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Decomposing the Gender Gap in Average Exit Rate from Unemployment

A b s t r a c t. In the paper, we analyse the exit rates from unemployment, taking into account gender differences. The process of leaving the unemployment state was examined for each sex separately using the parametric hazard models. The objective was to present a decomposition of inequalities between men and women when leaving unemployment. The application of the modified Oaxaca-Blinder decomposition technique allowed us to isolate the factors explaining the observed inequalities. We found, that the gender gap is explained almost exclusively by differences in the effects of men's and women's characteristics.

K e y w o r d s: duration of unemployment, parametric hazard models, gender gap, Oaxaca-Blinder decomposition.

J E L Classification: J16, J64.

Introduction

Different levels of the economic activity between women and men are often analyzed in the economic literature. It is noted that men are more frequently associated with the labor market, while women, to a lesser extent (due to their involvement in the family career). The review of the various aspects related to the activity of women and men in the labor market is provided, for example, by Altonji, Blank (1999).

Numerous empirical studies tend to focus on the gender wage gaps (Blinder, 1973; Oaxaca, 1973; Beblo et al., 2003). The findings of these

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studies show that males earn substantially higher wages than females. The part of each wage differential is due to differences in „objective" characteristics such as education and work experience. However, a partial differential remains even when male-female differences in these traits are controlled for. Also the occupational segregation by gender is discussed in the literature (Petrongolo, 2004). The studies show that women have a weaker position in the labor market. Women are often discriminated against even if their qualifications are higher than for men.

Different attitudes of men and women are also reflected in the opportunities to take employment. Gender is a significant factor affecting the movements between labor market states. It is an important variable in determining the chances of finding a job. Many studies have shown that women have a lower probability of finding a new job (Katz, Meyer, 1990b), especially on a permanent basis (Edin 1989), and are exposed to more frequent periods without work (Steiner, 1989; Jensen, Westergard-Nielsen, 1990). Women are at a disadvantage even if their job-search activity is higher than for men.

Analyses focused on the description of leaving the unemployment state, which were carried out in Poland so far, disregard the issue of gender behaviour. They generally do not consider that the effect of different factors may depend on gender. In empirical models, gender only shifts the dependent variable and there are not estimated separate equations for men and women (see for example Malarska (2007)). The opposite approach propagate Gonzalo, Saarela (2000), Ollikainen (2003), Tansel, Taşçi (2010) or Landmesser (2008), who estimated separate hazard models for both sexes.

The present study is an analysis of exit rates from unemployment, taking into account gender differences. In the paper, the process of leaving the unemployment state was examined for each sex separately using the tools of duration analysis – the parametric hazard models. The results confirmed that the influence of explanatory variables on the chance to exit the unemployment depends on the sex of the individual.

However, the main objective of the study was to perform a decomposition of inequalities between men and women when leaving unemployment. The quantitative dimensions of the various causes of unequal chances by taking a job are not well known, but the Oaxaca-Blinder microeconometric decomposition technique applied allowed us to isolate the factors explaining the inequalities.

1. The Analysis Method

The study comprises the duration of time a person spent in the unemployment state (*T*). Modeling of such a variable requires the use of survival analysis tools. Constructed hazard models are suitable for the analysis of censored observations and for studying the influence of individual characteristics on the chances of leaving the unemployment state (cf. Lancaster, 1979).

The basic function describing the distribution of the duration times is the survival function $S(t) = \Pr[T > t] = 1 - F(t)$, which expresses the probability of survival beyond a certain point in time *t* (cf. Kalbfleisch, Prentice, 2002). The hazard function (risk, intensity function) is the ratio of the density function and the survival function. It is the limit of probability that the episode is completed during the time interval [*t*, *t*+*dt*] given that it has not been completed before the moment *t*, for *dt*→0:

$$h(t) = \frac{f(t)}{S(t)} = \lim_{dt \to 0} \frac{\Pr[t \le T < t + dt \mid T \ge t]}{dt}. \tag{1}$$

The hazard rates describe the intensity of the transition from one state to another.

Using the parametric proportional hazards models, it is possible to specify hazard as a function of time and some explanatory variables:

$$h(t|\mathbf{x}_j) = h_0(t)\exp(\mathbf{x}'_j\boldsymbol{\beta}). \tag{2}$$

Models in this class differ in their assumptions about the baseline hazard $h_0(t)$. The courses of hazard functions can take many forms, from monotonic to non-monotonic.

To model the monotonic hazard, the Weibull distribution with two parameters $W(\lambda, p)$ is often used. The Weibull distribution described originally the dispersion of the fatigue life of materials (Weibull, 1939). It is also used by researchers modeling the duration of unemployment time (due to the decreasing intensity while leaving the state). For a variable $T \sim W(\lambda, p)$ survival and hazard functions are defined as $S(t) = \exp(-\lambda t^p)$ and $h(t) = pt^{p-1}\lambda$, for $\lambda > 0$, $p > 0$ and $t \ge 0$. The estimated parameter p is called a shape parameter. If p = 1, then the hazard function is constant; if $p > 1$, it monotonically increases, while for $p < 1$ the hazard monotonically decreases. The form of the Weibull hazard model after taking the parameterization $\lambda = \exp(\mathbf{x}'\boldsymbol{\beta})$ is as follows:

$$h(t|\mathbf{x}_j) = pt^{p-1}\exp(\mathbf{x}'_j\boldsymbol{\beta}). \quad (3)$$

In order to describe the process of leaving the state of unemployment the Weibull proportional hazard models were estimated for both men and women separately. This was followed by the analysis of inequalities observed using a modification of the Oaxaca-Blinder decomposition technique.

The idea of Oaxaca-Blinder decomposition can be applied whenever we need to explain the differences between two comparison groups. Let $\mathbf{x}^W, \mathbf{x}^M$ be the characteristics of men and women, respectively, and let $\boldsymbol{\beta}^W, \boldsymbol{\beta}^M$ be the returns to these characteristics and $\overline{\Phi}$ - the average level of dependent variable in the econometric model (e.g. the average hazard rate). The popular Oaxaca-Blinder decomposition for the gender gap at the aggregate level is as follows (Oaxaca, 1973; Blinder, 1973):

$$\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^W) - \overline{\Phi}(\mathbf{x}^{M\prime}\boldsymbol{\beta}^M) = [\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^M) - \overline{\Phi}(\mathbf{x}^{M\prime}\boldsymbol{\beta}^M)] + [\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^W) - \overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^M)]. \quad (4)$$

The equation (4) is based on one group's characteristics and the estimated coefficients of another group's equation. The first term on the right hand side of the equation expresses the difference of the potentials of both groups (women and men). If the characteristics **x** used to estimate an econometric model exhausted all the factors affecting the chance to leave the unemployment state, it is possible to assume that the second term on the right hand side of this equation represents the amount of discrimination. This expression is the result of differences in the estimated parameters, and so in the „prices" of individual characteristics of men and women. Blinder argued that „the latter sum […] exists only because the market evaluates differently the identical bundle of traits if possessed by different demographic groups" (Blinder, 1973, pp. 438–439).

The contribution of the differences in characteristics and coefficients of individual variables (the detailed decomposition) can be easily found when linear equations are used. The methodology proposed by Yun (2004) provides a way to apply the Oaxaca-Blinder decomposition to a non-linear function for both aggregate and detailed decompositions. A modification made by Yun allowed the use of the above concepts to determine the contribution of each explanatory variable in Weibull regression to the total difference. The formula given by Yun has the following form (as given in Ortega Masagué, 2008):

$$\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^{W}) - \overline{\Phi}(\mathbf{x}^{M\prime}\boldsymbol{\beta}^{M}) =$$
$$= \sum_{i=1}^{k} W_{\Delta x_i}[\,\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^{M}) - \overline{\Phi}(\mathbf{x}^{M\prime}\boldsymbol{\beta}^{M})\,] + \sum_{i=1}^{k} W_{\Delta\beta_i}[\,\overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^{W}) - \overline{\Phi}(\mathbf{x}^{W\prime}\boldsymbol{\beta}^{M})\,], \tag{5}$$

where:

$$W_{\Delta x_i} = \frac{(\bar{x}_i^{W} - \bar{x}_i^{M})\beta_i^{M}}{(\bar{\mathbf{x}}^{W} - \bar{\mathbf{x}}^{M})'\boldsymbol{\beta}^{M}} \text{ and } \sum_{i=1}^{k} W_{\Delta x_i} = 1,$$

$$W_{\Delta\beta_i} = \frac{\bar{x}_i^{W}(\beta_i^{W} - \beta_i^{M})}{\bar{\mathbf{x}}^{W\prime}(\boldsymbol{\beta}^{W} - \boldsymbol{\beta}^{M})} \text{ and } \sum_{i=1}^{k} W_{\Delta\beta_i} = 1,$$

k is the number of explanatory variables in the model,

$\bar{\mathbf{x}}^{W}, \bar{\mathbf{x}}^{M}$ - the mean levels of characteristics for men and women, respectively.

The detailed decomposition methodology proposed by Yun is the decomposition of differences in the first moment, i.e. differences in the mean value of the variable of interest. The method „does not depend on the functional form as long as the dependent variable is a function of a linear combination of independent variables and the function is once differentiable" (Yun, 2004, p. 275). In order to obtain a proper weight Yun evaluated the value of the function using mean characteristics and used a first order Taylor expansion.

2. The Empirical Data

Unemployment is a problem frequently connected with specific regions. In our research work we try to analyze in detail the situation in district Słupsk in north Poland (voivodeship Pomorskie). In this region, many inhabitants of rural areas were previously employed in the state-owned agricultural farms. However, a large number of these farms went bankrupt after the political system change in 1989. The former employees, women and men, turned out to be the most helpless social group in Poland. Therefore, it seems desirable to analyze the situation of the inhabitants of this region on the labor market over the past 20 years.

The study was conducted using individual data of people registered as unemployed in the District Labor Office in Słupsk. The selected sample consisted of 4 372 people registered in the office from January 1990 to August 2007. There were 2 203 women and 2 169 men randomly selected (women constituted 50.4% and men 49.6% of the selected sample). The data

about each person took the multiepisode form and contained a detailed history of the office customers. At the data basis it was established how long unemployment episodes lasted (in days) or how long they are still going on (in the case of censored episodes). Each person could register many times in the labor office in his or her history. Therefore, for 4 372 examined people a total of 10 118 episodes of being unemployed was noted (10% of these episodes were censored) (see Table 1).

In the case of women, censored episodes constituted larger share of total episodes than it was for men. This was due to the fact that women had on average longer episodes of unemployment than men. For example, uncensored episodes for women lasted on average 413.1 days and for men 271.2 days. The information on the average duration in the unemployment state during a single episode is also presented in the Table 1.

Table 1. The number and the average duration of unemployment episodes

Number of episodes	All persons		Women		Men	
Total	10118	100%	4786	100%	5332	100%
Censored	1007	10%	664	13.9%	343	6.4%
Uncensored	9111	90%	4122	86.1%	4989	93.6%
Average duration of episode (in days)	**All persons**		**Women**		**Men**	
Total	406.5		523.2		301.7	
Censored	1049		1207		745.5	
Uncensored	335.4		413.1		271.2	

On average, a woman registered in the labor office 2.55 times and a man 3.02 times (more often, but for shorter periods). The average age of women at the beginning of the unemployment episode was 31.99 years old, while for men it was 33.66 years old. Detailed information on the age of registrants, their level of education and place of residence are shown in the Table 2.

Women registered in the labor office were usually younger than men, more frequently they had higher or secondary education level than in the case of men, they rarely had vocational education level. They are characterized by a higher proportion of residence in the city. Episodes of unemployment were also examined for the payment of unemployment benefits, training benefits and social security benefits. It was found that men, more often than women received unemployment benefits, while women were often assigned training allowances and social security benefits.

Table 2. The structure of unemployment episodes by selected characteristics

Characteristics		All persons		Women		Men	
Age-group	17–24 years old	3068	30.3%	1512	31.6%	1556	29.2%
	25–34 years old	2755	27.2%	1353	28.3%	1402	26.3%
	35– 44 years old	2408	23.8%	1200	25.1%	1208	22.7%
	45–54 years old	1742	17.2%	699	14.6%	1043	19.6%
	over 55 years old	145	1.4%	22	0.5%	123	2.3%
Education level	tertiary	767	7.6%	517	10.8%	250	4.7%
	vocational secondary	1957	19.3%	1170	24.4%	787	14.8%
	general secondary	710	7.0%	516	10.8%	194	3.6%
	basic vocational	3100	30.6%	1240	25.9%	1860	34.9%
	lower second. or primary	3584	35.4%	1343	28.1%	2241	42.0%
Place of residence	town	5079	50.2%	2551	53.3%	2528	47.4%
	village	5039	49.8%	2235	46.7%	2804	52.6%

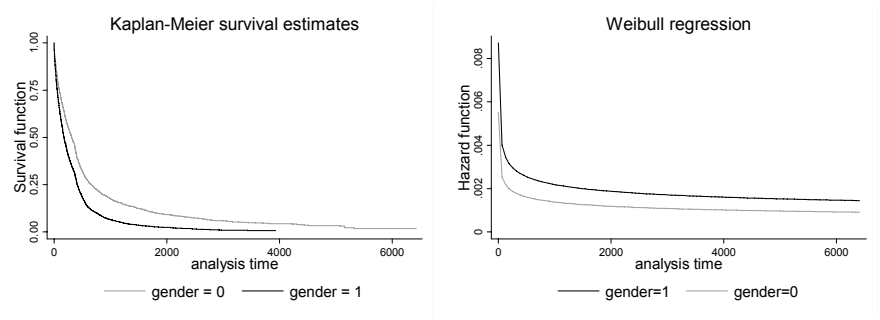
The information obtained from the database of the labor office allowed to establish a set of potential explanatory variables in the models describing the intensity of leaving the unemployment state. Most of them are dichotomous variables, such as:

- „gender" (number 1 coded the male sex),
- set of variables for the five age categories („age1724", „age2534", „age3544", „age4554", „age55over"),
- set of variables for the education level („tertiary", „vocational secondary", „general secondary", „basic vocational", „lower secondary or primary"),
- „married" (1, if a person is not of free marital status),
- „town" (1, if the person lives in the city),
- „disabled" (1, if a person is disabled),
- „unemployment benefits" (1 for those who receive unemployment benefits),
- „training benefits" (1 for those who receive training benefits),
- „social security" (1 for social security beneficiaries from polish *Zakład Usług Społecznych*).

In addition, the models used information about the consecutive unemployment episode number for the person (the variable called „episode_nr").

3. The Results of Empirical Analysis

In order to analyse the distribution of unemployment durations, first the nonparametric Kaplan-Meier survival function $S(t)$ - separately for men and women - was plotted (Figure 1 (A)).



(A) (B)

Figure 1. Nonparametric Kaplan-Meier estimator for the survival function (A) and plots of the hazard functions in Weibull model (B)

The survival curve for men indicates a lower likelihood of continuation in the state of unemployment than for women (see Figure 1(A)). There was a statistical significance of differences in the courses of the survival functions for both sexes.

Then, based on the total sample, the parametric Weibull proportional hazard model for the chance to leave the unemployment state was estimated (the parameter estimates of this model are listed in Table 3, part (A)).

For example, the interpretation of the parameter by the variable "gender" is as follows: an opportunity to leave the unemployment state in the case of men is about 58.2% higher than in the case of women (exp (0.459) = 1.582). A positive value of the parameter β_k means that a one unit change in the k-th explanatory variable results in the relative increase of hazard. A negative value is associated with the relative decrease of hazard, respectively. We conclude, that the chances of leaving unemployment rise among men, people at a younger age, better educated, married, living in the city, with the next in turn episode without a job, and they decrease with a disability and the fact of receiving unemployment and training benefits or social security payments. Figure 1 (B) shows two graphs of Weibull hazard functions derived from the estimated model for "gender" = 0 and "gender" = 1. These functions decrease (as $p < 0$) and at any time women are characterized by the lower intensity of leaving the unemployment than men.

The next step was to estimate two Weibull hazard models for time spent in unemployment state for men and women separately (the estimation results are presented in Table 3, part (B) and (C)). These models differ in parameter estimates standing by the relevant variables. Compared to the reference group (women and men aged 55 years and over, respectively) younger wom-

en are more likely to exit from unemployment than young men. For women the positive effect of higher education is stronger than for men. Marriage intensifies the exit from unemployment among men. The level of the corresponding parameter for women shows a decrease in employment opportunities. Among the remaining parameters, attention should be paid to the coefficients which appear by the variables associated with financial benefits. The negative effect of unemployment benefits and training allowances on the opportunities to leave unemployment for women is smaller than for men, but the impact of social security payments are stronger for women. Apart from that, the estimated values of the parameter p indicate a steeper decline in employment opportunity for women over time.

Table 3. The results of the Weibull model estimation for the whole sample (A), for women only (B) and for men only (C)

Variable	All persons (A)			Women (B)			Men (C)		
	β_i^A		$exp(\beta_i^A)$	β_i^W		$exp(\beta_i^W)$	β_i^M		$exp(\beta_i^M)$
gender	0.459	***	1.582	–	–	–	–	–	–
age1724	0.633	***	1.884	1.213	***	3.362	0.713	***	2.039
age2534	0.526	***	1.692	1.208	***	3.348	0.502	***	1.653
age3544	0.410	***	1.508	1.185	***	3.269	0.293	***	1.340
age4554	0.324	***	1.382	1.096	***	2.993	0.217	**	1.243
tertiary	0.571	***	1.769	0.769	***	2.157	0.355	***	1.427
vocational secondary	0.316	***	1.372	0.425	***	1.529	0.211	***	1.235
general secondary	0.348	***	1.416	0.428	***	1.534	0.275	***	1.317
basic vocational	0.168	***	1.183	0.263	***	1.300	0.113	***	1.120
married	0.115	***	1.121	-0.099	***	0.906	0.287	***	1.332
town	0.095	***	1.100	0.057	*	1.058	0.128	***	1.136
disabled	-0.275	***	0.759	-0.153	*	0.858	-0.321	***	0.726
episode_nr	0.069	***	1.072	0.098	***	1.104	0.051	***	1.052
unemploy. benefits	-0.290	***	0.748	-0.231	***	0.793	-0.372	***	0.690
training benefits	-0.613	***	0.542	-0.554	***	0.575	-0.670	***	0.512
social security	-0.698	***	0.497	-0.787	***	0.455	-0.425	***	0.654
cons	-5.503	***	0.004	-6.148	***	0.002	-5.104	***	0.006
p	0.777	***	–	0.770	***	–	0.797	***	–
Number of episodes	10118			4786			5332		
lnL	-17804.816			-8356.835			-9357.641		

Note: *** significant at 1%; ** significant at 5%; * significant at 10%.

However, estimates of the parameters obtained in the models (B) and (C) are difficult to compare to each other, due to different empirical subsamples. Thus, subsequently observed inequalities between women and men in leaving the unemployment were decomposed using the modified Oaxaca-Blinder technique. The results on an aggregated basis are presented in Table 4 (the aggregation consisted in an accumulation of effects for related variables).

Table 4. Decomposition of the gender gap in hazard rates from unemployment (results of modified Oaxaca-Blinder decomposition technique)

Observed differential (total)			Value -0.001507	% 100	
	Value	%		Value	%
Characteristics	–0.000100	6.63	Returns	–0.001407	93.37
age-group	–0.000113	7.50	**age-group**	**–0.000953**	**63.28**
education level	**–0.000388**	**25.76**	**education level**	**–0.000450**	**29.89**
married	0.000124	–8.24	married	0.000134	–8.91
town	–0.000036	2.41	town	0.000051	–3.39
disabled	–0.000016	1.09	disabled	–0.000008	0.54
episode_nr	0.000115	–7.63	**episode_nr**	**–0.000158**	**10.48**
benefits	**0.000215**	**–14.26**	benefits	–0.000022	1.48

Note: The factors, that cause diversity of chances on the labor market to the greatest extent, are in bold.

There is a negative difference between the mean values of the hazard function for men and women (–0.001507), meaning that women typically have lower chances of leaving the unemployment state than men. Decomposition, which was carried out, made it possible to isolate the factors explaining the inequality observed to a different extent.

It turns out that the differences in exit rates are only in the 6.63 percent explained by the individual characteristics of women and men (vectors $\mathbf{x}^W$ and $\mathbf{x}^M$). The gender gap in the chances of exit from unemployment recognized in this way comes from the fact that women are different from men due to certain characteristics relevant in the labor market. The effect of the different education levels of women and men can be noticed. Even though women on average are better educated than men, they have rarely technical education, which results in a smaller probability of employment than in the case of men. The differences in transition rates from unemployment are reduced by more frequent training allowances and social security benefits for women.

However, gender inequalities examined should be assigned in the majority – in 93.37% – to the coefficients $\boldsymbol{\beta}^W$ and $\boldsymbol{\beta}^M$ of estimated hazard models (rather than to the differentiation of individuals characteristics). We find out that people with the same characteristics, if they are of different sexes, have various chances of exiting unemployment. The gender gap in unemployment rates is therefore explained not by differences in the characteristics of men and women but by differences in the labor market returns to their characteristics. A different "evaluation" of men's and women's characteristics is a major cause of the inequality. It can be assumed that employers favor men. Women are discriminated against in the labor market. Different opportunities are mainly due to prejudices associated with the woman's age

(generally it is believed that younger women are less involved in work for family reasons) and her education level.

Conclusions

The analysis conducted shows that the differences in the intensity of leaving unemployment are explained by individual characteristics of women and men only in a limited way. To a much greater extent these differences can be attributed to the „valuations" of men's and women's characteristics carried out by the labor market. Inequalities observed in opportunities for men and women would probably occur even if the characteristics of both groups were identical.

The calculated differences result from the parameter values, and thus it is important that all the parameters in the models have the statistical properties expected. Therefore, for a correct inference – using the method presented in the article – the careful selection of variables for hazard models is very important.

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Dekompozycja nierówności płciowych w przeciętnych stopach wyjścia ze stanu bezrobocia

Z a r y s t r e ś c i. W pracy przeprowadzono analizę stóp wyjścia ze stanu bezrobocia, uwzględniającą zróżnicowanie płciowe. Proces opuszczania stanu bezrobocia badano dla obu płci osobno wykorzystując parametryczne modele hazardu. Głównym celem było dokonanie rozkładu nierówności między kobietami i mężczyznami podczas opuszczania bezrobocia. Zastosowana zmodyfikowana mikroekonometryczna technika dekompozycji Oaxaca-Blindera pozwoliła na wyodrębnienie czynników wyjaśniających zaobserwowane nierówności. Otrzymano, że nierówności płciowe są wyjaśniane w większości przez różniące się „wyceny" cech kobiet i mężczyzn dokonywane przez rynek.

S ł o w a k l u c z o w e: czas trwania w bezrobociu, parametryczne modele hazardu, nierówności płciowe, dekompozycja Oaxaca-Blindera.