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Application of the Logit Model to the Analysis of Economic Activity Factors of the Disabled

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Keywords: *disability; economic activity; logit models*

Abstract: *The purpose of this study was to identify factors affecting the classification as a working group of economically active people with disabilities. According to the Labour Force Survey methodology, working population is defined as labor resources, labor supply and labor force, which includes all people of working-age 15 and older, considered as employed or unemployed. Community of people with disabilities is extracted from the general population aged 15 and more, on the basis of law. People with disabilities include those aged 16 and over who have been awarded a judgment about the degree of disability or inability to work (CSO 2011).*

In the analyses of the labor market models with qualitative variables, which include logit models, are very often used. For the purpose of the study it was assumed that these models will describe the probability of a person with a disability

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to qualify for the category of employed. The basis for estimating probability models were individual data obtained under representative Labour Force Survey in the fourth quarter of 2010. A set of explanatory variables contains 54 binary variables.

Introduction

People with disabilities face many barriers in the labor market in the possibilities of obtaining employment. In this sphere, we can distinguish among others individual barriers arising from the disability or from disease (Nowak, 2002). Often these are the personality traits of a disabled person, the attitude towards oneself, education, ownership, occupation, additional skills and the type and degree of disability (Gorczycka, 2005).

The aim of the study is an attempt to identify factors that affect the classification of a group of working people with disabilities as active population. According to the LFS methodology, working population is defined as labor resources, labor supply and labor force, which includes all people aged 15 years and older, considered as employed or unemployed.

Those included among the employed are all people aged 15 and more who during the reference week (GUS, 2011):

- performed for at least one hour any work generating pay or income, i.e. were employed as employees, worked on their own (or leased) agricultural farm, or conducted their own economic activity outside agriculture, assisted (without pay) in work on family agricultural farm or in conducting family economic activity outside agriculture,
- had work but did not perform it due to sickness, maternity leave or vacation, due to other reasons, but the break in employment: did not exceed 3 months; exceeded 3 months, but those people worked as employees and during that period received at least 50% of the hitherto remuneration,
- apprentices who entered into occupational training or occupational preparation contract with a private or public employer, if they received remuneration.

The unemployed are people who simultaneously meet the conditions (GUS, 2011):

- in the reference week were not employed, were actively looking for work, i.e. for over 4 weeks (the reference week being the fourth one) had been involved in concrete actions aimed at finding a job, were available to take up work within two weeks after the reference week,

– people who were not seeking work because they had already found a job and were only waiting to start work within the period no longer that 3 months, and they were available for this job.

Population of the disable was separated from the population aged 15 and more on the basis of the legal criterion. Those included among the disabled were people aged 16 and more who were granted the certificate of disability or inability to work (GUS, 2011).

Analyses of the labor market are very often based on models of qualitative variables, which include logit models (see Balcerzak & Śliwicki, 2013). For the purpose of the study it was assumed that these models will describe the probability of a person with a disability to qualify for the category of the employed.

Selected Data on People with Disabilities in the Labour Market

The activity rate of people with disabilities in the fourth quarter of 2011 was 17.3%. In comparison with the previous year (fourth quarter 2010), the activity rate decreased by 0.1 percentage points.

The employment rate of people with disabilities in the fourth quarter of 2011 was 14.6%. In other years, the rate was respectively: 2005 – 12.8%, 2006 – 12.9%, 2007 – 13.9%, 2008 – 14.4%, 2009 – 14.2% and 2010 – 15.0%.

The unemployment rate among people with disabilities at the end of the fourth quarter of 2011 was 15.2%. During the year, i.e. in relation to the fourth quarter of 2010 (13.6%), it increased by 1.6 percentage points. On the other hand, compared to 2009, the increase was 4.2 percentage points in 2009 was higher and stood at 4.5 percentage points.

In Poland, the proportion of unemployed people with disabilities among all unemployed people was 5.28%. According to the regions, this share ranged from 3.72% (mazowieckie voivodeship) to 7.88% (lubuskie voivodeship). The smallest proportion of people with disabilities occurred in the region: zachodniopomorskie, podkarpackie, mazowieckie and lubelskie. In turn, the highest recorded in the provinces located in the western Polish and lubuskie and dolnośląskie voivodships, as well as in the łódzkie voivodeship. The dominating interval among the regions was 5,3-6,2% (5 voivodeships).

Among the unemployed with disabilities in Poland in 2011 the dominant group were people with disabilities out of work for over 24 months. In terms of education, most of the unemployed disabled had a lower secondary and vocational education (35.9 thousand). Among the disabled are peo-

ple with seniority from 10 to 20 years (22.8 thousand) and from 20 to 30 years (21.7 thousand).

Theoretical Basis of Logit Models

Logit models belong to the group of qualitative variables models, i.e. those where the dependent variable Y is a qualitative variable of the form:

$$y_i = \begin{cases} 1; & \text{employed person} \\ 0; & \text{unemployed person} \end{cases} \tag{1}$$

The logit model takes the form (Gruszczyński, 2010):

$$y_i^* = \ln \frac{p_i}{1-p_i} = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_k x_{ki} + u_i, \tag{2}$$

where:

β_j – structural parameter of the model,

$j = 1,2, \ldots, k$,

u_i – random factor,

$\ln \frac{p_i}{1-p_i}$ – logit,

y_i^* – unobserved variable,

x_{ji} – values of explanatory variables,

p_i – the probability of taking by the dependent variable Y values of 1, determined on the basis of the density function of the logistic distribution:

$$p_i = \frac{\exp(x_i'\beta)}{1+\exp(x_i'\beta)} = \frac{1}{1+\exp(-x_i'\beta)} = \frac{1}{1+e^{-y_i}} = \frac{1}{1+e^{-(\beta_0+\beta_1 x_{1i}+\beta_2 x_{2i}...\beta_k x_{ki})}}. \tag{3}$$

Unobserved variable is called a hidden variable. Thus, what we observe is a dummy variable:

$$y_i = \begin{cases} 1; & y_i^* > 0 \\ 0; & y_i^* \leq 0 \end{cases} \tag{4}$$

Logit is the logarithm of the odds ratio of taking or not a value of 1 for the variable y_i . If the chances are equal ($p_i = 0{,}5$), the logit is equal to zero. For p_i <0.5 the logit is negative, and for p_i > 0.5 it is positive. Logit transformation of the likelihood allows you to override the value by the number of interval $(-\infty,+\infty)$. if we denote (Gruszczyński, 2010):

$$\frac{p_i}{1-p_i} = \exp(x_i'\beta) = \exp(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki}), \tag{5}$$

This means that the increase in the value X_{ji} of the associated unit, ceteris paribus, the $\exp(\beta_j)$ fold change in the odds ratio. In the case of $\exp(\beta_j)$> 1 we have an increase, in the case of $\exp(\beta_j)$<1 we observe a decrease of the odds ratio $\frac{p_i}{1-p_i}$.

Marginal effects in the logit model are not fixed and depend on the explanatory variables:

$$\frac{\partial p_i}{\partial X_{ji}} = \beta_j \frac{\exp(x_i'\beta)}{[1+\exp(x_i'\beta)]^2} = \beta_j p_i (1-p_i). \tag{6}$$

The interpretation of the structural parameters of the model is similar to the interpretation of the parameters of the linear model. They are read as an increase in the probability of the event Y = 1 associated with individual growth of X_j. For positive β_j, the increase X_j is associated with increased chances that Y = 1, and is accompanied by decrease decrease chances that Y = 1. For the negative β_j growth for X_j associated with

decreased chance that Y = 1, and the growth X_j is accompanied by a decrease opportunities that Y = 1. Marginal effects can be calculated for medium or set of explanatory variables.

The significance of the logit model is verified using the likelihood ratio test, in which the system of hypotheses is: $H_0 : \beta_1 = \beta_2 = ... = \beta_k = 0$, $H_1 : \exists_{1 \le j \le k} \beta_j \neq 0$. The null hypothesis states that all the parameters of the explanatory variables are zero, that is real a model with intercept. Test statistic takes the form:

$$LR = 2\left(\ln L_p - \ln L_{ww}\right), \tag{7}$$

where:

L_p means the value of likelihood function for the full model,

L_{ww} means the value of likelihood function for the model containing only the intercept.

The quality of fit of the model dummy variables can be assessed on the basis of R^2 so-called pseudo – R^2. The values of this ratio are in the range [0,1], and the higher values are to provide a better fit of the model. The study used a pseudo McFadden R^2. It is based on a comparison of the full model with a reduced model only for the intercept. It is calculated according to the formula (Kośko *et al.*, 2007):

$$McFaddenR^2 = 1 - \frac{\ln L_p}{\ln L_{ww}}, \tag{8}$$

where:

$\ln L_p$ is the logarithm of the likelihood function of the full model,

a $\ln L_{ww}$ is the quotient of the likelihood function model in which there is only an intercept.

In practice, the values of McFadden R^2 are small, closer to 0 than 1, due to the fact that the model is estimated on the microdata. The prediction of such data causes difficulties. Factor R^2 can be calculated as the correlation coefficient between y and $\hat{y}$. This measure is based on the residual sum of squares (Maddala, 2008):

$$R^2 = 1 - \left[\frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2}{\sum_{i=1}^{n} (y_i - \bar{y})^2} \right]. \qquad (9)$$

In the case of binary dependent variable we have (Maddala, 2008):

$$\sum_{i=1}^{n} (y_i - \bar{y})^2 = \sum_{i=1}^{n} y_i^2 - n\bar{y}^2 = n_1 - n\left(\frac{n_1}{n_0}\right)^2 = \frac{n_1 n_0}{n}. \qquad (10)$$

From this:

$$R^2 = 1 - \frac{n}{n_1 n_0} \sum_{i=1}^{n} (y_i - \hat{y})^2, \qquad (11)$$

where:
n_1 is the number of observations, for which a dummy variable takes the value 1 in the sample,
n_0 is the number of observations, for which a dummy variable takes the value 0 in the sample.

Another way to examine the quality of fit of the model is to present the results of predictions based on the model. The estimate is based on the estimated probability $\hat{p}_i$, which is a function of $F(x_i'\beta)$. Usually it is assumed that if $F(x_i'\beta) \geq 0{,}5$ the forecast is equal $\hat{y}_i = 1$. If $F(x_i'\beta) < 0{,}5$ the forecast is equal $\hat{y}_i = 0$. On this basis, one generated the accuracy table 1.

Table 1. Accuracy table

Empirical	**Predicted**		**Total**
	$\hat{Y} = 0$	$\hat{Y} = 1$	
$Y = 0$	n_{00}	n_{01}	N_{p0}
$Y = 1$	n_{10}	n_{11}	N_{p1}
Total	N_{f0}	N_{f1}	N

Source: own work based on Kufel (2008).

where:
n_{00} – number of cases, for which the empirical and predicted value is equal to 0,
n_{01} – number of cases, for which the empirical value is equal to 0 and predicted value is equal to 1,
n_{10} – number of cases, for which the empirical value is equal to 1 and predicted value is equal to 0,
n_{11} – number of cases, for which the empirical and predicted value is equal to 1.

Percentage accuracy of forecasts is calculated as follows (Kufel 2011):

Total:

$$Traf\ \mathrm{Prog} = \frac{n_{00} + n_{11}}{N} \cdot 100, \tag{12}$$

for $Y = 1$:

$$Traf\ \mathrm{Prog}_1 = \frac{n_{11}}{N_{p1}} \cdot 100, \tag{13}$$

for $Y = 0$:

$$Traf\ \mathrm{Prog}_0 = \frac{n_{00}}{N_{p0}} \cdot 100 \tag{14}$$

Furthermore, the accuracy of qualitative variables models can be represented by the odds ratio according to the formula:

$$IRS = \frac{n_{11} \cdot n_{00}}{n_{01} \cdot n_{10}} \tag{15}$$

Data Used for Estimation Logit Models

Probability models were estimated on the basis of individual data obtained from the representative Labour Force Survey in the fourth quarter of 2010. A set of explanatory variables has 54 binary variables (Table 1) describing the socio-economic situation of the respondents in the labor market. These include the level of education (WYKSZ), voivodeship of living (WOJ), and place of living urban / rural (MIASTO), the relationship with the head of the family (SP), earlier situation on the labor market (ROK_WCZ), marital status (STCYW), seniority (STAZ).

Table 1. Set of explanatory variables

Relationship with the head of the family			
SP_01	Head of the family	SP_06	Father / mother / father in law / mother in law
SP_02	Husband/wife	SP_07	Grandfather / grandmother / grandson / granddaughter / great-grandson / great-granddaughter
SP_03	Partner	SP_08	Brother / sister
SP_04	Son/daughter	SP_09	Uncle / aunt / further relative
SP_05	Son in law/ daughter in law	SP_10	Unrelated member of the household
Voivodeship of living			
WOJ_02	dolnośląskie	WOJ_18	podkarpackie
WOJ_04	kujawsko-pomorskie	WOJ_20	podlaskie
WOJ_06	lubelskie	WOJ_22	pomorskie
WOJ_08	lubuskie	WOJ_24	śląskie
WOJ_10	łódzkie	WOJ_26	świętokrzyskie

Table 1 Continued

WOJ_12	małopolskie	WOJ_28	warmińsko-mazurskie
WOJ_14	mazowieckie	WOJ_30	wielkopolskie
WOJ_16	opolskie	WOJ_32	zachodniopomorskie
Marital status			
STCYW_01	Single	STCYW_03	Widow
STCYW_02	Married	STCYW_04	Divorced/ in separation
situation on the labor market year ago			
ROK_WCZ_1	Employment	ROK_WCZ_5	Disability
ROK_WCZ_2	Unemployment	ROK_WCZ_6	Recruit service
ROK_WCZ_3	Education/training	ROK_WCZ_7	Family responsibilities
ROK_WCZ_4	Retirement/early retirement	ROK_WCZ_8	Other form of economic inactivity
Level of education			
WYKSZ_10	Higher with degree (at least Ph.D.), master's degree or equivalent, bachelor's or engineer diploma certifying successful completion of the college,	WYKSZ_60	lower secondary
WYKSZ_20	Post-secondary	WYKSZ_70	primary
WYKSZ_30	Secondary vocational	WYKSZ_80	incomplete primary
WYKSZ_40	Secondary general	WYKSZ_90	without education
WYKSZ_50	Vocational		

Table 1 Continued

Seniority			
STAZ_DO5LAT	To 5 years	STAZ_OD20DO30LAT	From 20 to 30 years
STAZ_OD5DO10LAT	From 5 to 10 years	STAZ_OD30LAT	More than 30 years
STAZ_OD10DO20LAT	From 10 to 20 years		
Place of living (urban/rural)			
MIASTO (urban=1)			

Source: own work based on statistical forms ZD, ZG.

Results of the Estimation

For comparative purposes, logit models were estimated for the total number of people with disabilities, for men and for women. Estimation results are shown in Tables 2-7.

Table 2. Results of estimation of logit model (total)

Variable	**Coeffi-cient**	**Standard error**	***z*-statistic**	***p-value***		**Mar-ginal effect**	**Odds ratio**
const	0,2822	0,2981	0,9466	0,3438			
SP_02	-0,8392	0,2457	-3,4160	0,0006	***	-0,0613	0,4320
SP_05	-1,7054	0,8218	-2,0750	0,0380	**	-0,2090	0,1817
STCYW_2	0,4795	0,2448	1,9590	0,0501	*	0,0314	1,6153
MIASTO	-0,5207	0,1991	-2,6150	0,0089	***	-0,0301	0,5941
ROK_WCZ_1	2,0628	0,2145	9,6190	0,0000	***	0,1972	7,8681
ROK_WCZ_2	-1,3520	0,2393	-5,6500	0,0000	***	-0,1320	0,2587
WYKSZ_20	-0,9809	0,3959	-2,4770	0,0132	**	-0,0872	0,3750

Table 2 Continued

Variable	**Coefficient**	**Standard error**	***z*-statistic**	***p-value***		**Marginal effect**	**Odds ratio**
WYKSZ_30	-1,0318	0,2849	-3,6210	0,0003	***	-0,0818	0,3564
WYKSZ_40	-1,4796	0,3564	-4,1520	0,0000	***	-0,1571	0,2277
WYKSZ_50	-0,8645	0,2531	-3,4160	0,0006	***	-0,0581	0,4213
STAZ_DO5LAT	1,6393	0,3364	4,8730	0,0000	***	0,0567	5,1518
STAZ_OD10DO20LAT	1,7351	0,3104	5,5900	0,0000	***	0,0664	5,6694
STAZ_OD20DO30LAT	2,0406	0,2904	7,0260	0,0000	***	0,0837	7,6951
STAZ_OD30LAT	2,4102	0,2791	8,6340	0,0000	***	0,1552	11,1363

Significance level: *** $\alpha = 0{,}01$, ** $\alpha = 0{,}05$, * $\alpha = 0{,}10$.

Source: own calculation in Gretl.

Table 3. Table of accuracy

Empirical	**Predicted**		**Total**	**Accuracy**
	$\hat{Y} = 0$	$\hat{Y} = 1$		
$Y = 0$	139	106	245	56,7%
$Y = 1$	40	1401	1441	97,2%
Total	179	1507	1686	91,3%

Source: own calculation in Gretl.

Table 4. Results of estimation of logit model (women)

Variable	Coeffi-cient	Standard error	*z*-statistic	*p-value*		Marginal effect	Odds ratio
const	-0,9974	0,3842	-2,5960	0,0094	***		
WOJ_18	1,0785	0,5917	1,8230	0,0683	*	0,0539	2,9403
WOJ_20	1,1536	0,6831	1,6890	0,0913	*	0,0556	3,1697
ROK_WCZ_1	1,9817	0,3205	6,1830	0,0000	***	0,2177	7,2551
ROK_WCZ_2	-1,7095	0,3728	-4,5860	0,0000	***	-0,2130	0,1810
WYKSZ_10	1,4247	0,4821	2,9550	0,0031	***	0,0721	4,1568
WYKSZ_40	-0,8365	0,4146	-2,0170	0,0437	**	-0,0813	0,4332
WYKSZ_70	1,2108	0,4638	2,6110	0,0090	***	0,0629	3,3563
STAZ_DO5LAT	1,5376	0,5150	2,9860	0,0028	***	0,0661	4,6532
STAZ_OD10DO20LAT	1,5842	0,4270	3,7100	0,0002	***	0,0792	4,8754
STAZ_OD20DO30LAT	1,8875	0,4214	4,4800	0,0000	***	0,0994	6,6028
STAZ_OD30LAT	2,2687	0,4125	5,4990	0,0000	***	0,1461	9,6667

Significance level: *** $\alpha = 0{,}01$, ** $\alpha = 0{,}05$, * $\alpha = 0{,}10$.

Source: own calculation in Gretl.

Tables 3, 5 and 7 show the number of hits the predicted values 0 and 1 with respect to empirical values.

Table 5. Table of accuracy

Empirical	Predicted		Total	Accuracy
	$\hat{Y} = \mathbf{0}$	$\hat{Y} = \mathbf{1}$		
$Y = 0$	74	48	122	60,7%
$Y = 1$	16	590	606	97,4%
Razem	90	638	728	91,2%

Source: own calculation in Gretl.

Table 6. Results of estimation of logit model (men)

Variable	Coeffi-cient	Standard error	*z*-statistic	*p-value*		Marginal effect	Odds ratio
const	1,4429	1,1676	1,2360	0,2165			
SP_01	-2,0999	1,1869	-1,7690	0,0769	*	-0,0821	0,1225
SP_02	-3,2928	1,2185	-2,7020	0,0069	***	-0,4330	0,0371
SP_03	-3,0902	1,3901	-2,2230	0,0262	**	-0,4715	0,0455
SP_04	-2,0968	1,1913	-1,7600	0,0784	*	-0,2046	0,1229
SP_05	-3,5326	1,5213	-2,3220	0,0202	**	-0,5824	0,0292
SP_06	-2,6160	1,3608	-1,9220	0,0545	*	-0,3480	0,0731
SP_10	-3,0822	1,5350	-2,0080	0,0447	**	-0,4715	0,0459
WOJ_06	1,3996	0,6277	2,2300	0,0258	**	0,0401	4,0535
WOJ_10	1,2022	0,6742	1,7830	0,0745	*	0,0363	3,3274
WOJ_22	1,1906	0,7233	1,6460	0,0998	*	0,0349	3,2890
WOJ_30	1,0021	0,5667	1,7680	0,0770	*	0,0324	2,7241
ROK_WCZ_1	2,1483	0,3017	7,1220	0,0000	***	0,1661	8,5704
ROK_WCZ_2	-1,3187	0,3333	-3,9570	0,0001	***	-0,1019	0,2675
WYKSZ_30	-0,7202	0,3992	-1,8040	0,0712	*	-0,0407	0,4867
WYKSZ_40	-1,2424	0,5515	-2,2530	0,0243	**	-0,0970	0,2887
WYKSZ_50	-0,6885	0,3249	-2,1190	0,0341	**	-0,0334	0,5023
STAZ_DO5LAT	2,0614	0,4982	4,1380	0,0000	***	0,0480	7,8571
STAZ_OD10DO20LAT	2,0034	0,4773	4,1980	0,0000	***	0,0525	7,4140
STAZ_OD20DO30LAT	2,6965	0,4478	6,0210	0,0000	***	0,0746	14,8274
STAZ_OD30	3,0910	0,4215	7,3330	0,0000	***	0,1957	21,9997

Source: own calculation in Gretl.

Table 7. Table of accuracy

Empirical	Predicted		Total	Accuracy
	$\hat{Y} = 0$	$\hat{Y} = 1$		
$Y = 0$	58	65	123	47,2%
$Y = 1$	19	816	835	97,7%
Razem	77	881	958	91,2%

Source: own calculation in Gretl.

Table 8. Statistics of fitting of the logit models

Specification	Model (total)	Model (women)	Model (men)
McFadden *R*-square	0,4010	0,4288	0,4032
corrected *R*-square	0,3795	0,3923	0,3460
Likelihood ratio test	560,4	282,2	296,1
Log-likelihood	-418,6	-188,0	-219,2
Accuracy (total)	91,3%	91,2%	91,2%
Accuracy (for *Y*=1)	97,2%	97,4%	97,7%
Accuracy (for *Y*=0)	56,7%	60,7%	47,2%
Odds ratio	45,9	56,8	38,3

Source: own calculation in Gretl.

The results of likelihood-ratio test (p-value = 0.000 <0.10) indicate the significance of the estimated models. The overall accuracy rate projected by the models is very high at over 97%: a model for the entire population with disabilities – 97.2%, a model for disabled women – 97.4%, a model for disabled men – 97.7%. This indicates that the models identified a mechanism of individual variables on the probability of a person with a disability to qualify for this category of employees.

Insignificant variables were eliminated from the model by the *a posteriori* method. This procedure involves comparing the value of p with fixed significance level α. If p was greater than α then variable was eliminated from the model and re-estimation was made. The value assumed at 10%.

Conclusions

From the perspective of cognitive values, the highest value gives the marginal effects and odds ratios. Marginal effects (calculated for the mean values of the explanatory variables) are interpreted as the effect of the covariate on the probability of success (i.e. the adoption of a value of 1 for the dependent variable). Odds ratios while interpreted as percentage effects of specific changes in the value of the covariate on the odds ratio, calculated as the ratio of the probability of success to the probability of failure (Gruszczyński, 2010).

On the basis of the presented in tables 2, 4 and 6 logit models, one can determine the direction and strength of the influence of individual socio-demographic characteristics on the probability of classification of individual groups of persons with disabilities to work. Estimation of separate models for men and women allows for comparative analysis.

The first factor significantly influencing the probability of belonging to a group of employed is the relationship with the head of the family. The next significant variables that remained in models are variables denoting the husband / wife of the head of household (SP_2) and son in law / daughter in law (SP_5). Each of these variables will decrease the probability of qualifying for the category of the labor force employed. In the model for women with disabilities variables concerning relationship with the head of the family proved to be statistically insignificant. The model for men contains seven variables describing the relationship of the head of the family. Each of them has a negative impact on the probability to qualify for a group of disabled people working professionally active men. The smallest chance of being employed have sons in law of the head of the household (SP_5) – reducing the probability of 58.24 percentage points.

In the logit model for the total number of people with disabilities the voivodeship of living turned out statistically insignificant. The model for women contains variables concerning podkarpackie and podlaskie voivodships. Living in their area increases the probability of qualifying women with disabilities to the group of employed by 5.39 and 5.56 percentage points, respectively. In the model for men, four variables concerning voivodeships remained as significant: lubelskie voivodeship (WOJ_06), łódzkie (WOJ_10), pomorskie (WOJ_22) and wielkopolskie (WOJ_30). Living on the territory of each of them increases the probability of being employed – the largest increase relates to the lubelskie voivodeship 4.01 percentage point, while the smallest for wielkopolskie voivodeship – 3.24 percentage points.

Among the variables representing marital status only in the model for the total disabled as a significant remaining variable STCYW_2, which means that being a husband / wife of the head of household increases the probability of qualifying for the employed group by 3.14 percentage points.

Place of living is also a variable that appeared as significant only in the model for the total number of persons with disabilities. Living in the city causes a decrease in the probability of being employed about 3.01 percentage points.

An important factor in the impact on the probability of being employed is also the status of the labor market in the previous year. In all models remained as a significant variable ROK_WCZ_1 and in any case it causes

an increase in the probability of qualifying for the employed group. For all people with disabilities the increase is 19.72 percentage points, 21.77 percentage points for women and 16.61 percentage points for men. The models for the whole disabled group and women also contain as a significant variable concerning unemployment (ROK_WCZ_2), which causes a decrease in the probability of being employed respectively by 13.20 percentage points and 21.30 percentage points. The model for men also contains variable ROK_WCZ_3, which means training. It causes a decrease in the probability of being employed of 10.19 percentage points.

The next group of variables included in the models relates to education. The model for the disabled persons contain variables denoting post-secondary education (WYKSZ_20), secondary vocational (WYKSZ_30), general secondary (WYKSZ_40) and vocational (WYKSZ_50). Each of these types of education, affects the probability of qualifying for the employed group. The strongest effect causes the possession of general secondary education – a decrease of 15.71 percentage points. In the case of women as a significant remained variables describing higher education with a degree (at least PhD), master's degree or equivalent, bachelor's or engineer, a college diploma (WYKSZ_10), secondary schools (WYKSZ_40) and basic (WYKSZ_70). Having a general secondary education causes a decrease in the probability of being employed for 8.13 percentage points. The other two types of education increase the probability of qualifying for the employed group respectively by 7.21 percentage points and 6.29 percentage points. The model for men contains three variables denoting secondary vocational education (WYKSZ_30), general secondary (WYKSZ_40) and vocational (WYKSZ_50). Each of them causes a decrease in the probability of being employed with respectively by 4.07 percentage points, 9.70 percentage points and 3.34 percentage points.

The last group of variables included in the models relates to seniority. Each model contains the same set of variables describing work experience and in each of them has a positive effect on the probability of qualifying for the group of employed Having seniority over 30 years (STAZ_OD30LAT) causes the strongest effect on the probability of being employed. For all persons with disabilities it causes an increase by 15.52 percentage points, for women by 14.61 percentage points and for men by 19.57 percentage points.

As a result of model estimation procedures variable PLEC was eliminated from the model. It means that sex has no significant influence on the probability of qualifying for a group of employed people with disabilities.

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