WAGE DISPARITIES IN POLAND: ECONOMETRIC ANALYSIS[1]

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Abstract: The aim of our research is to identify determinants influencing wages in Poland in the years 2005 and 2009, and to find out if wages obtained by men and women depend on the same factors. Investigation is provided on the basis of data from the Polish Labor Force Survey, employing ordered multinomial logit models and exponential regression.

Keywords: labor market, wage disparity, ordered multinomial logit model, exponential regression

INTRODUCTION

Rogertson, Shimer and Wright (2005) claim that the economic fortunes of most individuals are largely determined by their labor market experiences that is, by paths for their wages, their employers, and their intervening spells of unemployment. Hence, economists are naturally interested in documenting the empirical behavior of wages, employment, and unemployment, and also in building models to help understanding mechanisms that shape these outcomes and using the models to assess the consequences of changes in policies and institutions.

There are many factors influencing wages that are either connected with the individual attributes of employees or describe the general situation at the labor market and characterize the particular place (– institution or enterprise) of employment. The former may be the subject of potential wage disparities. Inequalities at the labor market concern different aspects and social relations such as [Cain 1986, p. 693]: gender, sexual orientation, age, race, disabilities, religion, etc. Labor market discrimination by gender, race, and ethnicity is the word-wide

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problem and estimation of these types of discriminations has become routine [Neuman & Oaxaca 2003].

"Equal pay for equal work" is one of the fundamental principles of the European Union. However, the Structure of Earnings Survey (SES) reports that in 2006 in all 27 EU countries the gender wage gap (GPG) was 18.4% on average, while in Poland it was 7.4%. In fact among 27 European Union member states situation at the labor market essentially differs since the smallest GPG is observed in Italy – 4.4%, and the biggest in Estonia – 30.3% [Witkowska & Matuszewska-Janica 2012].

The aim of our research is to identify determinants that affect ernings in Poland in two selected periods (i.e. years 2005 and 2009), and to find out if wages obtained by men and women depend on the same factors. Investigation is provided by two types of econometric models i.e. ordered multinomial logit model and exponential regression, that are estimated employing individual data from the Polish Labor Force Survey (PLFS).

LITERATURE REVIEW

The socialist countries of Eastern Europe and the former Soviet Union were long committed, at least nominally, to gender equality in the labor market [Brainerd 2000]. Government policies such as relatively high minimum wages and generous maternity leave and day care benefits encouraged women to work, and female labor force participation rates were high compared with those of other countries. While women remained over-represented in areas such as health and education, they fared at least as well as their counterparts in most developed and developing countries in terms of female-male wage differentials.

The transformation of economies from centrally planned toward market-oriented that has been taking place in Central and Eastern Europe involved significant changes in labor market institutions. Constraints on layoffs and redundancies were significantly reduced but unemployment – the unknown in communist era phenomenon - appeared. In Poland the unemployment rate rose essentially from zero in 1988 to the first peak[2] of 16.4% in 1994, and there has been massive inter-sectoral reallocation of labor [Keane & Prasad 2006]. During last 20 years of transition there has been a large, well documented rise in wage inequality in most of the transition countries [Milanovic 1999, Brainerd 2000, Keane & Prasad 2006, Newell & Reilly 2001, Newell & Socha 2005 and 2007].

Keane 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 data set allows them to trace out changes beginning from the last few years of pre-transition era, following

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[2] The smallest monthly unemployment rates in Poland are observed in 1998 – 9.5% and in 2008 – 12.4% while the highest value in 2002 – 20.1%, 2003 – 20.7%, 2004 – 20.6%.

the "big bang" in 1989-1990, and six years of transformation. They find that overall earnings inequality rose markedly during the transition period 1989–1996. They 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. But their results contradict this view since 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.

Newell and Socha (2007), applying Labor Force Survey, find that the increase in wage inequality in years 1998-2002 was associated with rapidly rising returns to education for highly-qualified workers in highly-skilled occupations and falling relative wages for those with only primary education. Rising within-skill group wage variance was also concentrated. This is associated with privatization and an increase in the share of young people in some low-paying occupations. There is a clear contrast between the private and public sectors in the impact of local labor market conditions on wages.

Considering the situation of women in the first decade of economic and political transformation in Poland, Grajek (2001) claims that the year of giving away the power by the communists (1989) turned out to be far more important in terms of improving relative position of women than the actual year of launching the reform package (1990) and all the following years of transition. Females had gained substantially due to the structural shift in the very first years of the new economic system and the improvements have slowed down or even reversed in the next years, probably due to the "statistical" discrimination.

Adamchik and Bedi (2003) examine gender differences in a variety of labor market outcomes with an emphasis on the gender wage gap in Poland in years 1993-1997. The empirical analysis shows that during this period there was a marked decline in relative employment outcomes for women while industrial and occupational segregation remained unchanged. The mean gender wage gap of about 22-23 percent remained steady and except for a reduction at the lower tail remained stable throughout the wage distribution.

MODELS, VARIABLES AND DATA

To describe wages in Poland we construct several models that are estimated using individual PLFS data from the fourth quarter 2005 and the first quarter 2009. Since dependent variable is described in the PLFS either as quantitative variable i.e. amount of monthly net salary in PLN (in 2009) or as qualitative feature

i.e. belonging to the certain wage interval (in 2004) therefore we apply two different classes of models[3]. The former is exponential regression model estimated after linearization (i.e. for the logarithm of wages) by Ordinary Least Squares method (OLS). That type of models is often used in research concerning wages [Grajek 2001, Blau & Kahn 2006, Newell & Reilly 2001, Newell & Socha 2007, and Cukrowska 2011]. The latter is ordered multinomial logit model estimated by Maximum Likelihood method [Boes & Winkelmann 2009, Gruszczyński 2010]. It is worth mentioning that in our models age is represented by two variables i.e. age and the square of age to describe the phenomenon that wages increase to the certain age (or job seniority), and then stabilization of salaries is observed [Chzhen & Mumford 2009, Dudek 2009].

According to different characters of the data representing monthly wages (i.e. wages obtained by respondents in the month prior to the month when survey was conducted) we consider exponential models only for the year 2009, while ordered multinomial logit models are built for the years 2005 and 2009, after classification of respondents (who defined amount of their monthly net salary in PLN) to the previously defined classes. In our research we construct models for all respondents (- general models) and models estimated separately for men and women that simplifies gender wage gap analysis (- partial models). Such approach was proposed by Juhn, Murphy and Pierce (1991), and is often used in gender disparities analysis [Grajek 2001, Blau & Kahn 2006, Newell & Reilly 2001].

Table 1. List of explanatory factors

Respondents' characteristics	No. of variants	Reference variant	Employment characteristics	No. of variants	Reference variant
REL -relationship with the head of the household	2	not household head	OWN - type of enterprise	2	public
MAR - marital status	2	not married	SEC - sector of employment	4	other than defined
RES - size class of the place of residence –no. of inhabitants	5	countryside	SIZ - size of employee's firm*	5	50-100 employees
OCC - occupation	10	unskilled workers	* in 2005 there were only 4 classes but reference variant for both years is the same		
AGE - age	quantitative feature				
EDU - education	5	preliminary or lower			
GEN - gender	2	men			

Source: own elaboration

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[3] In fact in survey from 2009 it was possible to report monthly salary either as quantitative or qualitative variable.

Explanatory variables, that are selected arbitrarily for the model construction, are often used in the research concerning wages, for instance [Newell & Socha 2007]. These variables describe respondents' characteristics and employees' firm characteristics. Table 1 contains description of explanatory factors together with the number of variants, representing by binary variables appointed for each factor, and the definition of the reference variable that is necessary for interpretation of the parameters. The list of explanatory variables of all models is presented in Tables 2 and 4.

MODEL ESTIMATES

Selected results of the models' estimation are presented in Tables 2 and 4. The former contains comparison of general multinomial logit models estimated for two analyzed periods. The latter compares parameters of regression models estimated for the year 2009 for the total sample and partial models. In Tables stars denote significance level * α=0.1, ** α=0.05, and *** α=0.01, and symbol × denotes lack of variables. Parameter is statistically significant for $\alpha \leq 0.05$.

As one may notice (Table 2) among selected factors only economic sector SEC does not influence significantly wages in both years, and type of ownership OWN is not significant in 2009. Being head of the household and married generate higher wages in comparison to the reference variant while women earn essentially less than men. Age is significantly positive while square age - negative. Educated employees obtain higher salaries than the ones having only preliminary education (or less), and better education seems to guarantee higher earnings. All type of occupation (except farmers in 2009) earn more than unskilled workers, and representatives of army, authority, higher officers and managers (i.e. variable managerial), as well as professionals seem to gain the highest wages. Also respondents living in cities with at least 100 thousand inhabitants earn better than countryside citizens. In both years of analysis, respondents of the institutions employing less than 50 employees have smaller salaries than the reference group, while respondents from enterprises employing more than 100 employees obtain higher wages in 2009. It is worth mentioning that in 2009 wages obtained in private sector are bigger than in public while in 2005 the parameter is significantly negative.

Analyzing model estimates obtained for partial models we do not notice essential differences between partial and general models, except (Table 3)[4]:

- lack of significance of variables: private ownership of the enterprise, lower vocational education, and occupation as farmers, fishers, foresters, etc. in the model that is estimated for women in 2005;

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[4] In both models estimated for women variable describing representatives of army is lacking.

- lack of significance of variable describing respondents from towns with less than 10 thousands inhabitants, and significant positive influence of employment in private enterprise in the model that is estimated for women in 2009.

Comparison of parameter signs from partial logit models estimated for both years is presented in Table 3 where symbols + and - denote statistically significant parameter positive and negative respectively, 0 – insignificant parameter.

Table 2. General models estimates: ordered multinomial logit models

Selected factors	Period	I Quarter 2009			IV Quarter 2005		
	No. of observations	12936			9080		
	Variables	Parameter	Error term		Parameter	Error term	
SEC	agriculture	-0.393	0.483		-0.972	1.116	
	industry	-0.231	0.467		-0.688	1.107	
	service	-0.329	0.465		-0.857	1.105	
OWN	private	0.054	0.043		-0.127	0.058	**
RES	>100 thousands	0.406	0.043	***	0.468	0.062	***
	50-100 thousands	-0.011	0.065		0.144	0.082	*
	10-50 thousands	-0.033	0.047		-0.075	0.062	
	<10 thousands	-0.168	0.067	**	0.092	0.090	
REL	household head	0.429	0.037	***	0.705	0.052	***
GEN	woman	-1.208	0.041	***	-1.074	0.057	***
AGE	age	0.175	0.012	***	0.175	0.015	***
	age^2	-0.002	0.000	***	-0.002	0.000	***
MAR	married	0.314	0.041	***	0.372	0.059	***
EDU	university	1.608	0.090	***	2.358	0.140	***
	post secondary or vocational	0.901	0.076	***	1.159	0.122	***
	general secondary	0.861	0.090	***	1.217	0.144	***
	lower vocational	0.441	0.072	***	0.544	0.116	***
SIZ	<10 employees	-0.572	0.060	***	-0.847	0.078	***
	11-19 employees	-0.216	0.061	***	-0.506	0.057	***
	20-49 employees	-0.108	0.055	**	-0.349	0.066	***
	>100 employees	0.474	0.050	***	×	×	×
OCC	army	3.406	0.237	***	3.035	0.259	***
	managerial	3.044	0.108	***	3.442	0.158	***
	professional	2.131	0.088	***	2.120	0.140	***
	technical	1.857	0.081	***	2.210	0.131	***
	clerical	1.122	0.083	***	1.528	0.137	***
	sales & services	0.585	0.079	***	0.651	0.146	***
	farmers, fishers, etc.	0.373	0.271		1.449	0.359	***
	industry workers	1.026	0.071	***	1.335	0.124	***
	skilled workers	1.181	0.074	***	1.544	0.125	***

Source: own elaboration [Witkowska & Majka 2012]

Taking into consideration regression model of wages estimated for logarithm of this variable observed in 2009 (Table 4) we notice that in general model marital status is not significant together with some variables describing cities with less than 100 thousands inhabitants and size of the institutions with less than 50 employees. Therefore the main difference observed for both general models estimated on the basis of the survey from 2009 is lacing of significance of variable describing that married employees earn more than unmarried ones in the regression model.

Table 3. Factors influencing wages in partial models in years 2005 and 2009

Significant factors	No. of significant variables	Particular variables	Sign of parameter			
			2009		2005	
			Women	Man	Women	Man
SEC	all (3)		0	0	0	0
OWN	all (1)		+	0	0	-
RES	2	*>100000* inhabitants	+	+	+	+
		<10000 inhabitants	0	+		
REL	all (1)		+	+	+	+
AGE	quantitative	age	+	+	+	+
		age^2	-	-	-	-
MAR	all (1)		+	+	+	+
EDU	all (4)	*lower vocational*	+	+	0+	
		others	+	+	+	+
SIZ	all (4)	*<10 employees*	-	-	-	-
		11-19 employees	-	-	-	-
		20-49 employees	-	0	-	-
		>100 employees	+	+	×	×
OCC	all (9)	*sales & services*	0	0	0	+
		others	+	+	+	+

Source: own elaboration

Parameter estimates obtained for the partial models are very similar to the ones obtained for the general model. The detailed comparison of parameter signs is presented in Table 5. It is visible that all variables, but marital status, influence wages in similar way in all estimated models. In case of wages obtained by married employees they are higher than unmarried ones for men (positive sign) and smaller for women (negative sign), while for the total sample of respondents this variable is insignificant. Although in all ordered multinomial logit models this variable is significantly positive. To complete discussion concerning model estimation we should add that interpretation of the parameters signs is acceptable and similar to the results obtained in other research.

Table 4. General and partial models estimates for 2009: regression models

Model	2009 Total			2009 Women			2009 Men		
No. of observations	7132			3400			3732		
Variable	Param.	Error		Param.	Error		Param.	Error	
agriculture	4.740	0.070	***	3.478	0.112	***	6.080	0.096	***
industry	4.759	0.063	***	3.584	0.087	***	6.080	0.090	***
service	4.725	0.062	***	3.547	0.084	***	6.044	0.089	***
private	0.051	0.013	***	0.093	0.019	***	0.003	0.017	
>100 thousands	0.080	0.013	***	0.084	0.019	***	0.071	0.017	***
50-100 thousands	0.024	0.019		0.017	0.026		0.030	0.025	
10-50 thousands	0.012	0.013		0.036	0.020	*	-0.016	0.017	
<10 thousands	-0.033	0.020	*	-0.011	0.028		-0.060	0.026	**
household head	0.077	0.011	***	0.068	0.017	***	0.087	0.015	***
woman	-0.242	0.012	***	×	×	×	×	×	×
age	0.101	0.003	***	0.141	0.004	***	0.043	0.004	***
age²	-0.001	0.000	***	-0.002	0.000	***	-0.001	0.000	***
married	0.004	0.012		-0.047	0.017	***	0.112	0.017	***
university	0.457	0.025	***	0.570	0.039	***	0.354	0.034	***
post second. or *vocational*	0.291	0.020	***	0.366	0.034	***	0.222	0.024	***
general secondary	0.317	0.025	***	0.412	0.038	***	0.231	0.033	***
lower vocational	0.170	0.019	***	0.235	0.033	***	0.128	0.022	***
<10 employees	-0.079	0.018	***	-0.080	0.026	***	-0.135	0.023	***
11-19 employees	-0.026	0.018		0.021	0.027		-0.105	0.024	***
20-49 employees	0.020	0.016		0.035	0.024		-0.024	0.021	
>100 employees	0.110	0.015	***	0.119	0.022	***	0.085	0.019	***
army	0.610	0.033	***	0.611	0.049	***	0.567	0.042	***
managerial	0.381	0.025	***	0.382	0.032	***	0.346	0.042	***
professional	0.332	0.023	***	0.341	0.031	***	0.297	0.033	***
technical	0.199	0.023	***	0.256	0.031	***	0.085	0.035	**
clerical	0.136	0.022	***	0.178	0.029	***	0.057	0.034	*
sales & services	0.184	0.067	***	0.380	0.174	**	0.099	0.068	
farmers, fishers, etc.	0.185	0.019	***	0.094	0.035	***	0.161	0.024	***
industry workers	0.234	0.020	***	0.196	0.039	***	0.201	0.025	***

Source: own elaboration [Witkowska & Majka 2012]

Table 5. Factors influencing wages in 2009

Significant factors	No. of significant variables	Particular variables	Sign of parameter		
			Total	Women	Man
SEC	all (3)		+	+	+
OWN	all (1)		+	+	0
RES	1	*>100000* inhabitants	+	+	+
REL	all (1)		+	+	+
GEN	all (1)		-	×	×
AGE	quantitative	age	+	+	+
		age^2	-	-	-
MAR	all (1)		0	-	+
EDU	all (4)		+	+	+
SIZ	2	*<10 employees*	-	-	-
		>100 employees	+	+	+
OCC	all (9)	*clerical*	+	+	0
		sales & services	+	+	0
		others	+	+	+

Source: own elaboration

CONCLUSIONS

In our research nine models are estimated, - six of them are ordered multinomial logit models, and three - exponential models. To sum up results obtained for estimated models we claim as following.

- The main difference between situation observed in the years 2005 and 2009 is that private institutions employees rated their wages lower than public institutions employees in 2005 while in 2009 the parameter standing by the variable *private* is positive for both general models and statistically significant in regression model. Regardless the year of investigation, women working in private institutions are better paid than women in public institutions although this variable is significant in 2009 only. Type of the place of employment ownership influences men earnings in 2005 when men in public institution gain higher wages.
- Employees from the biggest cities earn significantly more than the ones from the countryside. Respondents living in towns up to 10 thousand inhabitants declare lower wages than employees from villages in 2009. In 2005 the parameter standing by this variable is statistically insignificant.
- Variables describing sector of employment are insignificant in both multinomial logit models but they are significant in exponential model, that is the main difference between these two types of models.
- Gender wage gap is observed years 2005 and 2009.

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