

The Impact of Educational Attainment on Gross Wages: A Comparative Analysis of the Public and Private Sectors in Czechia

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Abstract

This research paper examines the impact of educational attainment on gross wages in the public and private sectors in Czechia, focusing on potential disparities in wage outcomes. Using a comprehensive dataset from the Average Earnings Information System (ISPV) for 2022, we employ regression analysis, while controlling for factors such as age and gender. Our empirical analysis uncovers a positive relationship between educational attainment and wages in both the public and private sectors. However, it is noteworthy that the private sector demonstrates a slightly lower return to education compared to the public sector, as indicated by one specific regression technique employed in our study. However, the second estimation technique does not confirm this result. Additionally, we estimate a stronger negative impact of gender (female) on wage levels in the private sector than in the public sector. Analyzing wage differentials among young workers (aged 24-30) compared to the overall workforce, we observe that the disparities in average earnings are mostly less pronounced at the early stages of their careers. This research deepens our understanding of the relationship between educational attainment, wages, and sectoral differences, providing a foundation for evidence-based decision-making and policy formulation in the context of the Czech labor market.

Key Words

impact of educational attainment on wages, public sector, private sector, wage differentials, Czech Republic

JEL Classification: I26, J31, J45

Introduction

Education is widely recognized as a main determinant of individual economic outcomes, with educational attainment often being linked to higher wages and improved employment prospects. However, the relationship between educational attainment and wages can vary across different sectors of the economy. In this research paper, we aim to explore the impact of educational attainment on gross wages in both the public and private sectors. The central research question guiding this study is: What is the impact of educational attainment on gross wages in the public and private sectors in the Czech Republic? Based on existing literature and theoretical foundations, we posit the following hypothesis: Employees with higher levels of education will have higher gross wages compared to those with lower levels of education, and this effect will differ between the public and private sectors.

A number of studies examining the returns to education and wage differentials between the public and private sectors have been published. Research in this field has been ongoing for several decades (*e.g.* Bender 1998; Borjas 2002; Gittleman and Brooks 2012;

Keefe 2012; Sławińska 2021). One of the most recent studies utilizing the Mincerian function, Montenegro and Patrinos (2022), indicates that, on average, the public sector offers higher wages than the private sector; however, the impact of education on earnings is more significant in the private sector. The topic of the public-private pay gap has been addressed in the Czech Republic by researchers such as Picka (2014) and Picka and Klazar (2016). According to Picka (2014), at the lower decile level, there is a positive discrimination in favor of employees in the public sector, and as the quantile increases, the coefficient becomes negative, penalizing public sector affiliation, especially among men. Utilizing quantile regression, the study Picka and Klazar (2016) examines the wage disparity between the public and private sectors in the Czech Republic. The impact of higher education on the earnings of Czech employees, distinguishing between the public and private sectors and estimating the Mincerian function, was examined by Finardi and Fischer (2017). Their result indicates that obtaining a higher education degree in the private sector leads to a higher wage premium compared to the public sector, based on data from 2009.

Furthermore, we examine the differences in employee remuneration at the beginning of their careers (age 24-30) in the public and private sectors. As young individuals embark on their professional journeys, they often ponder where their education can be best monetized. The text is organized as follows. The first chapter contains a description of the research methodology, chapter 2 presents the results of the analysis, chapter 3 discusses the results, and the final section concludes.

1. Methods of Research

To investigate our research question, we employ a quantitative research approach utilizing a large-scale dataset of individuals' educational attainment and corresponding gross wages in both the public and private sectors. We specifically conduct the analysis using micro-level data from the Average Earnings Information System (ISPV) for the year 2022.. The ISPV is administered by a specific unit within the state statistical service at the Ministry of Labour and Social Affairs of the Czech Republic and it serves as the exclusive provider of structural wage statistics in the Czech Republic. The ISPV data was extrapolated to the entire population using the methodology developed by Červenka, Beran, and Bílková (2022).

For our initial step, we begin by examining the descriptive statistics of the variables. We notice differences in education, age, and wages in the public and private sectors. In our subsequent analysis, we employ regression analysis to assess the impact of educational attainment on wages while controlling for other relevant factors, such as age and gender. This allows us to further explore the observed differences in education, age, and wages between the public and private sectors. Our aim is to explore the impact of educational attainment, distinguishing five levels of education, on gross wages. The analysis proceeds in three steps. First, we examine the impact of education on gross wages regardless of the private or public sector. Subsequently, we analyze the sectors separately. In the third step, we include gender as an additional control variable.

The equations for the multiple regression models are as follows:

$$\log(\text{gross wage})^j = \beta_0 + \beta_1 \text{education}^j + \beta_2 \text{age}^j + u^j \quad (1)$$

$$\log(\text{gross wage})_G^j = \beta_0 + \beta_1 \text{education}_G^j + \beta_2 \text{age}_G^j + u_G^j \quad (2)$$

$$\log(\text{gross wage})_P^j = \beta_0 + \beta_1 \text{education}_P^j + \beta_2 \text{age}_P^j + u_P^j \quad (3)$$

$$\log(\text{gross wage})_G^j = \beta_0 + \beta_1 \text{education}_G^j + \beta_2 \text{age}_G^j + \beta_3 \text{sex}_G^j + u_G^j \quad (4)$$

$$\log(\text{gross wage})_P^j = \beta_0 + \beta_1 \text{education}_P^j + \beta_2 \text{age}_P^j + \beta_3 \text{sex}_P^j + u_P^j \quad (5)$$

where *gross wage* is the gross monthly wage, *education* is the highest level of education achieved on a scale from 1 to 5, and *age* stands for the age calculated as 2022 minus year of birth. The variable *sex* is dichotomous, with categories representing male and female. The superscripts *j* represent individual employees, while *G* and *P* denote the public (government) and private sectors, respectively. The error term in the regression equations is denoted as *u*. For young workers (aged 24-30), we specifically examine the differences in average and median wages between the public and private sectors based on educational attainment and compared these differences to the wage differentials observed among all employees in the dataset. To determine the statistical significance of the observed differences in wages, we employ a t-test.

2. Results of the Research

Descriptive statistics are presented in Table 1. Overall, we work with nearly 4.5 million observations. 80% of the observations are from the private sector, and 20% are from the public sector. The average age of employees is 43.5 years and the most common level of education is secondary education with a school-leaving examination (with „*maturita*“). The difference in average gross earnings between men and women exceeds 10,000 CZK, while the difference in medians is 6,500 CZK. When separating the public and private sectors, the average wage for men in public sector exceeds the average wage for women by 7,000 CZK, and the median exceeds by 6,000 CZK (see Tab. 2). In the private sector, the average wage for men is higher by 11,000 CZK than for women, with the median exceeding 7,500 CZK (see Tab. 3).

Tab. 1: Descriptive Statistics – Both sectors

Variable	Obs.	Standard deviation	Mean			Median		
		Total	Total	Male	Female	Total	Male	Female
Education	4 470 448	1,24	2,99	2,90	3,09	3	3	3
Age	4 470 448	11,94	43,50	43,00	44,00	44	43	45
Gross wage / Gross salary	4 470 448	34 775	43 613	48 686	38 491	37 087	40 494	33 900

Note: In education, we distinguish between 5 levels: (1) elementary and incomplete education; (2) secondary education without a school-leaving examination (i.e. without „*maturita*“); (3) secondary education with a school-leaving examination; (4) higher vocational education, and bachelor's or (5) university education. Men account for 50.24% of the observations. The private sector accounts for 3,575,960 observations. Earnings are reported in CZK.

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

Tab. 2: Descriptive Statistics – Public sector

Variable	Obs.	Mean			Median		
		Total	Male	Female	Total	Male	Female
Education	894 488	3,56	3,61	3,54	3	3	3
Age	894 488	46,16	45,44	46,48	47	46	47
Gross wage / Gross salary	894 488	42 413	47 529	40 230	39 024	43 087	37 396

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

Tab. 3: Descriptive Statistics – Private sector

Variable	Obs.	Mean			Median		
		Total	Male	Female	Total	Male	Female
Education	3 575 960	2,85	2,80	2,91	3	3	3
Age	3 575 960	42,84	42,68	43,03	43	43	44
Gross wage / Gross salary	3 575 960	43 913	48 843	37 808	36 570	40 107	32 598

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

As we are interested in the impact of education on gross wages, the following table (see Tab. 4) presents the differences in average gross wages between the public and private sectors for employees categorized by educational attainment. Across all levels of educational attainment, it is evident that the private sector consistently exhibits higher average and median gross wages in comparison to the public sector. The largest wage differential between the public and private sectors is observed among employees with a university education, reaching 30%. Their median wage in private sector is higher by just under 13%. The highest difference in median wages is among employees with secondary education without a school-leaving examination, reaching nearly 20%.

Tab. 4: Average and Median Wages in the Public and Private Sectors in 2022, Categorized by Education Levels (in CZK)

Education	Mean			Median		
	Public sector (G)	Private sector (P)	Difference	Public sector (G)	Private sector (P)	Difference
Elementary and incomplete education	27 037	30 485	12.75%	24 442	28 676	17.32%
Secondary education without a school-leaving examination (i.e. without „maturita“)	28 665	34 425	20.09%	27 081	32 451	19.83%
Secondary education with a school-leaving examination	38 855	43 066	10.84%	36 905	37 984	2.92%
Higher vocational education, and bachelor's	43 706	50 602	15.78%	41 138	42 161	2.49%
University	53 836	70 343	30.66%	48 469	54 644	12.74%

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

Before conducting the regression analysis, we tested the fulfillment of four regression assumptions: normality of residuals, heteroscedasticity, multicollinearity, and autocorrelation. After testing the normality of residuals, we have found that the variable is not normally distributed. Moreover, the Breusch-Pagan test revealed the presence of heteroscedasticity. Since the VIF (Variance Inflation Factor) test yielded a value of 1, we can conclude that multicollinearity is not a concern. The Durbin Watson test value is 1.18 which is lower than 2, thus indicating that positive autocorrelation exists in data. We

addressed autocorrelation by applying the Cochrane–Orcutt transformation, resulting in a transformed Durbin-Watson statistic. The results are displayed in Table 5. The first column represents the number of the estimated regression equation.

Tab. 5: Cochrane-Orcutt AR(1) Regression Results

Eq.	Log (gross wage)	Coef.	Std. Err.	t	P> t	DW statistic (transformed)	Adj. R-squared
(1)	Education	0.1572578	0.0001474	1066.62	0.000	2.200	0.2052
	Age	0.0022434	0.0000145	154.77	0.000		
	Cons.	9.994552	0.0008297	1.2e+04	0.000		
(2)	Education	0.1762297	0.0002854	617.45	0.000	2.165	0.3045
	Age	0.0045341	0.0000301	150.82	0.000		
	Cons.	9.736174	0.0018491	5265.33	0.000		
(3)	Education	0.1570573	0.0001715	915.67	0.000	2.197	0.1918
	Age	0.002015	0.0000164	122.95	0.000		
	Cons.	10.0262	0.000927	1.1e+04	0.000		
(4)	Education	0.1757642	0.0002823	622.61	0.000	2.147	0.3217
	Age	0.0046087	0.0000296	155.71	0.000		
	Sex	-0.1169347	0.0007812	-149.69	0.000		
	Cons.	9.933274	0.0022558	4403.52	0.000		
(5)	Education	0.160297	0.0001653	969.76	0.000	2.189	0.2517
	Age	0.0023062	0.0000158	145.78	0.000		
	Sex	-0.2026138	0.0003816	-530.96	0.000		
	Cons.	10.29762	0.0010293	1.0e+04	0.000		

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

As we can observe from Table 5, all of the variables are statistically significant at 1% significance level. The estimated coefficient of education is consistently positive, indicating that wages increase with educational attainment. The return to an additional level of education is slightly lower in the private sector than in the public sector. Achieving one level higher of education is accompanied by a 17.6% increase in wages in the public sector and a 15.7% increase in the private sector. Similarly, the positive relationship between age and wage levels holds true. An additional year of age increases wages by 0.4% in the public sector and by 0.2% in the private sector. When we added a dummy variable for gender to the model, the estimated coefficient is negative. The coefficient is -0.12 in the public sector and -0.20 in the private sector, indicating a stronger negative impact of gender (female) on wage levels in the private sector than in the public sector.

Considering the departure from normality in the residuals observed in a simple ordinary OLS regression, we also adopt robust estimation techniques to obtain unbiased standard errors. The results are displayed in Table 6. The first column represents the number of the estimated regression equation.

Tab. 6: Regression Results with Robust Standard Errors

Eq.	Log (gross wage)	Coef.	Robust Std. Err.	t	P> t	R-squared
(1)	Education	0.1730295	0.0001635	1058.5	0.000	0.2334
	Age	0.001946	0.0000144	134.8	0.000	
	Cons.	9.960274	0.0007912	1.3e+04	0.000	
(2)	Education	0.1803097	0.0002973	606.49	0.000	0.3086
	Age	0.0050246	0.0000287	175.26	0.000	
	Cons.	9.699015	0.0017567	5521.11	0.000	
(3)	Education	0.1830362	0.0002006	912.31	0.000	0.2353
	Age	0.0017716	0.0000168	105.47	0.000	
	Cons.	9.962518	0.0009255	1.1e+04	0.000	
(4)	Education	0.1789434	0.0002905	615.89	0.000	0.3373
	Age	0.0052347	0.0000287	182.14	0.000	
	Sex	-0.1425731	0.0007499	-190.11	0.000	
	Cons.	9.936672	0.0020247	4907.68	0.000	
(5)	Education	0.187445	0.0001954	959.36	0.000	0.2997
	Age	0.0019289	0.0000164	117.41	0.000	
	Sex	-0.2347815	0.0004045	-580.46	0.000	
	Cons.	10.28287	0.0010214	1.0e+04	0.000	

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

Even when using an alternative estimation technique, all variables in all models are statistically significant. The differences in returns to an additional level of education are nearly indistinguishable in the public and private sectors, unlike the estimates from the previous technique. The positive association between age and wage levels persists. Employing this alternative estimation technique, we find that age exerts a stronger influence on wage growth in the public sector compared to the private sector. Specifically, each additional year of age is associated with a 0.5% increase in wages in the public sector, while the effect is slightly lower at 0.17% in the private sector. When including the gender variable, the results indicate a consistent gender disparity. In both sectors, the coefficient is negative, with the private sector exhibiting a higher magnitude.

Subsequently, we examined the remuneration of young employees (aged 24-30) in the public and private sectors. Both average and median values increase with higher levels of education, and across all categories, we observe higher earnings in the private sector (see Tab. 7).

Tab. 7: Average Gross Earnings in the Public and Private Sectors for Individuals Aged 24-30 in 2022, Categorized by Education Levels (in CZK)

Gross wage/ Gross salary	Public sector (G)	Private sector (P)	Difference	Public sector (G)	Private sector (P)	Difference
	Mean	Mean	Mean	Median	Median	Median
(1) elementary and incomplete education	28 246	31 209	10,49 %	26 101	29 787	14,12 %
(2) secondary education without a school-leaving examination (i.e. without „maturita“)	28 846	34 519	19,67 %	28 013	33 063	18,03 %
(3) secondary education with a school-leaving examination	34 787	39 144	12,52 %	34 131	36 394	6,63 %
(4) higher vocational education, and bachelor's	38 539	43 056	11,72 %	36 871	39 045	5,90 %
(5) university education	43 861	48 386	10,32 %	40 315	43 170	7,08 %

Source: authors' calculations in STATA 16.1 based on ISPV data 2022

Both for average gross wages and median gross wages, we observe the highest difference in earnings between employees in the private and public sectors with a secondary education without a school-leaving examination. The t-test revealed that the differences in average wages for individuals aged 24-30 between the public and private sectors are statistically significant for all levels of education. When examining wage differentials between young workers and the overall workforce, we find that disparities in average earnings are mostly less pronounced at the early stages of their careers (cf. the fourth and the last columns of Tab. 4 and Tab. 7).

3. Discussion

In our research, we discovered that the effect of educational attainment on gross wage was statistically significant at all levels. In both the public and private sectors, wages increase with higher levels of education. The control variables of age and gender also emerged as statistically significant. Our primary result indicates that raising the educational level yields an almost equivalent percentage increase in gross wages for both the public and private sectors. The initial observed phenomenon of a slightly lower return to an additional level of education in the private sector compared to the public sector can be attributed to several plausible explanations. One possible explanation lies in the unique skill demands of the private sector, which may prioritize specific qualifications or expertise that are not solely dependent on higher educational attainment. Additionally, it is crucial to consider that the composition of industries and job profiles within the private sector may differ significantly from the public sector, introducing further variations in wage differentials.

We also estimated a larger negative coefficient for gender in the private sector compared to the public sector. We can offer potential explanation for this finding. The public sector often has more standardized pay structures and transparent salary scales. This can help mitigate gender bias by ensuring that pay is determined based on objective criteria rather than subjective negotiations or individual bargaining power. Lastly, we find that wage disparities in average and median wages between the private and public sectors are mostly lower among young workers compared to the disparities we identified among all employees. Young workers may have similar educational backgrounds and qualifications,

especially among recent graduates. This can contribute to smaller wage disparities as their skills and knowledge are more comparable, regardless of the sector they work in.

Conclusion

Through this research, we aimed to contribute to the understanding of the impact of educational attainment on gross wages, taking into account the variations between the public and private sectors. Our analysis yielded three main results. Firstly, we have found that the return on an additional level of education is nearly equivalent in the private sector compared to the public sector. Secondly, we observed a negative relationship between gender (female) and wage levels in both sectors, with a stronger negative relationship in the private sector. Age also has a positive influence on wage levels, with a stronger effect in the public sector. Lastly, when examining wage disparities among young workers, we discovered that the differences in average and median wages between the private and public sectors were mostly smaller compared to the overall employee dataset.

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References

- BENDER, K. (1998). The Central Government-Private Sector Wage Differential. *Journal of Economic Surveys*, 1998, **12**(2): 177-220. <https://doi.org/10.1111/1467-6419.00052>
- BORJAS, G. (2002). *The Wage Structure and the Sorting of Workers into the Public Sector*. National Bureau of Economic Research (NBER), 2002, Working Paper 9313. <https://doi.org/10.3386/w9313>
- ČERVENKA, F., BERAN, V., & BÍLKOVÁ, D. (2022). *Význam minimální mzdy v okresech a sektorech české ekonomiky*. RILSA, Praha. Available at: https://katalog.vupsv.cz/fulltext/vz_521.pdf
- FINARDI, S., & FISCHER, J. (2017). Odhad Mincerovy funkce v podmínkách České republiky. *Český finanční a účetní časopis*, 2017(3), 57-68.
- GITTLEMAN, M., & BROOKS, P. (2012). Compensation for State and Local Government Workers. *Journal of Economic Perspectives*, **26**(1): 217-42. <https://doi.org/10.1257/jep.26.1.217>
- KEEFE, J. (2012). Are Public Employees Overpaid? *Labor Studies Journal*, 2012, **37**(1): 104–126. <https://doi.org/10.1177/0160449x11429263>
- MONTENEGRO, C., & PATRINOS, H. (2022). *Returns to Education in the Public and Private Sectors: Europe and Central Asia*. IZA Discussion Paper 15516. <https://doi.org/10.21203/rs.3.rs-2022007/v1>
- PICKA, J. (2014). Problém „public-private pay gap“ v České republice. *Politická ekonomie*, 2014, **62**(5): 662–682.
- PICKA, J., & KLAZAR, S. (2016). Kvantilová dekompozice public-private pay gap v České republice. *Ekonomický časopis*, 2016, **64**(4): 317–330.
- SŁAWIŃSKA, K. (2021). Public-private sector wage gap in a group of European countries: an empirical perspective. *Empirical Economics*, 2021, **60**, 1747–1775. <https://doi.org/10.1007>