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Slovak Women Wage Structure: Does Education Matter?

Struktura zarada žena u Slovačkoj: Da li obrazovanje ima značaja?

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A B S T R A C T

The aim of the article is to analyze changes in the returns to education for women between 2005 and 2009 in the Slovak Republic. A Mincer equation is estimated along the entire wage distribution using quantile and OLS regressions. Data used for the analysis are individual data from harmonized EU SILC statistical survey. The results indicate tree points. Firstly, education affects women's earnings positively. The return to an additional year of schooling is close to 5 %. Secondly, returns to education for women did not change significantly from 2005 to 2009. Thirdly, the influence of education on the women´s earnings is more significant than of work experience.

KEW WORDS: mincer equation, returns to education, Slovak Republic

Introduction

The wage rewards of schooling – "returns to education" – are a central concern to both labor economics and econometrics. There are numbers of empirical studies documenting the rise in returns to education in transitional economies of Central and Eastern European countries,

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especially among men. The literature on early-transition returns to education for men includes Krueger and Pischke (1995) and Bird, Schwarze and Wagner (1994) for East Germany; Rutkowski (1996, 1997) for Poland; Halpern and Körosi (1997) for Hungary; Orazem and Vodopivec (1997) for Slovenia; Lubyová and Sabirianova (2001) for Slovakia and Russia; Jones and Ilayperuma (1994) for Bulgaria; Flanagan (1995) and Chase (1997) for the Czech Republic. However, there is a dearth of descriptive evidence on returns to education for women. This paper fills the gap for the Slovak Republic by estimating private wage returns to education for women using an EU SILC data in 2005-2009.

Two studies have investigated changes in returns to education for women in Slovak Republic. They dealt with changes in the benefits of education between the final years of communism system and the early years of market economies. Chase (1997) find an increase in annual returns to schooling for women during period of 1984-1993 in the Slovak Republic. He reports that returns to a year of education increased from 4.4 percent for women in 1984 to 5.4 percent in 1993 in the Slovak Republic.

Filer, Jurajda and Planovsky (1999) have estimated the development of returns to education for women in Slovakia, using the enterprise survey data (Information System on the Cost of Labour). There was the finding that returns to education in Slovakia increased substantially between 1995 and 1997, when they reached a level two times higher than in 1984. The rate of increase was approximately equal both for men and women.

Table 1 presents the increase in women's earnings for each additional year of education in the Slovak Republic for 1984, 1993, 1995, 1996 and 1997.

Table 1: Trends in coefficients on education for women over time in Slovakia

	1984	1993	1995	1996	1997
Years of schooling					
OLS	0.044	0.054	0.063	0.074	0.081
Number of observations	2 131	1 776	23 849	53 717	49 984

Source: Chase, 1997; Filer, Jurajda and Planovsky, 1999

In this paper, we extend the existing evidence by covering the situation for women after the end of the first transition decade. We provide an estimation of the basic earnings equations for calculating private rates of returns to education and returns to labor market experience for women.

The paper is organized as follows. Section 2 is devoted to the conceptual framework and the methodology used in the paper. Section 3 describes the data set and shows descriptive statistics and changes in wage structure between 2005 and 2009. Estimation results are presented in section 4. Section 5 gives concluding remarks.

Methodology

In this study the conceptual framework used is the human capital model of earnings determination. This framework is developed by Mincer (1958 and 1974) and Becker (1975). According to this model wage differences among individuals are the result of the differences in their schooling, training and work experience. Accordingly, log hourly wages are postulated to depend on schooling, experience and other exogenous socio-economic factors. (Tansel, 2008).

Traditionally the rates of return to education are measured on the base of standard Mincer earnings function of the log-linear form. Mincer (1958, 1974) was one of the firsts who applied human capital concepts directly to the personal distribution of earnings and used the standards earnings function for estimation of rates of return to education and experience.

We use earnings equation in the form (Heckman, Lochner, and Todd, 2003):

$$ln[w(s,x)] = \alpha_0 + \rho_s s + \beta_{i0} x + \beta_{i1} x^2 + \varepsilon_i \qquad (1)$$

where $ln[w(s,x)]$ is log of wage at schooling level s and work experience x; ρ_s is coefficient on education variable, which is often called ''returns to education'' or "returns to schooling" (assumed to be the same for all schooling levels) and ε is a mean zero residual with $E(\varepsilon|s,x) = 0$.

The estimation of Mincer earnings function enables us to find the returns to schooling and experience. It is realized using Ordinary Least Squares Method and Quantile Regression based on the following authors:

Koenker (2006), Koenker a Bassett (1978), Koenker a Hallock (2001), Koenker a Hallock (2008) and Yu, Lu, Sander (2003).

Data and Descriptive Statistics

The results of the official statistical Survey on Income and Living Conditions (EU SILC) provided by the Slovak Statistical Office is used to estimate the benefits of education in 2005-2009. EU SILC data clearly provide the basis for detailed analysis of the standard human capital model developed by Mincer (see section Methodology). The principal variable in this model is earnings of log form. For EU SILC data, the earnings are measured on annual basis.

The following figure (Figure 1) and table (Table 2) and figure present the descriptive statistics[8] of the annual wages within the analyzed period and box-plot of the wage distribution.

Figure 1: Box-plot of the wage (EUR) distribution in the period 2005-2009

Source: *authors*

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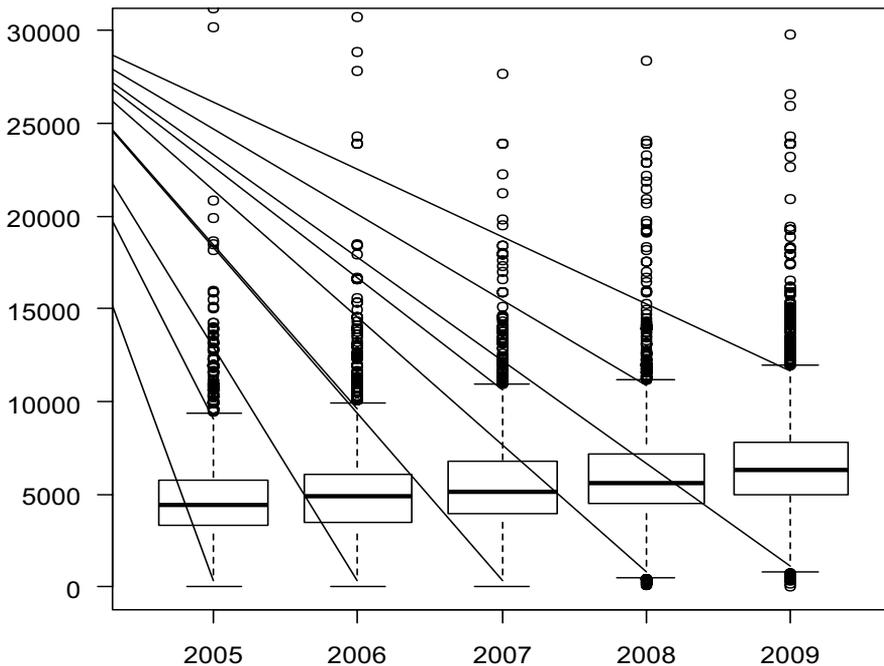
[8] For more descriptive statistics, see Appendix A.

Table 2: Mean, median and probability distribution of women wages (EUR) in the period of 2005-2009

	Mean	**Median**
Year 2005	4 953.14 (149 218.4 SKK)	4 461.28 (134 400.5 SKK)
Year 2006	5 443.96 (164 004.7 SKK)	4 902.08 (147 680.0 SKK)
Year 2007	5 605.71 (168 877.5 SKK)	5 121.52 (154 291.0 SKK)
Year 2008	6 054.40 (182 395.0 SKK)	5 642.97 (170 000.0 SKK)
Year 2009	6 660.22 (200 645.8 SKK)	6 306.85 (190 000.0 SKK)

Source: *authors*

The positive skewness typical for the distribution of income is visible. Moreover, the values of mean and median of wages, although constantly rising over the years and thus corresponding to the economic growth, are not equal. In each case, mean has exceeded median relatively significantly. This evokes the conclusion, that more than 50 % of the sample participants earn less than mean. Therefore, some authors emphasise the importance of the median as more appropriate measure of the average income.

The other main variables in the standard Mincer model include years of schooling and labor market experience. The variable years of schooling accounts for years of schooling adjusted for actual level of education. Based on the information on the highest level of education attained, we impute years of schooling[9]. This allows us to estimate returns to education in terms of the increase in income per additional year of schooling. The variable labor market experience record a worker's actual labor force experience.

Estimation Results

In this section, Mincerian log-wage regressions were estimated. Earnings equation was applied in the conditions of the Slovak Republic within the period of 2005 – 2009. As mentioned earlier, we modeled the variability of the population wages using both the quantile regression (QR) and the ordinary least squares method (OLS). Concerning the former one,

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[9] see Appendix A for details

we examined the returns to education and experience at different quantiles of the wage distribution. The analysis has been realized for 5th, 10th, 25th, 50th, 75th, 90th and 95th quantiles, thus provides complex view of the wages of female employees in the Slovak Republic.

Table 3 reports parameter estimations from log-wage regression equations. The results imply that wages of female employees in the Slovak Republic increase by about 5 percent with each additional year of schooling. Table 3 compares the results of the classical (OLS) and the median (MR) regression[10]. The differences are not substantial. However, further analysis will be based on the quantile regression, as the linear model requires several conditions which are in case of Mincer equation not fulfilled.[11] Firstly, non-normality of residuals is caused also by the right skewed distribution of an income. Secondly, expected multicollinearity (cor>0.9) between covariables exp and exp2 is present, as one variable is expressed as squared value of another one. Thirdly, in 2005, 2006 and 2008 the assumption of homoscedasticity (constant variance of residuals) of residuals is violated.

Table 3: Estimated Mincerian returns to education, 2005-2009

		Intercept	Education (educ)	Work experience (exp)	Work experience squared (exp2)
Year 2005	OLS	10.8400 ***	0.0523 ***	0.0179 ***	-0.00020 **
	MR	10.8832 ***	0.0521 ***	0.0193 ***	-0.00030 ***
Year 2006	OLS	10.8300 ***	0.0551 ***	0.0186 ***	-0.00023 *
	MR	10.8982 ***	0.0555 ***	0.0176 ***	-0.00023 ***
Year 2007	OLS	10.8800 ***	0.0613 ***	0.0170 ***	-0.00024 **
	MR	11.0622 ***	0.0567 ***	0.0128 ***	-0.00022 **
Year 2008	OLS	11.0100 ***	0.0566 ***	0.0209 ***	-0.00035 ***
	MR	11.1724 ***	0.0557 ***	0.0110 ***	-0.00017 *
Year 2009	OLS	7.7841 ***	0.0533 ***	0.0141 ***	-0.00019 **
	MR	7.8002 ***	0.0548 ***	0.0123 ***	-0.00013 **

Significant at: *** <0.1%, ** 0.1%, * 1%

Source: *authors*

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[10] For more detailed results of the quantile regression, see Appendix D.

[11] The results of tested OLS model are in Appendix C.

Table 4 provides the graphical analysis of the quantile regression results for the years 2005-2009. We can observe the effects of the length of schooling period and working period on the income value of an individual woman.

The first important conclusion is the positive relationship between each covariable and the independent variable. The longer the period of education (work experience) is, the higher the wage is. In most cases, the education influences the level of the salary more significantly than the work experience does. Moreover, the differences between the effects of these two covariables rise with the increasing earnings.

Considering the education more detailed, no eminent rising tendency of the effect of the covariable is visible, except for the year 2005. The regression coefficients for the lowest quantiles (5th, 10th) reach relatively high levels and afterwards they are slightly decreasing to be returned back to bigger values for the last quantiles.

There are several explanations for this development: Higher effect of the education on the low wages can be due to the young graduated people with the tertiary education having their first job, who are often willing to work for the minimum wage for a certain time merely to gain some experience. Moreover, considerably high unemployment in the Slovak Republic forces the unemployed tertiary educated women to look for the irregular temporary jobs, often for the period of several weeks or months.

No constant increasing of the education effect on the wages can also be connected with the large number of the female students in the study programmes, such as Pedagogics, Philosophy or Administration. These are in the Slovak Republic insufficiently paid.

Observing the second variable, the length of the work experience of a woman, its effect on the wages is gradually decreasing. In certain cases, the length of the work experience has appeared as an insignificant factor with even no influence on the wages (95th quantile in 2007, 2008, 90th and 95th quantile in 2009). One possible explanation of the falling trend is lower wages in the low qualified jobs. In these cases, the work experience plays more important role than the university education. Analogically, the best paid professions are highly qualified (IT sphere, Banking, Finance, ...), thus require tertiary education. Obviously, secondary and tertiary school graduates usually gain less work experience, as they prefer to spend several years studying to working.

Table 4: Coefficients on education an experience for woman in the period 2005-2009

	Effect of the number of years of education on wages	Effect of the number of years of work experience on wages
Year 2005		
Year 2006		
Year 2007		
Year 2008		
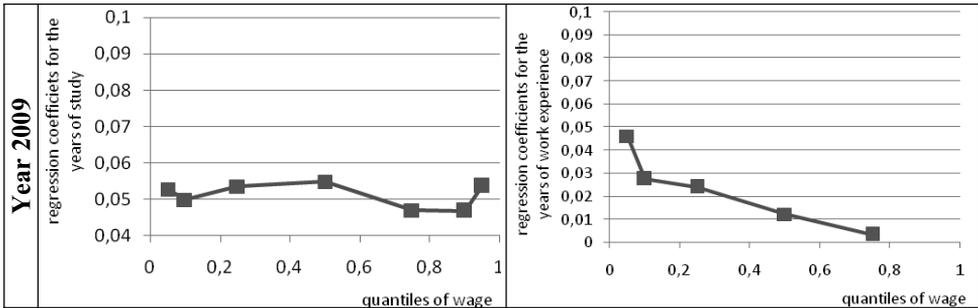
Source: *authors*

Conclusion

In this paper returns of the education for women estimated in Slovakia are provided for the years 2005-2009. These estimates are provided by using both the OLS and the regression methods.

There are three main conclusions. Firstly, the results indicate that education has significant and positive influence on the women's earnings. Women's return to education is close to 5 %. We find that returns to education are higher for lowest quantiles (5th, 10th) and the last quantiles (95th) than for other quantiles. Possible reasons are young graduates looking for their first job or insufficiently paid study programmes, which are popular among women.

Secondly, the results indicate that the returns estimates for women did not change dramatically during the period 2005-2009.

The third conclusion emphasises more significant effect of education on women´s earnings than of work experience.

Consequently, the investment into education as the human capital is convenient investment.

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A P S T R A K T

Cilj ovog rada je da analizira promene u zaradama žena , stavljenim u odnos sa njihovim obrazovanjem za period između 2005. i 2009. u Slovačkoj. Mincerova jednačina uključuje kompletnu distribuciju zarada, koristeći kvantilnu regresiju i metod najmanjih kvadrata. Podaci korišćeni za analizu su pojedinačni podaci iz harmonizovane SILC ankete Evropske unije. Rezultati ukazuju na tri zaključka. Prvo, obrazovanje pozitivno utiče na zarade žena. Povećanje zarada na svaku dodatnu godinu školovanja žena je oko 5%. Drugo, povećanje zarada prema obrazovnom nivou žena nije se značajno menjalo u periodu od 2005. do 2009. Treće, uticaj obrazovanja na zarade žena je značajniji u odnosu na radno iskustvo.

KLJUČNE REČI: *Mincerova jednačina, zarade, obrazovanje, Slovačka Republika*

Appendix A: Summary statistics

Table A1: 2005

Variable	Annual wage (SKK)	Years of education	Years of work experience
Number of observations	2 742	2 742	2 742
Mean	149 218.4	13.384019	19.68162
Median	134 400.5	12.140000	12
Standard deviation	116 995.5	2.919788	10.53392
Variance	136 879.5e+5	8.525163	110.96354
Minimum	1 875	8.5	1
Maximum	3 568 502	21.64	24

Table A2: 2006

Variable	Annual wage (SKK)	Years of education	Years of work experience
Number of observations	2 599	2 599	2 599
Mean	164 004.7	13.454205	20.10812
Median	147 680	12.140000	21
Standard deviation	476 495.8	2.875321	10.69927
Variance	227 048.2e+6	8.267470	114.47445
Minimum	1 000	8.500000	1
Maximum	24 000 010	21.640000	47

Table A3: 2007

Variable	Annual wage (SKK)	Years of education	Years of work experience
Number of observations	2 700	2 700	2 700
Mean	168 877.5	13.464393	20.57481
Median	154 291.0	12.14	22
Standard deviation	82 743.7	2.904774	10.79359
Variance	684 651.9e+04	8.437709	116.50163
Minimum	300	4	1
Maximum	1 369 005	21.64	49

Table A4: 2008

Variable	Annual wage (SKK)	Years of education	Years of work experience
Number of observations	3 042	3 042	3 042
Mean	182 395.0	13.479014	19.68540
Median	170 000	12.14	21
Standard deviation	83 061.55	2.844124	10.93297
Variance	689 922.0e+04	8.089044	119.52974
Minimum	2 000	8.5	1
Maximum	1 012 000	21.64	49

Table A5: 2009

Variable	Annual wage (EUR)	Years of education	Years of work experience
Number of observations	2 965	2 965	2 965
Mean	6 660.221	13.705470	20.33929
Median	6 306.845	12.14	22
Standard deviation	3 512.574	2.922420	10.96219
Variance	123 381.8e+02	8.540538	120.16959
Minimum	6.638784	8.5	1
Maximum	79 200.03	21.64	47

Appendix B: Imputation of Years of Schooling

Table B: Classification ISCED 97 and Years of Schooling

ISCED 1997		Years of schooling
Code	Name	
0	ISCED 0	0
1	ISCED 1	4
2	ISCED 2	8.5
3	ISCED 3	12.5
4	ISCED 4	14
5	ISCED 5	18
6	ISCED 6	21

Appendix C: OLS Tests

Table C1: Results of the Jarque-Bera Normality Test for the OLS Method

	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009
p value	< 2.2e-16	< 2.2e-16	< 2.2e-16	< 2.2e-16	< 2.2e-16

Table C2: Results of Durbin-Watson Autocorrelation Test

	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009
DW statistics	1.9808	1.9423	1.9517	1.9665	1.8853

Table C3: Results of Breusch-Pagan Heteroscedasticity Test

	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009
p value	0.0001846	0.000591	0.08392	0.006211	0.2296

Table C4: Correlation between independent variables - Multicollinearity Test

Cor. coeff.	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009
educ/exp	-0.1397742	-0.1825382	-0.1549748	-0.1861927	-0.1798790
educ/exp2	-0.1429126	-0.1780933	-0.1501855	-0.1887246	-0.1729618
exp/exp2	0.9663851	0.9648797	0.9651804	0.9638727	0.9656287

Appendix D: Regression coefficients and p values for OLS and QR

Table D1: OLS and Quantile Regressions (Women 2005)

Quantiles	5th	10th	25th	50th	75th	90th	95th
Intercept	9.95094	10.25555	10.54630	10.88321	11.11603	11.22325	11.32620
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of education (educ)	0.04395	0.04838	0.05804	0.05217	0.05550	0.06839	0.07182
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of work experience (exp)	0.04429	0.03557	0.02364	0.01933	0.00839	0.00597	0.00680
p value	0.00067	0.00017	0.00000	0.00000	0.00000	0.00000	0.00018
Years of work experience squared (exp^2)	-0.00064	-0.00059	-0.00043	-0.00030	-	-	-
p value	0.00067	0.00343	0,00000	0.00006	-	-	-

Table D2: OLS and Quantile Regressions (Women 2006)

Quantiles	5th	10th	25th	50th	75th	90th	95th
Intercept	9.38776	10.01424	10.67198	10.89823	11.21520	11.32808	11.44963
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of education (educ)	0.06370	0.05039	0.05695	0.05554	0.05450	0.06217	0.06523
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of work experience (exp)	0.05974	0.04944	0.01546	0.01760	0.00724	0.01110	0.00536
p value	0.00035	0.00002	0.00049	0.00000	0.00000	0.00047	0.00882
Years of work experience squared (exp^2)	-0.00080	-0.00077	-0.00024	-0.00023	-	-0.00016	-
p value	0.03050	0.00142	0.02138	0.00023	-	0.01421	-

Table D3: OLS and Quantile Regressions (Women 2007)

Quantiles	5th	10th	25th	50th	75th	90th	95th
Intercept	9.38892	10.13396	10.65692	11.06222	11.26624	11.42448	11.70814
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of education (educ)	0.07982	0.06561	0.06428	0.05675	0.05852	0.06674	0.06263
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of work experience (exp)	0.05719	0.03766	0.01506	0.01287	0.00627	0.00313	-
p value	0.00000	0.00001	0.00003	0.00004	0.00000	0.00248	-
Years of work experience squared (exp^2)	-0.00081	-0.00061	-0.00020	-0.00022	-	-	-
p value	0.00072	0.00013	0.02402	0.00222	-	-	-

Table D4: OLS and Quantile Regressions (Women 2008)

Quantiles	5th	10th	25th	50th	75th	90th	95th
Intercept	9.68350	10.13497	10.70025	11.17242	11.42279	11.61445	11.76372
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of education (educ)	0.06589	0.06802	0.06290	0.05577	0.05097	0.05761	0.06297
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of work experience (exp)	0.05829	0.04213	0.02579	0.01101	0.01304	0.00356	-
p value	0.00011	0.00000	0.00000	0.00000	0.00002	0.00203	-
Years of work experience squared (exp^2)	-0.00084	-0.00073	-0.00044	-0.00017	-0.00020	-	-
p value	0.00562	0.00019	0,00000	0.01370	0.00422	-	-

Table D5: OLS and Quantile Regressions (Women 2009)

Quantiles	5th	10th	25th	50th	75th	90th	95th
Intercept	6.80588	7.22748	7.53422	7.80024	8.21925	8.53262	8.55386
p value	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of education (educ)	0.05272	0.04988	0.05351	0.05483	0.04691	0.04680	0.05373
p value	0.00007	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Years of work experience (exp)	0.04612	0.02766	0.02415	0.01233	0.00358	-	-
p value	0.00024	0.00020	0.00000	0.00000	0.00000	-	-
Years of work experience squared (exp^2)	-0.00080	-0.00043	-0.00044	-0.00013			
p value	0.00270	0.01712	0.00000	0.00600	-	-	-