A C T A U N I V E R S I T A T I S L O D Z I E N S I S
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MEN'S AND WOMEN'S ECONOMIC ACTIVITY IN POLAND

Abstract. The aim of the article is to examine the impact of a job seeker's gender on their economic activity and employment odds in Poland in 2010. The research tool was a logit model. The starting point for the analysis was the construction of models that related economic activity and employment to gender only. Then other models with many explanatory variables were constructed. Since the odds ratios for gender determined for the sake of those models are interpreted under the assumption that the other variables are constant, it indicates that the women's and men's odds ratio remains the same in urban and rural areas, on every education level and in every age group. But in reality it is not true. This is why the authors estimated the models that contained only one explanatory variable (gender) for individual subgroups.

Key words: logit model, professional activity and inactivity, employed and unemployed persons.

I. INTRODUCTION

In 2011 the professional activity rate in Poland reached 55.8%, the employment rate – 50.6%, while the unemployment rate was 9.3%. The above rates are different for men and women. The proportion of professionally active men was higher and amounted to 64.3% (in comparison to 48.2 % women). Also the share of the employed men was larger at 58.6% than of the employed women (43,4 %). On the other hand, the women's unemployment rate overgrew the men's (9.9 % and 8.8 % respectively). The aim of the article was to review activity odds and the employment odds for men and women. With a view to this the authors used the logit model with one and many explanatory variables, paying particular attention to the differences among the estimated parameters of individual models. The study covered the Polish population aged 15 and more in 2010. The article is a part of the Ministry of Science and Higher Education grant No N N111 273538 (2010-2012).

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II. THE RESEARCH METHOD

In order to examine the impact of a gender factor on the professional activity odds and on the employment odds the authors applied the logistic regression model[1] which can be expressed in a logit form as [Frątczak, Gach-Ciepiela, Babiker 2005]:

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right) = \alpha_0 + \sum_{i=1}^{k} \alpha_i x_i \,, \tag{1}$$

where:

$p = P(Y = 1 \mid x_1, x_2, ..., x_k)$ – the likelihood of a specific incident to happen,

x_i – explanatory variables for $i = 1,2,\ldots,k$

α_i – regression coefficient for $i = 0,1,2,\ldots,k$.

The results are interpreted by means of an expression $\exp(\alpha_i)$ being an odds rate (*OR*) of professional activity or employment in a given group in relation to the test group.

III. LOGIT MODELS OF PROFESSIONAL ACTIVITY AND EMPLOYMENT

When analysing the Poles' economic activity in 2010 the authors built two groups of logit models. In the first group they decided on the explanatory variable to be the type of economic activity which has been defined as follows:

$$Y = \begin{cases} 1, & \text{for a professionally active person} \\ 0, & \text{for a professionally inactive person} \end{cases}$$

and which have been called the professional activity models. The explanatory variable in the second group is a type of a professional activity defined as follows:

$$Y = \begin{cases} 1, & \text{for an employed person} \\ 0, & \text{for an unemployed person} \end{cases}$$

which have been named the employment models.

[1] Find more about logistic regression in: Hosmer, Lemeshow 2000; Kleinbaum, Klein 2002, Wiśniewski 1986.

The description of the explanatory variables is presented in Table 1.

Table 1. The description of explanatory variables in the logit model

Independent variable	Value	Groups	Numbers (in thous.)
P (gender)	1	Females	16647
	0	Males	15094
Z (the place of residence)	1	Urban areas	19594
	0	Rural areas	12147
W_1 (education)	1	Basic vocational	7813
	0	At most lower secondary	7295
W_2 (education)	1	General secondary	3391
	0	At most lower secondary	7295
W_3 (education)	1	Post-secondary and vocational secondary	7316
	0	At most lower secondary	7295
W_4 (education)	1	Higher	5925
	0	At most lower secondary	7295
S_1 (age)	1	25-34	6168
	0	15-24	5011
S_2 (age)	1	35-44	4979
	0	15-24	5011
S_3 (age)	1	45-54	5303
	0	15-24	5011
S_4 (age)	1	55-59	2832
	0	15-24	5011
S_5 (age)	1	60 years and more	7448
	0	15-24	5011

Source: own study based on the data published by the Central Statistical Office (2011) *Aktywność ekonomiczna ludności Polski IV kwartał 2010.*

The study was carried out in three stages. The analysis started with building models where professional activity and employment were related to gender only (stage I). The following models were built (with relevant parameters):

– the professional activity model:

$$\operatorname{logit}(p) = 0.5877 - 0.6602 \cdot P\,, \tag{2}$$

– the employment model:

$$\operatorname{logit}(p) = 2.3329 - 0.1201 \cdot P\,. \tag{3}$$

In both cases the parameter with the variable P is negative, so the women's activity and employment odds are lower than the men's. On stage II further models were constructed where explanatory variables consisted of the following

pairs: gender and the place of residence (P, Z), gender and education (P, W_i), gender and age (P and S_i). Since the age and the education variables are polynomial, the authors changed them into dichotomic variables (Table 1). The odds ratios for both sexes determined in the above presented models were interpreted resting on the assumption that the remaining variables were fixed. They also showed that relation of the women's odds ratio to the men's one was the same in both urban and rural areas, on each education level and in each age group, while in reality they are not. This is why the authors estimated those models that consisted of only one explanatory variable in individual subgroups (stage III). The results of the logit model estimation with many and one explanatory variable (in subgroups) are presented in Table 2.

Table 2. Estimated parameters of the professional activity and the employment logit models

	Professional activity				Employment			
X_i	Regression coefficient estimator	Standard error	p	Odds ratio	Regression coefficient estimator	Standard error	p	Odds ratio
1	2	3	4	5	6	7	8	9
	Gender and the place of residence							
α_0	0.5563	0.0007	0.0000		2.3541	0.0015	0.0000	
P	–0.6616	0.0007	0.0000	0.5160	–0.1176	0.0016	0.0000	0.8890
Z	0.0522	0.0007	0.0000	1.0535	–0.0368	0.0017	0.0000	0.9638
	Gender – urban areas							
α_0	0.5837	0.0007	0.0000		2.2786	0.0014	0.0000	
P	–0.6172	0.0009	0.0000	0.5395	–0.0377	0.0021	0.0000	0.9630
	Gender – rural areas							
α_0	0.5938	0.0009	0.0000		2.4173	0.0019	0.0000	
P	–0.7327	0.0012	0.0000	0.4806	–0.2537	0.0027	0.0000	0.7759
	Gender and education							
α_0	–1.0259	0.0010	0.0000		1.6586	0.0023	0.0000	
P	–0.7342	0.0008	0.0000	0.4799	–0.2217	0.0017	0.0000	0.8011
W_1	1.8938	0.0012	0.0000	6.6444	0.5609	0.0027	0.0000	1.7523
W_2	1.4254	0.0015	0.0000	4.1595	0.3669	0.0032	0.0000	1.4433
W_3	0.2380	0.0011	0.0000	1.2688	0.1943	0.0022	0.0000	1.2144
W_4	2.9235	0.0014	0.0000	18.6069	1.4857	0.0031	0.0000	4.4179
	Gender – at most lower secondary education							
α_0	1.6104	0.0017	0.0000		3.1715	0.0035	0.0000	
P	–0.2982	0.0022	0.0000	0.7422	–0.2655	0.0045	0.0000	0.7668
	Gender – basic vocational education							
α_0	1.1024	0.0012	0.0000		2.4262	0.0022	0.0000	
P	–0.7281	0.0016	0.0000	0.4828	–0.2462	0.0032	0.0000	0.7817
	Gender – general secondary education							
α_0	0.3712	0.0019	0.0000		2.0109	0.0037	0.0000	
P	–0.6907	0.0023	0.0000	0.5012	–0.1976	0.0048	0.0000	0.8207

Table 2 (cont.)

1	2	3	4	5	6	7	8	9
	Gender – post–secondary and vocational secondary education							
α_0	0.9226	0.0010	0.0000		2.2298	0.0018	0.0000	
P	–0.8600	0.0015	0.0000	0.4232	–0.2506	0.0031	0.0000	0.7783
	Gender – higher education							
α_0	–0.9513	0.0013	0.0000		1.6026	0.0029	0.0000	
P	–0.8999	0.0019	0.0000	0.4066	–0.0877	0.0045	0.0000	0.9161
	Gender and age							
α_0	–0.2917	0.0010	0.0000		1.2418	0.0020	0.0000	
P	–0.8438	0.0010	0.0000	0.4301	–0.1503	0.0017	0.0000	0.8604
S_1	2.5276	0.0015	0.0000	12.5234	1.0636	0.0023	0.0000	2.8967
S_2	2.7445	0.0017	0.0000	15.5568	1.4860	0.0027	0.0000	4.4192
S_3	–0.3920	0.0016	0.0000	0.6757	0.2741	0.0024	0.0000	1.3153
S_4	0.8063	0.0016	0.0000	2.2396	1.3693	0.0037	0.0000	3.9327
S_5	–1.5001	0.0016	0.0000	0.2231	1.9925	0.0063	0.0000	7.3340
	Gender – age 15–24							
α_0	–0.4549	0.0013	0.0000		1.2802	0.0024	0.0000	
P	–0.4685	0.0019	0.0000	0.6259	–0.2381	0.0037	0.0000	0.7882
	Gender – age 25–34							
α_0	2.6178	0.0023	0.0000		2.3361	0.0021	0.0000	
P	–1.3981	0.0026	0.0000	0.2471	–0.2137	0.0030	0.0000	0.8076
	Gender – age 35–44							
α_0	2.5180	0.0024	0.0000		2.7169	0.0027	0.0000	
P	–0.9419	0.0029	0.0000	0.3899	–0.1287	0.0039	0.0000	0.8792
	Gender – age 45–54							
α_0	1.6094	0.0017	0.0000		2.5555	0.0026	0.0000	
P	–0.4568	0.0022	0.0000	0.6333	–0.1039	0.0037	0.0000	0.9013
	Gender – age 55–59							
α_0	0.6720	0.0018	0.0000		2.5541	0.0041	0.0000	
P	–1.1359	0.0025	0.0000	0.3211	–0.0113	0.0065	0.0818	0.9887
	Gender – age 60 years and more							
α_0	–1.7113	0.0016	0.0000		2.9399	0.0068	0.0000	
P	–1.0396	0.0026	0.0000	0.3536	0.8291	0.0147	0.0000	2.2912

Source: own study (*STATISTICA*).

When interpreting a logit model the transformation of the parameters $\exp(\alpha_i)$ is applied. Individual odds ratios inform us that women have less chance than men for both being professionally active and finding employment. In order to make the data presentation more comprehensible the men's/women's odds ratios in Figure 1 are shown as the obverse of the odds in Table 2. When the odds value is bigger than 1, it is the men whose odds are higher. When the odds value is less than 1 – women's odds are bigger than the men's. In case of the odds value equal 1 their chances are equal as well (therefore the line drawn at the 1 level is a reference one).

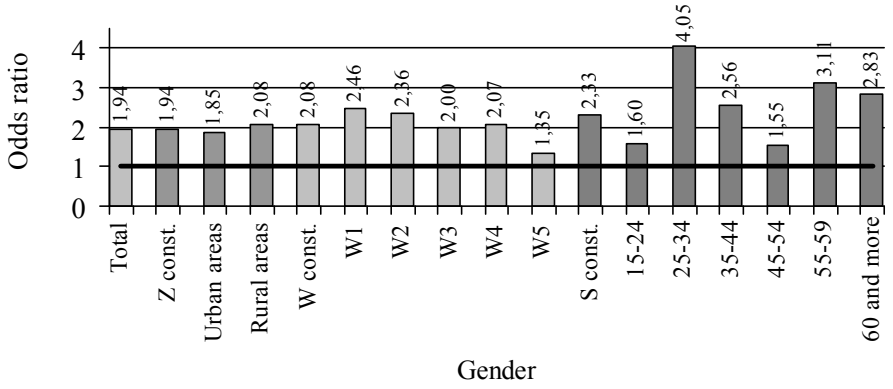

Figure 1. The total of the men's professional activity odds ratios in relation to the women's ones by their place of residence, education and age in Poland in 2010
Source: own study.

In Figures 1 and 2 the odds described as *In total* result from the transformation of the parameters of the models (2) and (3). The professional activity odds are almost doubled for men in comparison to women, while their employment odds are bigger by 13%. The variables denoted as *const*. refer to the models with many explanatory variables. While interpreting parameters with the variable *P* (gender) in these models we assume that other variables, i.e. the place of residence (Z), education (W_i) and age (S_i) remain constant.

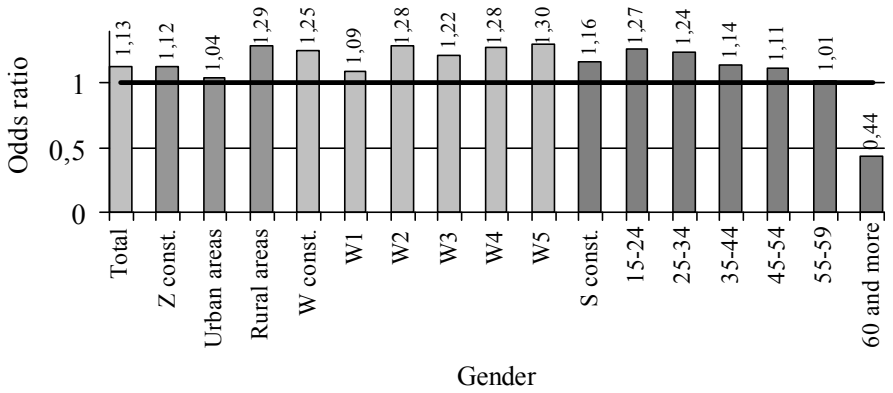

Figure 2. The total of the men's employment odds ratios in relation to the women's ones by their place of residence, education and age in Poland in 2010
Source: own study.

Assuming that the place of residence is constant, the activity odds ratio of males in relation to females is 1.94, which indicates that it is the same in both urban and rural areas. The results of modeling in the subgroups, however, show that these ratios differ (in the former: 1.85, in the latter 2.08). When constructing models with one variable, analogous differences were demonstrated in reference of education and age. It is particularly clear when we look at the professional activity models that take age into account. In the group of 15-24 year-olds the odds of males are 60% higher than females, and in the 24-34 year-old group they are four times higher. As for the employment models these proportions are smaller.

In conclusion we can say that if it is possible to build logit models for individual groups (assuming that the data are available and a group is of sufficient size), we can obtain more accurate data concerning the problem being investigated.

REFERENCES

Aktywność ekonomiczna ludności Polski IV kwartał 2010 (2011), Informacje i opracowania statystyczne, GUS, Warszawa.

Frątczak E., Gach-Ciepiela U., Babiker H. (2005), *Analiza historii zdarzeń. Elementy teorii, wybrane przykłady zastosowań*, SGH, Warszawa.

Hosmer D.W., Lemeshow S. (2000), *Applied Logistic Regression*, John Wiley & Sons, Inc.

Kleinbaum D.G., Klein M. (2002), *Logistic Regression. A Self-Lerning Text*, Springer-Verlag, New York.

Wiśniewski J. W. (1986), *Ekonometryczne badanie zjawisk jakościowych. Studium metodologiczne*, Wydawnictwo Uniwersytetu Mikołaja Kopernika, Toruń.

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AKTYWNOŚĆ EKONOMICZNA KOBIET I MĘŻCZYZN W POLSCE

Celem artykułu jest zbadanie wpływu płci na szansę aktywności zawodowej oraz na szansę posiadania zatrudnienia w Polsce w 2010 roku. Narzędziem badawczym jest model logitowy. Punktem wyjścia analizy była budowa modeli uzależniających aktywność zawodową oraz posiadanie zatrudnienia jedynie od płci. Następnie zbudowano modele z wieloma zmiennymi objaśniającymi. Ponieważ ilorazy szans dla płci wyznaczone w omówionych modelach są interpretowane przy założeniu stałości pozostałych zmiennych, wskazują, że iloraz szans kobiet w stosunku do mężczyzn jest taki sam, w mieście i na wsi, w każdej grupie wykształcenia oraz w każdej grupie wieku. W rzeczywistości tak nie jest. Dlatego też oszacowano modele zawierające tylko jedną zmienną objaśniającą (płeć) dla poszczególnych podgrup.