THE IMPACT OF EDUCATION ON WAGES IN THE BUSINESS AND NON-BUSINESS SECTORS IN THE CZECH AND SLOVAK REPUBLICS

Luboš Marek – Josef Jablonský

Abstract

We will examine the effects of the level of education on wages in the business and non-business sectors in the Czech and Slovak Republics. It is often claimed that wages in the non-business sector are higher than in the business one. We will verify this hypothesis on real data. To compare the levels of wages, we use the methods of analysis of variance, or rank tests. In order to apply these tests, we will first need to transform the data to meet the conditions necessary for these methods to be applicable. We work with data from the years 2000 through 2017, and for several levels of education. This time span is long enough to make relevant calculations possible, as well as evaluation not only of the situation in the last year, but also the trend over the entire 18-year period. We will calculate the average wages and also the selected percentile measures: median, lower and upper quartiles, and 10% and 90% quantiles. All calculations and comparisons will be made for both countries. It will therefore be necessary to recalculate the wages to the same monetary unit (Euro) and to adjust them to the inflation rates, which are different in each country.

Key words: average wage, quantile measures, trend, business, education

JEL Code: C530, F470

Introduction

The main goal of the efforts connected with the present paper is the evaluation of whether the achieved level of education influences wages in the business and non-business sectors in the Czech and Slovak Republics. Our data is divided according to the following factors: Sector – business and non-business; Education level – Basic, Secondary, Bachelor, Master, and PhD; and Country – Czech and Slovak Republics. Altogether, there are $2 \times 5 \times 2 = 20$ datasets at our disposal, and we can compare them with each other. Each dataset is a time series from the years 2000 through 2017, i.e., it contains 18 items of data; there is one exception, however: the Slovak

data for the PhD level of education has only been monitored since 2002. At the time of writing this paper, the data of 2018 are not known. Nonetheless, all wages are certain to have grown in 2018. The particular effect on our analyses can only be discovered when the respective data is available.

When analysing, we are especially concerned with comparing the wage levels, i.e., evaluating the average wages in individual categories. Since our data has the form of (several) time series, certain classical methods of comparison (such as t-tests, ANOVA, etc.) cannot be used. In the end, it has turned out that no tests are necessary – the comparison has an unambiguous outcome, which can be interpreted on the basis of the charts. Effects of achieved education levels are treated in (Marek et al., 2016). A more general analysis of wages and the factors influencing them are described in (Marek, 2010) and (Marek et al., 2016).

Several authors have described and analysed wage data. Some of them have focused on analysing the behaviour of the wage distribution; for example, (Malá, 2017) and (Bartošová et al., 2014). We have also worked in this area – cf., e.g., (Marek, 2016).

1 Data and Methodology

Our data comes from the Czech and Slovak Trexima Companies (http://www.trexima.cz, http://www.trexima.sk). Prior to the analysis, the data must be adjusted to be comparable. Namely, the adjustments included conversion to EUR and taking into account the inflation effects. We should point out that the conversion to EUR was partly applied to Slovak data as well because the Slovak Republic adopted EUR as late as 2009 and the wages were stated in SKK prior to that date. The inflation rate values for individual years have been looked up on the websites of the Czech Statistical Office (http://czso.cz) and the Slovak Statistical Office (http://datacube.statistics.sk).

2 Data Analysis

Our data analysis has been carried out for a total of 20 samples, with the main factor being the achieved level of education. We consider five such levels in the present paper and monitor the evolution of the average wages in the Czech and Slovak Republics for each of them, both the business and non-business sectors in the years 2000 through 2017.

2.1 Wage Evolution in Time

The time series format of our data enables us to calculate simple measures for their dynamics. Let us consider a time series with n observations $y_1, y_2 ..., y_n$. We will evaluate its time evolution in both absolute and relative terms (Cyhelský 1981). In particular, we calculate the average absolute increment

$$\bar{\Delta} = \frac{y_n - y_1}{n-1} \qquad (1)$$

and the average growth coefficient

$$\bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}} . \qquad (2)$$

Tab. 1: Simple Measures of Dynamics

Sector	Education Level	Czech Republic		Slovak Republic	
		$\bar{\Delta}_t$	$\bar{k}_t$	$\bar{\Delta}_t$	$\bar{k}_t$
Business	Basic	22.506	1.043	20.379	1.039
	Secondary	32.124	1.041	30.432	1.041
	Bachelor	36.147	1.037	19.499	1.018
	Master	52.215	1.037	38.601	1.025
	PhD	42.259	1.032	61.777	1.033
Non-business	Basic	16.270	1.045	16.631	1.048
	Secondary	30.973	1.051	25.697	1.049
	Bachelor	37.269	1.055	16.963	1.022
	Master	40.954	1.050	22.182	1.024
	PhD	57.428	1.052	35.856	1.033

Source: the authors' own calculations

Several observations are implied by this Tab 1:

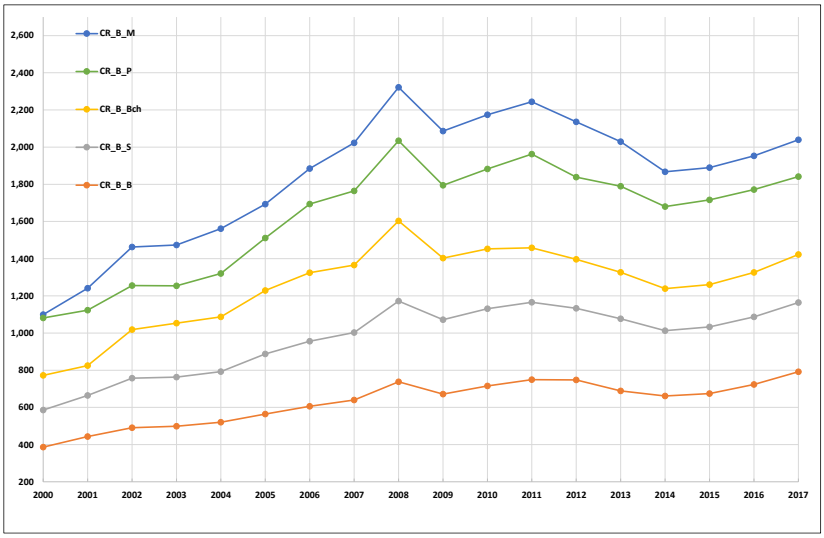
- the smallest value of the average absolute increment occurs in the Basic education level both in the CR and SR and both in the business and non-business sectors. The only exception is represented by the business sector in Slovakia, where the Bachelor education level grows somewhat slower;
- in the Czech Republic, it is true that the absolute growth of the wages is larger for a higher education level; in the Slovak Republic this statement is not valid in general;

- by far the largest average absolute increment occurs in the PhD category;
- for each education level, the situation about the average increment is different in each country;
- from the relative point of view, growth is the largest in the non-business sector in the Czech Republic, in particular, for the university levels of education;
- the relative growth is larger in the non-business sector than in the business one, and the values of the average growth coefficient are larger in the CR than in the SR for all categories;
- generally, the wages in the Czech Republic have been growing faster and higher than in the Slovak Republic in almost all categories.

2.2 Comparison According to the Level of Education

Let us have a look at the time evolution of average wages in the Czech and Slovak Republics in the most recent 18 years with regard to the achieved levels of education. For the sake of our comparison, the charts have been set to the same scale even though this setting is partly detrimental to the visual quality of the charts. The PhD data in Slovakia has only been known since 2002; hence the first two items of data are missing in the chart.

Fig. 1: Wages by Education Levels, Business, CR

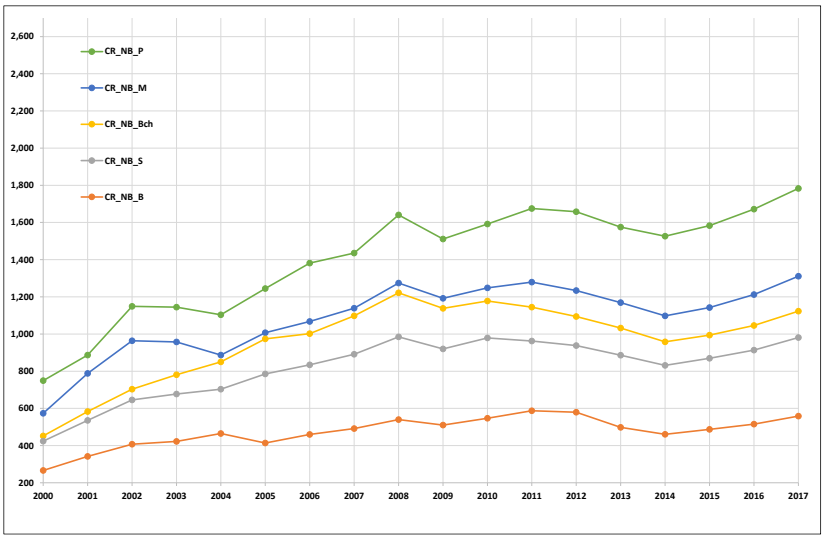


Source: the authors' own chart

The explanations in the charts go top-down. Each explanation consists of three components separated by underscores, with the following meanings: Country: CR – Czech

Republic, SR – Slovak Republic, Sector: B – business, NB – non-business, Education level: B – Basic, S – Secondary, Bch – Bachelor, M – Master, P – PhD.

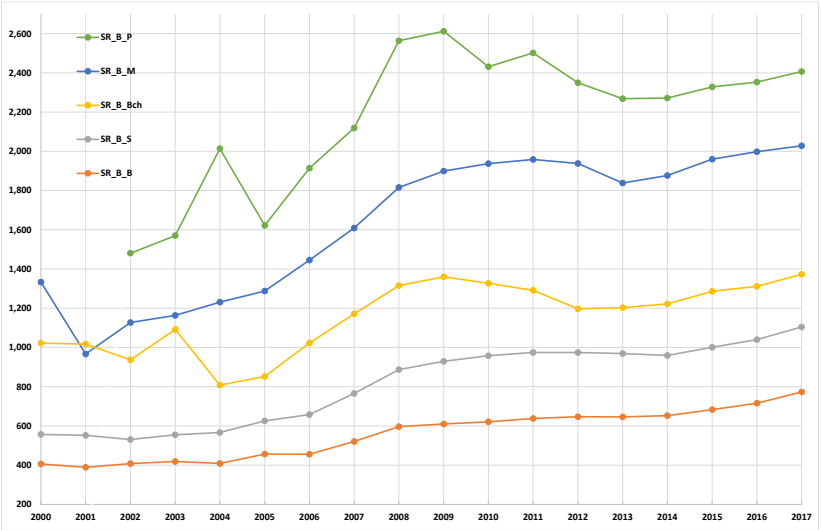
Fig. 2: Wages by Education Levels, Non-Business, CR



Source: the authors' own chart

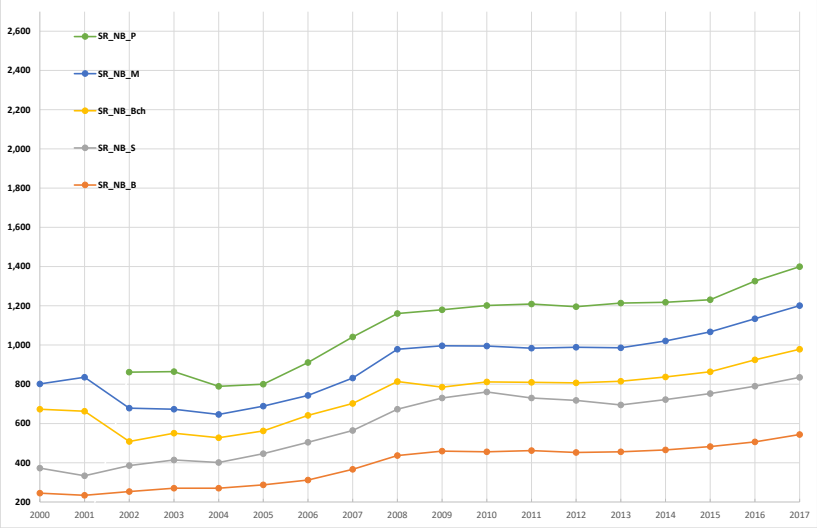
Even without any hypothesis testing, we can see that the average wages substantially differ from each other and that they depend on all three factors we consider, i.e., education level, sector and country. The influence of the education level is very pronounced and, with the sole exception of the business sector in the Czech Republic (in which the Master and PhD level are swapped, unlike in the other charts) the ordering of the wage values follow that of the education levels, namely: Basic < Secondary < Bachelor < Master < PhD.

Fig. 3: Wages by Education Levels, Business, SR



Source: the authors' own chart

Fig. 4: Wages by Education Levels, Non-Business, SR



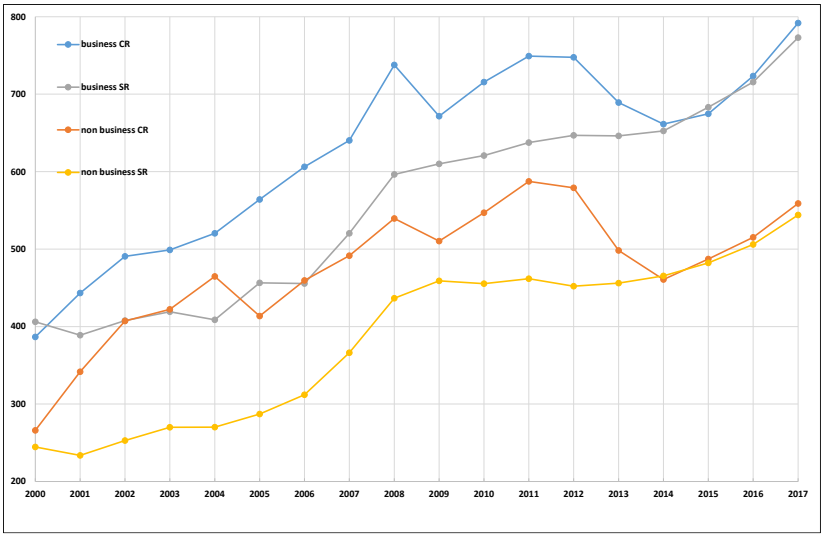
Source: the authors' own chart

Another significant factor is the sector: the business wages are much higher than non-business.

2.3 Comparison Between the CR and SR by Education Levels

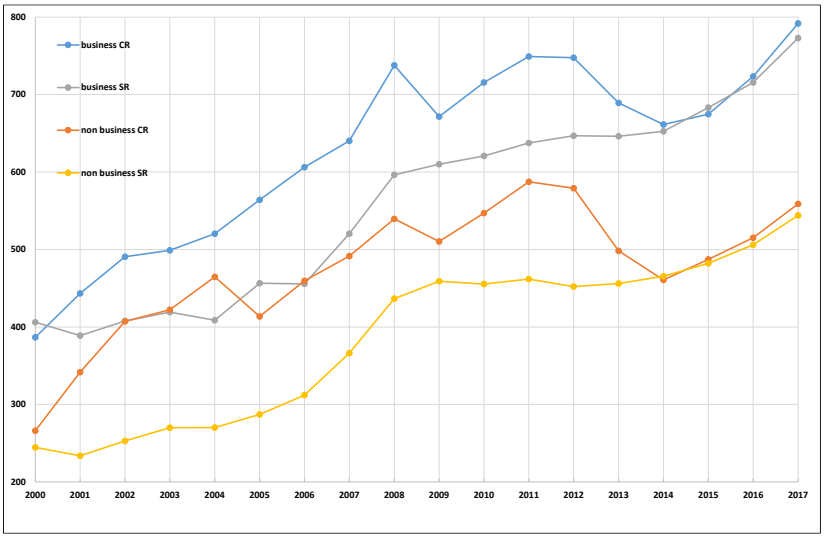
Now we are going to study the time evolution of the wages at the same education levels in the Czech and Slovak Republics. First goes Basic, followed by Secondary.

Fig. 5: Wages by the Basic Education



Source: the authors' own chart

Fig. 6: Wages by the Secondary Education

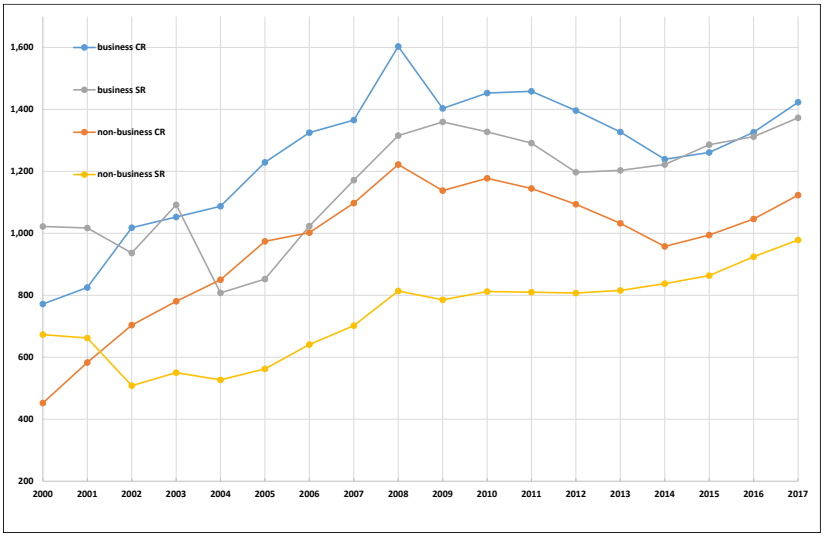


Source: the authors' own chart

For both the Basic and Secondary levels, there is a visible decrease in the Czech Republic in the years 2013 and 2014; the evolution in Slovakia was more regular. In the three most recent years we can see an increase with the data more or less the same in both countries.

Now we present three charts showing the time evolution of the wages paid to university-educated employees. First comes the Bachelor level.

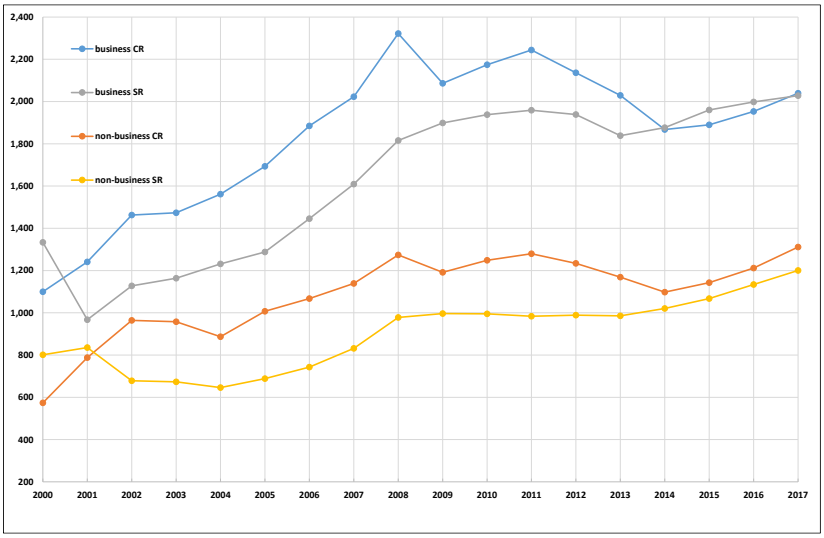
Fig. 7: Wages by the Bachelor Education



Source: the authors' own chart

Next, the chart showing the Master level is presented.

Fig. 8: Wages by the Master Education

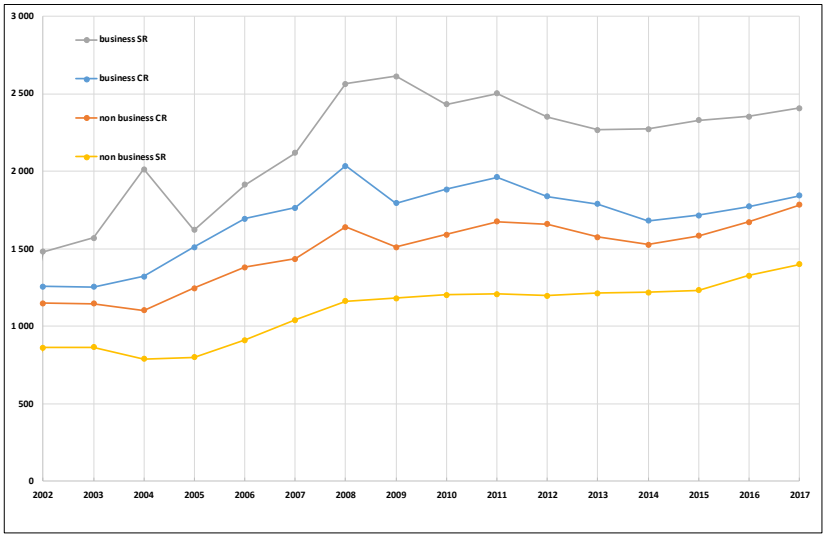


Source: the authors' own chart

The last of our charts shows the average wages for the employees at the highest level of education, that is, PhD. When comparing charts presented in this Chapter, we should keep in mind that their Y-axis scales are – for the sake of proper illustration – not the same.

The explanations in all these charts again go top-down (referring to the last year displayed, 2017). We can again observe an increase in the three most recent years. Apart from the PhD level, the data is approximately the same in both countries and for both sectors; and the average wage values are much higher in the business sector than in non-business in the entire time period in question.

Fig. 9: Wages by the PhD Education



Source: the authors' own chart

Conclusions

The goal of the present paper is the comparison of the average wages in the business and non-business sectors with regard to the achieved levels of education. This comparison has been carried out for the Czech and Slovak Republics, with the following conclusions:

- all three factors we have considered (sector, education level, and country) affect the average wage values;
- in general, the higher the education level, the higher the average wage values (regardless of the sector and country);
- the highest wage values occur in the PhD category, and these values are higher in the business sector;
- the country effects were most pronounced in the beginning years of our comparisons; in the four most recent years, the values in both countries converge to each other and, for certain education levels (Basic and Secondary) they are more or less identical.

This topic is extensive, and it would be interesting to carry out more comparisons and analyses. However, the scope of such an approach would go far beyond the capacity of the present text.

Acknowledgements

This paper was written with the Institutional Support to Long-Term Conceptual Development of Research Organisation, the Faculty of Informatics and Statistics of the University of Economics, Prague.

References

Bartošová, J. – Longford, N. T. (2014). A study of income stability in the Czech Republic by finite mixtures, Prague Economic Papers, vol. 23, no. 3, pp. 330–348.

Cyhelský, L. (1981). Úvod do teorie statistiky (In Czech; Introduction to Theory of Statistics). Praha. SNTL.

Malá, I. (2017). L-moments of a finite mixture of probability distributions. *International Days of Statistics and Economics* (str. 929-938). Slaný: Melandrium.

Marek, L. (2010). Analýza vývoje mezd v ČR v letech 1995-2008. *Politická ekonomie,* 186-206.

Marek, L. (2016). Model for distribution of wages. *Applications of Mathematics and Statistics in Economics* (stránky 378-386). Banská Štiavnice: Občianske združenie Financ.

Marek, L., & Doucek, P. (2016). Vývoj mezd a příjmové nerovnosti u ICT odborníků v České republice. *Politická ekonomie*, 922-938.

Marek, L., Doucek, P., & Nedomová, L. (2016). Does Higher Education Generate Higher Wages in the Czech ICT? In: *IDIMT-2016*. Poděbrady, 07.09.2016 – 09.09.2016. Linz : Trauner Verlag, 2016, s. 21–28. ISBN 978-3-99033-869-8.

Trexima, (2019): http://www.trexima.cz

Trexima, (2019): http://www.trexima.sk

Czech Statistical Office, (2018) Czech Statistical Office. [Online] Available at: http://czso.cz [Accessed 18 April 2019]

Slovak Statistical Office, (2019) Slovak Statistical Office. [Online] Available at: http://datacube.statistics.sk [Accessed April 2019]

Contact

Luboš Marek
University of Economics, Prague
nám. W. Churchilla 4, 130 67 Prague, Czech Republic
marek@vse.cz

Josef Jablonský
University of Economics, Prague
nám. W. Churchilla 4, 130 67 Prague, Czech Republic
jablon@vse.cz