

Explanatory variables		Model 1	Model 2	Model 3
GEN	*woman*	-1.2188 ***	-1.2127 ***	-1.1665 ***
AGE	*age*	-0.0280 ***	0.1749 ***	0.0964 ***
	age^2		-0.0021 ***	-0.0017 ***
EDU	*university*	1.6263 ***	1.6132 ***	1.5727 ***
	post secondary or vocational	0.7983 ***	0.9034 ***	0.7788 ***
	general secondary	0.7225 ***	0.8625 ***	0.7442 ***
	lower vocational	0.4187 ***	0.4425 ***	0.2985 ***
OWN	*private*	0.1848 ***	0.0527	0.1823 ***
SEC	*agriculture*	-0.7304	-0.4116	
	industry	-0.4738	-0.2500	
	services	-0.5260	-0.3471	
RES	*>100*10*^{3}	***	0.4085 ***	0.4241 ***
	*50-100*10*^{3}		-0.0128	0.0065
	*10-50*10*^{3}		-0.0347	-0.0341
	*town <10*10*^{3}		-0.1660 **	-0.1519 **
SIZ	*<10*	-1.1145 ***	-1.0502 ***	-1.0368 ***
	11-19	-0.7460 ***	-0.6873 ***	-0.6739 ***
	20-49	-0.6304 ***	-0.5815 ***	-0.5672 ***
	50-99	-0.5289 ***	-0.4774 ***	-0.4806 ***
OCC	*army*	3.6142 ***	3.4144 ***	3.3980 ***
	managerial	2.9992 ***	3.0579 ***	2.9084 ***
	professional	2.1097 ***	2.1392 ***	2.0109 ***
	technical	1.7891 ***	1.8692 ***	1.7079 ***
	clerical	1.0364 ***	1.1275 ***	1.0025 ***
	sales & services	0.5268 ***	0.5951 ***	0.4761 ***
	farmers. fishers. etc.	0.3291	0.3753	0.2337
	industry workers	0.9448 ***	1.0394 ***	0.9672 ***
	skilled workers	1.1005 ***	1.1888 ***	1.0929 ***
MAR	*married*		0.3157 ***	0.2669 ***
REL	*household head*		0.4250 ***	0.4090 ***
CON	*permanent*	0.9549 ***		0.7985 ***
	temporary-study	-0.5558 ***		-0.4875 ***
	temporary-no other job	0.1114		0.0479
SEN	*job seniority*	0.0389 ***		0.0412 ***
ADD	*additional job*	-0.2449 ***		-0.2831 ***

Source: own elaboration

Table 4. Parameter estimates of the models estimated for the whole sample: models 4÷6

Explanatory variables		Model 4		Model 5		Model 6	
GEN	*woman*	-1.2865	***	-1.1109	***	-1.1591	***
AGE	*age*	-0.0344	***	0.0004		-0.0435	***
EDU	*university*	1.6813	***	1.6367	***	1.6132	***
	post secondary or vocational	0.7971	***	0.9443	***	0.7940	***
	general secondary	0.7647	***	0.8327	***	0.7378	***
	lower vocational	0.3532	***	0.5405	***	0.3219	***
OWN	*private*	0.2039	***	0.0315		0.1833	***
SEC	*agriculture*	-0.6375		-0.4027			
	industry	-0.3834		-0.2615			
	services	-0.4387		-0.3562			
RES	*>100*10^3*			0.3791	***	0.4227	***
	*50-100*10^3*			-0.0141		0.0189	
	*10-50*10^3*			-0.0401		-0.0300	
	*town <10*10^3*			-0.1758	***	-0.1505	**
SIZ	*<10*	-1.0915	***	-1.0836	***	-1.0485	***
	11-19	-0.7360	***	-0.7105	***	-0.6843	***
	20-49	-0.6272	***	-0.5972	***	-0.5776	***
	50-99	-0.5297	***	-0.4906	***	-0.4934	***
OCC	*army*	3.5071	***	3.4203	***	3.3588	***
	managerial	2.9772	***	3.0618	***	2.9045	***
	professional	2.1063	***	2.1459	***	2.0142	***
	technical	1.8031	***	1.8684	***	1.7240	***
	clerical	1.0769	***	1.0918	***	1.0175	***
	sales & services	0.5500	***	0.5671	***	0.4829	***
	farmers. fishers. etc.	0.3012		0.3649		0.2075	
	industry workers	0.9377	***	1.0425	***	0.9725	***
	skilled workers	1.1048	***	1.1856	***	1.1045	***
MAR	*married*			0.4954	***	0.2912	***
REL	*household head*			0.4880	***	0.4184	***
CON	*permanent*	0.8104	***			0.8294	***
	temporary-study	-0.4935	***			-0.4560	***
	temporary-no other job	0.0608				0.0837	
SEN	*job seniority*	0.1209	***			0.1077	***
	job seniority^2	-0.0019	***	0.0000		-0.0017	***
ADD	*additional job*	-0.2944	***			-0.2802	***

Source: own elaboration

Analyzing parameter estimates of the models 3M and 3W (Table 6), one can see that the determinants affecting wages obtained by men and women are slightly different. Lover vocational education and work for military service increase odds of higher wages in comparison to the reference variant of variables only for men. While work in the private (versus public) sector rises the log odds of increasing incomes (by 0.488) for women only. The log odds of higher wages decreases for men living in towns with number of inhabitants smaller than 10 thousands in comparison to the ones living in the countryside. For both models increase in age and in job seniority causes increase of odds of higher earnings while increase in age squared causes decrease of odds of higher earnings.

Table 5. Parameter estimates of the models estimated for the whole sample: models 7÷9

Explanatory variables		Model 7	Model 8	Model 9
GEN	*woman*	-1.2058 ***	-1.1172 ***	-1.3170 ***
EDU	*university*	1.6199 ***	1.6495 ***	1.6802 ***
	post secondary or *vocational*	0.8392 ***	0.9508 ***	0.8301 ***
	general secondary	0.8093 ***	0.8348 ***	0.8185 ***
	lower vocational	0.3902 ***	0.5451 ***	0.4034 ***
OWN	*private*	0.1899 ***	0.0255	0.2087 ***
SEC	*agriculture*		-0.3989	-0.4911
	industry		-0.2529	-0.2380
	services		-0.3467	-0.2904
RES	*>100*10^3*	0.3933 ***	0.3551 ***	
	*50-100*10^3*	-0.0028	-0.0399	
	*10-50*10^3*	-0.0396	-0.0655	
	*town <10*10^3*	-0.1693 **	-0.1996 ***	
SIZ	*<10*	-1.0812 ***	-1.0869 ***	-1.1142 ***
	11-19	-0.7008 ***	-0.7109 ***	-0.7460 ***
	20-49	-0.5977 ***	-0.5999 ***	-0.6406 ***
	50-99	-0.5021 ***	-0.4891 ***	-0.5348 ***
OCC	*army*	3.4885 ***	3.4131 ***	3.6005 ***
	managerial	2.9513 ***	3.0618 ***	3.0095 ***
	professional	2.0491 ***	2.1535 ***	2.1272 ***
	technical	1.7879 ***	1.8644 ***	1.8486 ***
	clerical	1.0878 ***	1.0812 ***	1.1283 ***
	sales & services	0.5562 ***	0.5631 ***	0.6032 ***
	farmers. fishers. etc.	0.2195	0.3557	0.3172
	industry workers	1.0500 ***	1.0379 ***	1.0000 ***
	skilled workers	1.1802 ***	1.1847 ***	1.1637 ***
MAR	*married*	0.2520 ***	0.5024 ***	
REL	*household head*	0.3905 ***	0.4946 ***	
CON	*permanent*	0.9075 ***		0.8724 ***
	temporary-study	-0.3736 ***		-0.4243 ***
	temporary-no other job	0.1193		0.0892
SEN	*job seniority*	0.0652 ***		0.0854 ***
	job seniority^2	-0.0016 ***	0.0001	-0.0018 ***
ADD	*additional job*	-0.2616 ***	-0.2289 ***	-0.2772 ***

Source: own elaboration

Table 6. Parameter estimates of the models estimated for women and men

Explanatory variables		Model 3W		Model 3M		Model 6W	
AGE	*age*	0.1038	***	0.0789	***	-0.0243	***
	age^2	-0.0015	***	-0.0016	***		
EDU	*university*	1.5173	***	1.4503	***	1.5207	***
	post secondary or *vocational*	0.4663	***	0.8743	***	0.4708	***
	general secondary	0.5126	***	0.7859	***	0.4861	***
	lower vocational	0.0952		0.3889	***	0.1135	
OWN	*private*	0.4877	***	0.0256		0.4856	***
RES	*>100*10*^{3}	0.3513	***	0.4641	***	0.3427	***
	*50-100*10*^{3}	-0.0933		0.0597		-0.0896	
	*10-50*10*^{3}	-0.0414		-0.0294		-0.0434	
	*town <10*10*^{3}	-0.1259		-0.1968	**	-0.1199	
SIZ	*<10*	-1.2295	***	-1.0268	***	-1.2360	***
	11-19	-0.6231	***	-0.8103	***	-0.6207	***
	20-49	-0.6286	***	-0.5709	***	-0.6366	***
	50-99	-0.4827	***	-0.5090	***	-0.4925	***
OCC	*army*	22.5850		2.9717	***	22.4389	
	managerial	3.6499	***	2.5166	***	3.6594	***
	professional	2.4535	***	1.6985	***	2.4641	***
	technical	2.0715	***	1.5000	***	2.0875	***
	clerical	1.5351	***	0.4611	***	1.5445	***
	sales & services	0.7913	***	0.2653	**	0.7837	***
	farmers. fishers. etc.	1.3716	**	-0.0150		1.3282	**
	industry workers	0.5545	***	0.8961	***	0.5436	***
	skilled workers	0.9493	***	0.9779	***	0.9600	***
MAR	*married*	0.2287	***	0.3994	***	0.2624	***
REL	*household head*	0.3857	***	0.4209	***	0.3954	***
CON	*permanent*	1.1168	***	0.6090	***	1.1536	***
	temporary-study	-0.1959		-0.6774	***	-0.1616	
	temporary-no other job	0.3663	**	-0.1063		0.4109	**
SEN	*job seniority*	0.0415	***	0.0387	***	0.0970	***
	job seniority^2					-0.0015	***
ADD	*additional job*	-0.1445		-0.3757	***	-0.1409	

Source: own elaboration

Comparison of wage determinants in investigated years

The next step in our investigation is to estimate the model of wages, denoted as general model 3, on the basis of the whole samples. Table 7 contains comparison of parameter estimates obtained for ordered logit models estimated for analyzed periods. Job seniority is not included in models specified for years 2001 and 2003 as well as variant: *lower vocational* of variable describing level of education, and *army* as a variant of occupation in 2001 because there is lack of such data in PLFS in these years.

Table 7. Ordered logit models estimates: general models

Variables		2001		2003		2006		2009	
GEN	*woman*	-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	***
EDU	*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	***
	lower vocational	×		0.324	***	0.449	***	0.297	***
OWN	*private*	0.338	***	-0.003		0.128	**	0.182	***
RES	$>100*10^3$	0.586	***	0.414	***	0.478	***	0.452	***
	$50\text{-}100*10^3$	0.093		0.077		0.099		0.034	
	$10\text{-}50*10^3$	0.100		-0.034		0.078		-0.007	
SIZ	*<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	***
OCC	*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	***
MAR	*married*	0.341	***	0.401	***	0.316	***	0.266	***
REL	*household head*	0.700	***	0.742	***	0.561	***	0.407	***
CON	*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	
SEN		×		×		0.036	***	0.041	***
ADD	*additional job*	-0.027		-0.109		-0.146	**	-0.271	***

Source: Own elaboration.

Analyzing parameter estimates we notice that all explanatory variables are statistically significant, except single variants of descriptors. Majority of variables are characterized by expected sign and value of the parameter estimates. Women earn less than men in all years of analysis and discrepancy between monthly wages seems to be bigger in years 2006 and 2009 than in the first years of investigation. Higher level of education gives better chances for higher incomes however in 2009 the parameter estimates standing by university education was the biggest in 2006. In private sector monthly salaries seem to be higher than in public in years 2001, 2006 and 2009. In the biggest cities (with more than 100 thousands inhabitants) incomes are bigger than in towns with less than 10 thousands citizens and in the countryside, and it is the only statistically significant variant of the variable: place of residence.

Bigger enterprises offer higher wages since parameters of all variants, describing size of the enterprise, are significantly smaller than zero. Occupation, except the variant describing farmers and fishers in 2003 and 2009, also affects significantly earnings as well as type of employment contract, fact of being married and the household head. Parameters standing by age and squared age are significant with expected signs. Job seniority influence positively earnings in years 2006 and 2009 while it is difficult to interpret negative signs of the variable describing additional job.

CONCLUSIONS

In our research we analyze situation on the Polish labor market in years 2001, 2003, 2006 and 2009 based on LFS data, applying ordered logit model. The main determinants of wages are: gender, age or job seniority, level of education, size of firm and occupation in all analyzed years. However the influence of these factors in following periods may be different. The investigation shows that women's monthly incomes are significantly lower than men's one and the discrepancy seems to be the biggest in the last year of analysis however it may be caused by different factors.

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