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RESEARCH ARTICLE



# Unequal wage of men and women in ICT in the Czech Republic?

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**ABSTRACT**

This article analyzes inequality in the remuneration of ICT professionals in the Czech Republic during its evolution from 2000 to 2014. Data are analyzed by means of linear regression and the method of least squares for the entire period 2000–2014, and two periods 2000–2008 and 2009–2014, where we analyze de facto trends that emerged in the wages of ICT professionals after the economic crisis. We explore the evolution of wages and hence inequality between men and women from four perspectives: profession (ICT specialist – CZ ISCO 25 a ICT Technician CZ ISCO 35), education (secondary with maturita, bachelor's, master's, and doctoral degree), sphere of activity (wage sphere and salary sphere) and age (categories under 30 years, 30–50 years, and over 50 years). We find out that the trends in the equalization of wages between men and women are positive – a gradual equalization is taking place. What, however, we cannot regard as positive is the pace of equalization. The process is very slow and protracted. Another positive finding in terms of ICT professionals is the fact that the average amount of wage difference between men and women is approximately 17%, which is lower than in the entire Czech economy.

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**KEYWORDS**
ICT; wages in ICT sector; ICT professionals; ICT specialists; ICT technicians; gender aspects by ICT professionals

## Introduction

Information and communication technologies (ICT) have become part and parcel of everyday life. From hesitant beginnings in the 1950s and 1960s, when they were available to select scientists, the state sector and the military, through the great boom in the 1970s and 1980s, which has continued to this day. According to many studies, such as Dedrick, Gurbaxani, and Kraemer (2003), Zelenyuk (2014), Hanclová, Doucek, Fischer and Vltavská (2015), and Hanclova and Doucek (2012), their deployment in the economy has affected positively the growth of economic sectors and helped the post-Communist countries successfully join the advanced European countries.

Of course, ICT bring about other social changes manifested in social areas. As Ballesteros-Carrasco (2013, p. 306) tells: "ICT are often related to economic and social

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improvements. They have been associated with job creation as well as increases in the quality of work and remuneration. However, at a macroeconomic level, it is noteworthy that while the digitization process increases, employment and wages are generally deteriorating".

Torrent-Sellens (2008) confirms its conclusions, especially in terms of the increase in vacancies and quantum of wages in ICT professions.

Another one is the question of ethics when working with ICT (Sigmund, 2015) or questions concerning education of ICT experts and the manner of their positioning in practice (Doucek, Maryska & Novotny, 2014; Joseph, Ng, Koh, & Ang, 2007; Pillai & Shanta, 2011). An important dimension of the deployment of ICT in practice is that of the wages earned in this segment, which tend to be higher than average wages in economies (Bílková, 2015; Marek, 2010; Torrent-Sellens, 2008), and last but not least, there is the topical theme of equal remuneration for the same work, that is the question of equality in remuneration for the work of ICT professionals regardless of their gender. The importance of heterogeneous working teams where both men and women are represented is highlighted by studies conducted in the United States (Simard, 2014, p. 4), which state that: "Leading high-tech companies require diversity to maintain globally competitive technical workforces. Research shows that workforce diversity can boost a company's bottom line by providing creative variety of thinking styles and, thus, new business solutions."

A recent industry report by Gartner estimates that by the year 2012, teams with greater gender diversity (when compared to all-male teams) will be twice as likely to exceed performance expectations (Harris & Raskino, 2007). Gender diversity in the high-tech workforce fuels problem solving and innovation – the driving force of technology (Mannix & Neale, 2005). But when it comes to providing opportunities for technical women, high-tech firms lag sharply behind those in other sectors. As this report shows, men are significantly more likely than women to hold high-level management or executive positions.

The theme of gender equality is very extensive (Narain, 2014). It comprises political participation of women, gender-based discrimination, reproduction rights, violence against women, and other areas. A frequent topic is the difference between the wages received by men and women, or more precisely, the wide-spread phenomenon, where women earn much less in identical positions in the same sector. We can say that this phenomenon can be observed in any country of the world. This issue is important as is documented by the number of articles in professional journals and the number of analyses carried out by supranational institutions, such as OECD (OECD, 2015) or the European Commission (EC, 2014). Despite this fact, the debate is about the causes of inequality in the wages of men and women. The aim of this article is not to identify the causes, but to focus on the issue of inequality in wages in the Czech Republic with respect to ICT professionals, to confront the inequality with the situation in the economy of the Czech Republic as a whole, and to confront inequality with the situation in other countries. The reason for the focus on these questions is the fact that the existing studies make at the most general comparisons within the economy of other countries but not specifically for one category of workers. No similar studies have ever focused on the issue of women in ICT from the perspective of their different remuneration.

**Table 1.** Division of European countries into clusters according to the level of inequality in wages between men and women.

| Percentile | Relation | Countries |
|---|---|---|
| P 10 = 5.87 | Less than P 10 | Slovenia (3.47), Croatia (4.85) |
| P 25 = 10.09 | Between P 25 and P 10 | Italy (5.63), Malta (6.86), Poland (8.01), Luxembourg (9.3), Belgium (10.01) |
| Med =16.15 | Between Med and P 25 | Romania (10.09), Portugal (11.19), Bulgaria (13.69), Latvia (13.86), Ireland (14.35),Lithuania (15.80), France (15.83), Norway (16.03), Sweden (16.15) |
| Med =16.15 | Between P 75 and Med | Denmark (16.83), Hungary (17.61), Spain (17.97), Switzerland (18.51), Netherlands (18.62), Cyprus (18.76), Iceland (19.70), Finland (20.10) |
| P 75 = 20.10 | Between P 75 and P90 | Greece (20.94), United Kingdom (21.42), Slovakia (22.37), Germany (22.43) |
| P 90 = 23.13 | More than P 90 | Czech Republic (23.30), Austria (24.31), Estonia (28.73) |

Source: authors, data Eurostat (2015).

## Wage inequality in countries of Europe

As a starting point for the research on inequality between the wages of men and women, we used regularly monitored statistics published by Eurostat (Eurostat, 2015). An analysis of the evolution of inequalities of wages between men and women within the whole economy in European countries was carried out using data from 2000 to 2014. These data represent a proportional difference by which women's wages are lower than men's wages. Then we computed for each country mean values of the proportional difference for the entire period under review. We analyzed the data employing basic statistical methods and divided European countries into groups that have a similar level of inequality in remuneration. This was based on the division of an interval into percentiles, where countries with the most and least difference represent the first and tenth decile, and inside this interval we used for division into clusters the median and the other two quartiles. The proportional difference is based on calculation of the level of inequality in all European countries incorporated into this research and calculation of percentiles, which define maximum high of inequality in each country in comparison with Europe. The result of the analysis is shown in Table 1.

## Wage inequality in the Czech Republic

As Table 1 shows, the Czech Republic belongs to the category of countries in which inequality in the wages of men and women within the economy is greatest in the period under review. Wages of women are 23.30% lower than those of men.

In this context, there is an interesting fact: in the Czech Republic, the highest difference across the EU is between employment of childless women or women with older children and employment of women with young children. The difference between economic activities of mothers with children under six and other women is almost 40% because many women stop their economic activity after maternity leave and do not look for employment (Dolezalova, 2010).

One of the key consequences of gender-based wage inequality is the fact that women in productive age earn less, which is reflected in a lower pension and a higher risk of poverty in old age. In 2013, poverty threatened up to 14.7% of women over the age of 65 years in comparison with 7% of men (Dolezalova, 2010).

We also see a difference in the wages received by men and women in the case of ICT, which lead to fundamental economic changes in contemporary society in the form of a blanket spread of ICT to practically all activities. ICT are making inroads into the business sector and have become an inherent part of public and state administration and the activities of foundations and humanitarian organizations.

## Research questions

This article aims to analyze the situation regarding the wages of ICT professionals in the Czech Republic. The analysis gives an overview of the minimum and maximum differences due to the gender of ICT professionals, ICT specialists, and ICT technicians, divided into the following areas:

- profession,
- education,
- sphere of activity, and
- age.

After the basic initial analyses we formulated for the purposes of the research four working hypotheses (H1–H4), whose confirmation is always presented in the conclusion of an analyzed area.

In this article, we will test whether the existing inequality between the wages of men and women is different in the case of ICT from the development in the entire Czech economy, carrying out analyses through various dimensions.

The working hypotheses are as follows:

- H1: Difference between wages of men and women by profession (25 and 35) is equalized in time.
- H2: Difference between wages of men and women by education is equalized in time.
- H3: Difference between wages of men and women by sphere of activity (wage sphere/salary sphere) is equalized in time.
- H4: Difference between wages of men and women by age does not change in time.

If a hypothesis is rejected, we analyze questions concerning the time that passes until the wages of men and women are equalized.

## Methodology

This section explains the origin of the processed data, describes the methods we used to process the results, and contains a classification of groups of ICT professionals, according to which we performed the analysis.

### *Collection of data and assessment methodology*

The main source of data for the purpose of this article was 'Labor Force Sample Survey', which is conducted every year by the firm Trexima for the Ministry of Labor

**Table 2.** Annual cumulated exchange rates CZK/EURO.

| Year | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| Exchange rates | 36,882 | 3561 | 34,083 | 30,812 | 31,844 | 31,904 | 29,784 | 28,343 |
| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Exchange rates | 27,762 | 2494 | 26,445 | 2529 | 24,586 | 25,143 | 25,974 | 27,533 |

Source: CNB (2015).

and Social Affairs (Trexima, 2015). The data consist of responses from approximately 2,000,000 economic operators active in the territory of the Czech Republic. Of these workers, approximately 18,000 were ICT professionals.

Other sources for the survey are open data available from publicly accessible databases of Czech institutions, namely the Czech Statistical Office (in particular, data on the development of inflation and the numbers of workers), Ministry of Labor and Social Affairs, and Czech National Bank (annual cumulated exchange rates between the Czech crown and the euro – Table 2).

In addition to local data sources we used data from databases of the international institutions, Eurostat and OECD. In the research and analysis of gross wages of ICT professionals in the Czech economy, we employed the methodology of occupation classification CZ ISCO.

We processed the collected data using tools and statistical functions of MS Excel and SPSS to analyze the time series and to test the hypotheses. To test all the working hypotheses, we used correlation analysis and a paired *T*-test. Paired *T*-test is a procedure used to determine whether the mean difference between two sets of observations is zero. In a paired *T*-test, each subject or entity is measured twice, resulting in pairs of observations (Statistics Solutions, 2017). To test the working hypotheses, we employed correlation analysis and for some hypotheses the linear regression method together with the method of least squares. When employing the linear regression method we started from an approximation of the development using linear function $y = ax + b$, where '$a$' is the intercept, '$b$' is slope of the line. We performed all the regression analysis calculations with a 5% probability threshold.

## *ICT specialists and technicians*

The classification of professions was changed in the Czech Republic in 2011. Until 2010, the classification K-ZAM was used and starting from 2011 the classification CZ-ISCO was introduced. According to this methodology, positions are divided in the area of ICT into two basic groups:

- Specialists in information and communication technologies (CZ_ISCO 25).
- Technicians in information and communication technologies (CZ_ISCO 35).

More detailed information about the job specifications of the categories of professions is given in the following text.

## *Specialists in information and communication technologies – ICT specialists*

Specialists in information and communication technologies (CZ_ISCO 25) are professionals conducting research in economic practice, planning, designing, writing

documentation, testing, providing consultations and improving ICT systems. They perform these activities in the area of hardware and software.

Their work content usually includes: research on the use of information technologies in corporate systems and seeking areas for improvement and research on theoretical aspects, and operating methods for the use of computers; assessment, planning and designing hardware and software configurations for applications, including the internet, intranet and multimedia systems; development, creation, testing and maintenance of computer programs; research and development of database architecture and database control systems; development and implementation of plans for security and policy of data management and computer network management and related computer environments; analysis, development, interpretation and assessment of parameters of design and architecture of complex systems, data models and diagrams in the development, configuration and integration of computer systems. Most professions in this category demand a higher, fourth level of skills. Their job content is described in more detail in Doucek, Nedomová and Maryška (2015).

### *Technicians in information and communication technologies – ICT technicians*

Technicians in information and communication technologies (CZ_ISCO 35) provide support for routine operations of computer and communication systems and networks, and carry out technical assignments related to telecommunications, broadcasting of images, sounds and other types of telecommunication signals on the ground, at sea, or in the air. Most of these professions demand the third level of skills (CZSO, 2010). Their job description usually includes support for users of information systems; installation of new programs; building, operation and maintenance of network and other communication systems; installation, monitoring and support of internet and intranet pages; modification of web pages; backing up and restoration of web servers; control of equipment for making, editing and mixing audio and visual recordings; control and maintenance of transmission and satellite systems for radio and television programs; control and maintenance of radio communication systems, satellite services and multiplex systems on the ground, at sea and in the air; provision of technical support in research and development of computer and telecommunications and testing prototypes, designing and processing connection drawings according to entered parameters; technical supervision of the production, use, maintenance and repairs of telecommunication systems.

## Analysis of differences in wages of men and women

In the period under review, between the years 2000 and 2014, the Czech economy ranked among the more advanced economies of the world. The confirmation of this fact rests on two key factors. The first factor is the value of HDI (Human Development Index), where the Czech Republic was at the 28th place in the world in 2014, in the group of very high HDIs, which typifies developed countries (HDR, 2014). The other factor is the degree of integration of ICT into the economy, not only with the spectrum of services on offer, but also the number of specialists working in ICT.

Development trend of the number of ICT professionals is upward in the Czech Republic in the long run and it is shown in Figure 1.

In 2013, the number of ICT professionals stood at 148,000 active workers. The absolute number of ICT professionals has been rising since 2004. This growth is visible in the percentage share in the number of employed persons and the absolute number. This trend typifies all advanced countries (Eurostat, 2015).

In a more detailed analysis of the total numbers of ICT professionals by gender, we encounter an interesting anomaly as shown in Figure 2.

Development of the number of women among the ranks of ICT professionals in the period under review documents that ICT is becoming a male domain. In 2003, ICT professionals in posts of ICT specialists included 23% women while there were 13% women employed as ICT technicians, in 2013, women made up for 8% of ICT

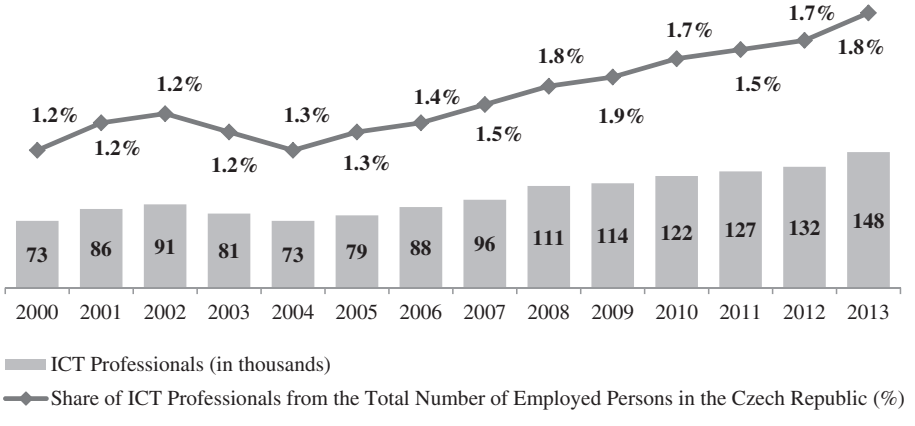


**Figure 1.** Share of IT professionals in total number of people employed in the Czech Republic. Source: CZSO (2014).

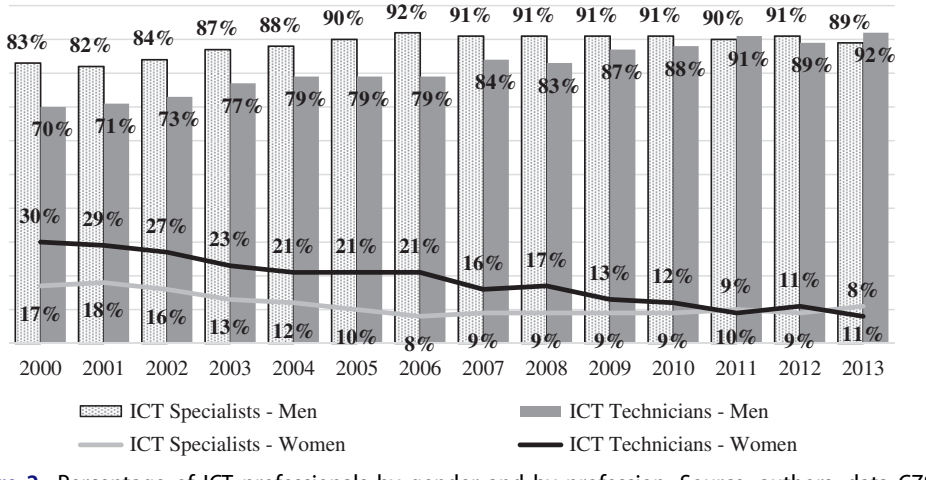


**Figure 2.** Percentage of ICT professionals by gender and by profession. Source: authors, data CZSO (2014).

specialists and 11% of ICT technicians. This marked fall in the number of women among ICT experts can be probably ascribed to the ICT boom in the economy, and hence higher demands for ongoing education and more demand for time spent at work in such professions. Another reason for the fall in the number of women in the group of ICT specialists may be the development of technologies, when at the beginning of the 1990s computers filled entire rooms and a great many people were needed to operate them, including many women. Naturally, the situation in the current data centres of big corporations and state administration is similar with the demand for operating personnel.

In positions of ICT specialists, the fall in the number of women halted around 2006 at 8% and has been oscillating around this figure since. The fall in the number of women employed as ICT technicians stopped in 2011 at 9%, rose moderately in 2012 to 11% and dropped to 8% in 2013. Practical experiences show that women are preferred as ICT specialists particularly in project management and administrative work (Oskrdal & Jelinkova, 2010).

### *Wages of men and women wages by profession (H1)*

In the first research area on inequality in remuneration between men and women, we divided ICT professionals into groups of professions – ICT specialists (CZ_ISCO 25) and ICT technicians (CZ_ISCO 35). Both groups of professions are defined in this article.

Figure 3 shows average wages in Euros between 2000 and 2014 for both groups of professions. It is evident from Figure 3 that women have always had a lower wage than men. By calculation to a mutual ratio, we find that women earn approximately 77–83% of men's wages in the case of ICT specialists and 75–85% in the case of ICT technicians. The highest disproportion between men and women was in the case of ICT specialists in 2004, when it was 23%. The situation has been improving since then

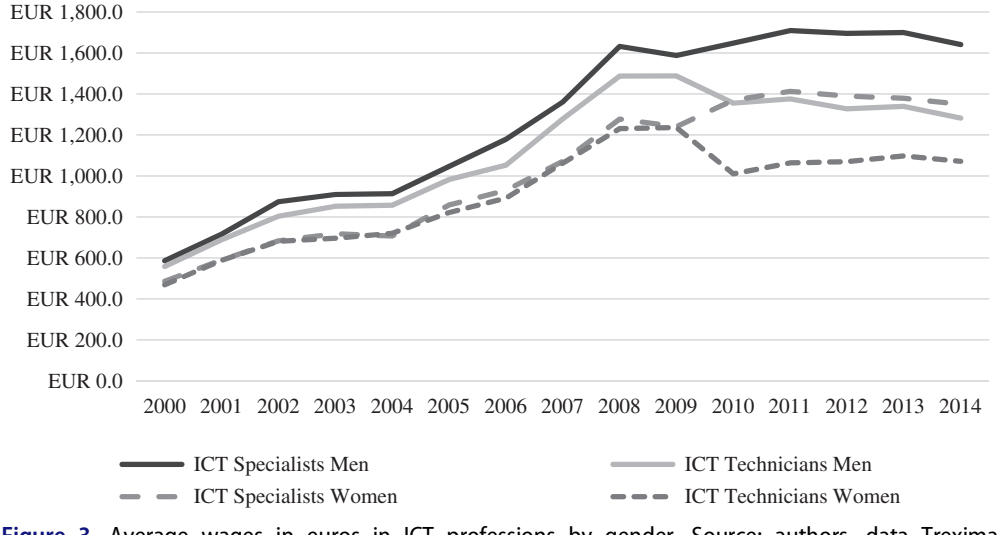


**Figure 3.** Average wages in euros in ICT professions by gender. Source: authors, data Trexima (2015).

**Table 3.** Linear regression of estimate of trends in ICT wages by group of professions.

| Group of professions | Linear regression $y = ax + b$; $R^2$ |
|---|---|
| ICT specialists – women | $y = 72.126x + 453.67$; $R^2 = 0.9253$ |
| ICT specialists – men | $y = 86.931x + 584.30$; $R^2 = 0.9095$ |
| ICT technicians – women | $y = 45.488x + 549.88$; $R^2 = 0.7293$ |
| ICT technicians – men | $y = 59.387x + 640.00$; $R^2 = 0.7600$ |

Source: authors.

and, at present, women's wages are on an average lower by 18%. The situation is similar for ICT technicians, where the current difference is 16%.

If we approximate the development of this time series using linear regression, we obtain values of trend functions shown in Table 3.

Concerning the trends throughout the period, the conclusion is clear. As the linear regression function lines have in the case of male ICT specialists and ICT technicians a higher value, their wages cannot ever be equalized. The only possible equalization of wages is between women and the group of professions of ICT specialists – women and ICT technicians – men. This could happen in less than 15 years (14.75 years).

We performed correlation analysis and a *T*-test for all combinations of professions by gender with a critical value of 1.7613.

The situation is different if we divide the entire period into two intervals. The first is the period of growth until the economic crisis, that is 2000–2008, and in the other we will analyze the evolution of wages between 2009 and 2014.

For the period 2000–2008, the estimated trend lines of the development of the wages of ICT specialists acquire the values $a_w = 101.9$ and $a_m = 114.3$. Since $a_w < a_m$, is not possible, according to this trend, the wages of male and female ICT specialists cannot be equalized in the period under review. The situation is similar for ICT technicians, where $a_w = 83.6$ and $a_m = 87.4$. The difference is smaller but the conclusion is identical: with this trend the wages will never equalize.

Between 2009 and 2010, there was a marked decline in the wages of ICT technicians by approximately 10%. For ICT specialists the values were $a_w = 15.7$ and $a_m = 11.6$. This fact will make it possible to equalize the wages, but only over 78 years. With ICT technicians we determined values $a_w = -15.6$ and $a_m = -32.1$. These values identify the wage decline trend. In this case, the wages of men and women would be equalized in approximately 20 years. However, we do not consider this scenario realistic because the wages cannot decline in the long term.

We proved with these tests that H1 is rejected. The difference between wages of men and women by profession throughout the period under review remains practically unchanged and the existing trend lines do not allow for equalization of men's and women's wages in the same profession within a reasonably acceptable time.

## *Wages of men and women from the perspective of education (H2)*

A thought-provoking question is the inequality between the wages of men and women from the perspective of education.

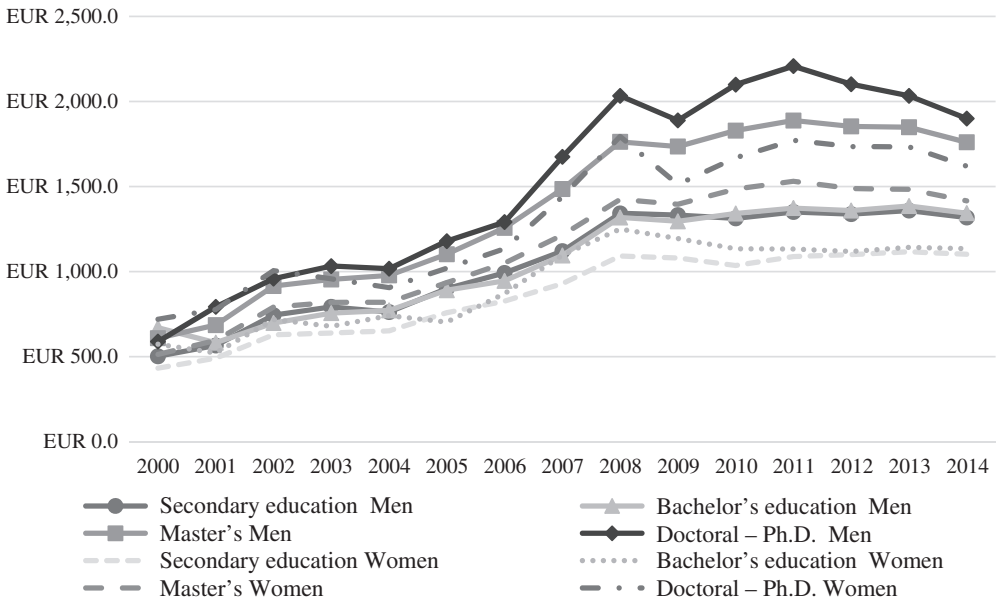


**Figure 4.** Development of average wages in ICT by education in the period 2000–2014. Source: authors, data Trexima (2015).

Graph in Figure 4 shows the average wages of male and female ICT professionals from the perspective of their educational level. In the analysis we focus on four educational levels: secondary, bachelor's, master's and a doctoral degree. In terms of frequency, the most common education is secondary and master's in the field of ICT. Bachelor's education is not yet widespread and there are not many of them in the economy. Doctoral education is limited in the ICT business to consulting and advisory firms in big cities.

Figure 4 shows that average wages are dependent on the level of education. An exception is the year 2000, when an unexplainable change of wages of bachelors' graduates occurred. Their average wage is higher than that of masters' graduates (in the case of men and women), but also doctoral graduates (in the case of men).

It is typical of the overall assessment of the evolution of wages by education that we determined in all the educational groups a decline in wages between 2008 and 2010, the period of economic crisis. It is most marked in the group with PhD education. The decline is not as marked in the other educational groups, and it is minimal for bachelor's education. This finding confirms the macroeconomic considerations that in the event of a decline in the economy those who are most affected are groups with higher incomes and the impact of the decline on low-income groups is lower.

Another interesting fact is that female doctoral graduates had higher wages in 2000 and 2002 than their male colleagues but in the following years inequality went back to the usual 15–20% difference to the disadvantage of women.

We analyzed the collected data with the regression function both for the entire data period and for the period before the economic crisis 2000–2008, and for the period after the eruption of the crisis 2009–2014 (Tables 4 and 5).

**Table 4.** Correlation between evolution of wages between men and women by group of professions.

| Type of dependency | Correlation coefficient | Calculated value of *T*-test one-tail | Conclusion for hypothesis |
|---|---|---|---|
| ICT specialists men versus ICT specialists women | 0.9968 | $3 \times 10^{-9}$ | Rejected |
| ICT technicians men versus ICT technicians women | 0.9902 | $7.3 \times 10^{-8}$ | Rejected |

Source: authors.

**Table 5.** Linear regression of ICT wage trends by group of education for the entire period 2000–2014.

| Group of education | Linear regression $y = ax + b$; $R^2$ |
|---|---|
| Secondary education – women | $y = 52.340x + 446.05$; $R^2 = 0.9047$ |
| Secondary education – men | $y = 66.175x + 519.31$; $R^2 = 0.8874$ |
| Bachelor's education – women | $y = 50.047x + 533.58$; $R^2 = 0.7813$ |
| Bachelor's education – men | $y = 65.015x + 534.86$; $R^2 = 0.9068$ |
| Master's education – women | $y = 75.977x + 522.90$; $R^2 = 0.8957$ |
| Master's education – men | $y = 99.250x + 583.65$; $R^2 = 0.9013$ |
| Doctoral education – PhD – women | $y = 81.704x + 666.00$; $R^2 = 0.8436$ |
| Doctoral education – PhD – men | $y = 115.87x + 592.82$; $R^2 = 0.8646$ |

Source: authors.

**Table 6.** Linear regression of estimated ICT wage trends by educational category.

| Education/period | 2000–2008 Linear regression $y = ax + b$; $R^2$ | 2009–2014 Linear regression $y = ax + b$; $R^2$ |
|---|---|---|
| Secondary education – women | $y = 74.498x + 344.09$; $R^2 = 0.9519$ | $y = 10.452x + 1050.5$; $R^2 = 0.4806$ |
| Secondary education – men | $y = 93.807x + 388.95$; $R^2 = 0.9400$ | $y = 1.5159x + 1329.5$; $R^2 = 0.0252$ |
| Bachelor's education – women | $y = 79.395x + 397.85$; $R^2 = 0.8246$ | $y = -8.1036x + 1171$; $R^2 = 0.3306$ |
| Bachelor's education – men | $y = 79.381x + 461.60$; $R^2 = 0.8758$ | $y = 10.237x + 1313.9$; $R^2 = 0.3692$ |
| Master's – women | $y = 102.28x + 395.47$; $R^2 = 0{,}9448$ | $y = 1.5931x + 1460.9$; $R^2 = 0.0035$ |
| Master's – men | $y = 130.77x + 429.45$; $R^2 = 0{,}9386$ | $y = 4.2339x + 1804.4$; $R^2 = 0.0180$ |
| Doctoral – PhD – women | $y = 110.00x + 533.64$; $R^2 = 0.7918$ | $y = 19.853x + 1604.1$; $R^2 = 0.1507$ |
| Doctoral – PhD – men | $y = 153.93x + 404.49$; $R^2 = 0.8987$ | $y = -7.0532x + 2062.9$; $R^2 = 0.0112$ |

Source: authors.

In the analysis of all the regression lines within one category of education between men and women, the wages of men and women can never be equalized on the basis of the identified trends for the entire period under review. Equalization may only take place in some cases between educational categories (e.g. PhD women have a greater growth dynamic than men with bachelors and secondary education), and equally, women with master's education have a greater growth dynamic than men with bachelor's education and secondary education.

Let us look now at the trend analysis in the period before the economic crisis, before 2008 and afterwards, after 2009. After 2009 the $R^2$ is very low, which means that the estimated parameters are not statistically significant. The results of regression analysis are shown in Table 6.

We performed the correlation analysis and the *T*-test for all educational categories: the result of the correlation analysis leads to the conclusion that in the period under review the differences between wages remain practically unchanged in time. The results are shown in Table 7. The critical value for the *T*-test – one-tail is 1.7613 and for *T*-test – two-tail it is 2.1448 (Tables 8 and 9).

**Table 7.** Results of correlation analysis and *T*-test for Hypothesis H2 divided by educational level.

| Type of dependency | Correlation coefficient | Calculated value of *T*-test one-tail | Calculated value of *T*-test two-tail | Conclusion for hypothesis |
|---|---|---|---|---|
| Secondary education men versus women | 0.9980 | $4 \times 10^{-8}$ | $8 \times 10^{-8}$ | Rejected |
| Bachelor's education men versus women | 0.9632 | $7.938 \times 10^{-5}$ | $1.6 \times 10^{-4}$ | Rejected |
| Master's men versus women | 0.9994 | $2.4 \times 10^{-7}$ | $2.57 \times 10^{-4}$ | Rejected |
| Doctoral – PhD men versus women | 0.9900 | $4.8 \times 10^{-7}$ | $5.13 \times 10^{-4}$ | Rejected |

Source: authors.

**Table 8.** Linear regression of estimated ICT wage trends by sphere of activity in the period 2000–2014.

| Sphere of activity | Linear regression $y = ax + b$; $R^2$ |
|---|---|
| Wage sphere – women | $y = 66.668x + 535.10$; $R^2 = 0.8650$ |
| Wage sphere – men | $y = 82.558x + 646.90$; $R^2 = 0.8623$ |
| Salary sphere – women | $y = 40.894x + 399.08$; $R^2 = 0.8513$ |
| Salary sphere – men | $y = 43.092x + 423.92$; $R^2 = 0.8472$ |

Source: authors.

**Table 9.** Linear regression of estimated ICT wage trends by sphere of activity.

| Period | 2000–2008 Linear regression $y = ax + b$; $R^2$ | 2009 – 2014 Linear regression $y = ax + b$; $R^2$ |
|---|---|---|
| Wage sphere – women | $y = 126.8000 + 442.77$; $R^2 = 0.9547$ | $y = -3.2064 + 1664.5$; $R^2 = 0.0279$ |
| Wage sphere – men | $y = 103.5900 + 368$; $R^2 = 0.9461$ | $y = 7.5808 + 1315.7$; $R^2 = 0.1148$ |
| Salary sphere – women | $y = 69.0980 + 303.84$; $R^2 = 0.9813$ | $y = -7.7025 + 974.61$; $R^2 = 0.7476$ |
| Salary sphere – men | $y = 64.3680 + 290.23$; $R^2 = 0.9728$ | $y = -6.7391 + 921.07$; $R^2 = 0.6452$ |

Source: authors.

It follows from this that we rejected the hypothesis in all the combinations and, therefore, the differences between men's and women's wages throughout the period under review 2000–2014 do not change significantly in time from the perspective of education.

### *Wages of men and women by sphere of activity (H3)*

From the perspective of the economy and equalization of differences in the wages between men and women, it is important to look at the sphere of activity of ICT professionals. Here we distinguish two main spheres: wage sphere and salary sphere. The evolution of wages of ICT professionals structured into these two groups for the entire period under review 2000–2014 is shown in Figure 5.

The traditional significant decline in wages between 2008 and 2010 relates exclusively to the wage sphere, while the salary sphere only shows a halt in the wage rise and subsequent stagnation with a slight decline in 2014 (the reason is the weakening of the Czech crown in that year).

It is typical of the whole period under review that wages in the wage sphere are significantly higher than wages in the salary sphere (Figure 5). It is typical of the evolution of wages that the difference between wages in the salary sphere between women and men is minimal. In the analysis of the time series we found that women receive in this sphere on average 94.5% of men's wages. In the wage sphere, it is only 81.9%.

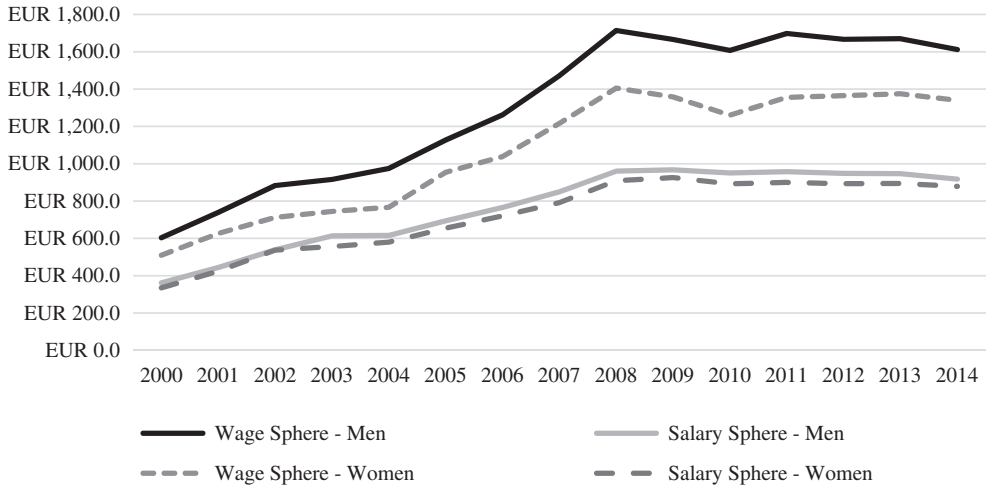


**Figure 5.** Evolution of average wages in ICT by sphere of activity. Source: authors, data Trexima (2015).

This is better than the total economy, but the difference of 18.1% is considerable. The reason for the relatively favourable situation in the salary sphere is the introduction of wage categories and scales. Workers are placed on them according to their job descriptions regardless of gender. The cause of the difference may be then bonuses that superiors award them to supplement their wage.

Let us see what the evolution of wages and the differences between men and women in the period before 2008 and since 2009 to the present were like.

The second period 2009–2014 is typified by a trend of a decline in wages and marked or slowing of the growth rate. The growth trend remained preserved only in women in the wage sphere. Observed trends provide a theoretical chance of levelling the wages sphere of activity and wage for approximately 32 years and salary sphere in 53 years.

It is typical of the first period between 2000 and 2009 that the wage growth dynamic is higher for men than for women (coefficient '*a*'), so it is not possible for the wages to equalize with this trend. It is typical of the second period 2009–2014 that the trend of wage decline or marked slowing of the growth tempo. The growth trend only remained preserved for women in the wage sphere. The identified trends give a theoretical chance of equalization of the wages according to the sphere of activity: in the wage sphere in approximately 32 years and in the salary sphere in 53 years.

We performed the correlation analysis and *T*-test for both spheres of activity: the result of the correlation analysis leads to the conclusion that in the period under review the differences between wages remain practically unchanged in time. The results are shown in Table 10. The critical value for the *T*-test – one-tail is 1.7613.

We proved with these tests that H3 is rejected. The difference between wages of men and women from the perspective of the employment sphere (wage/salary) does not change in time and the existing trend lines do not allow for equalization of men's and women's wages in the same sphere of activity in the foreseeable future.

**Table 10.** Correlation between evolution of wages between men and women by sphere of activity.

| Type of dependency | Correlation coefficient | Calculated value of *T*-test one-tail | Conclusion for hypothesis |
|---|---|---|---|
| Wage sphere men versus women | 0.9974 | $9 \times 10^{-9}$ | Rejected |
| Salary sphere men versus women | 0.9983 | $4.2 \times 10^{-8}$ | Rejected |

Source: authors.

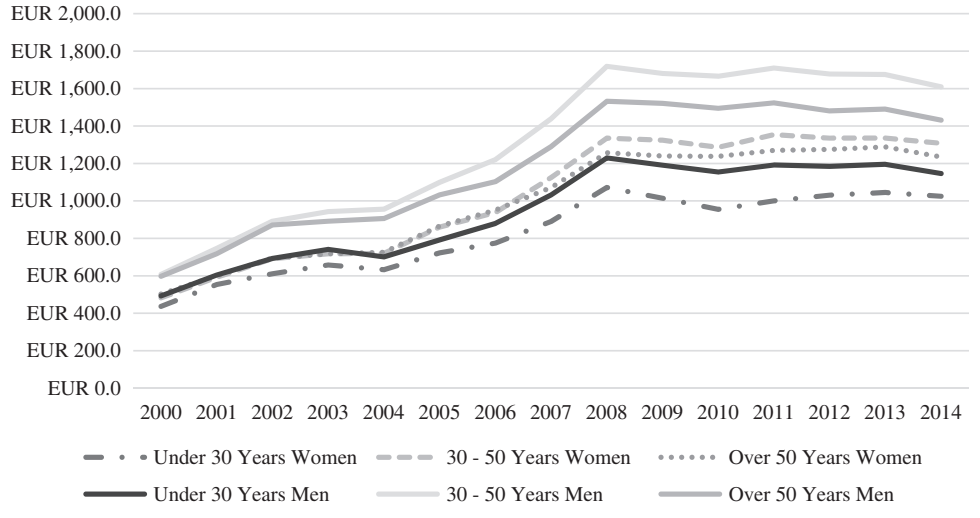


**Figure 6.** Evolution of average wages in ICT by age in 2000–2014. Source: authors, data Trexima (2015).

### *Wages of men and women by age (H4)*

The last part of our analysis is devoted to the influence of age on the width of the wage gap between men and women. Initially, we formulated Hypothesis H4 that differences between men and women wages in terms of age converge in time. From a methodological point of view, we divided the economically active population into three categories. The youngest category is 30 years (it is de facto a category of 15–30 years), the second category is between 30 and 50 years and in the third category are ICT professionals over 50 years. Figure 6 shows the evolution of wages of men and women in the three categories in the period under review 2000–2014.

The highest average wage was observed in men in the age category 30–50 years. The next highest remunerated group were men over 50 years, followed by women aged 30–50. In the case of the evolution of women's wages before 2006, it was determined that the amount of wages grew with age, therefore, the wages were lowest in the category of 30 years and the highest in the category over 50 years. Since 2007, this no longer holds true, and a similar trend, as with men, starts and thus the highest average wages are in the category of 30–50 years and lowest in the category under 30 years. We can only speculate about the causes that led to different behaviour in the first 7 years of the sample analyzed.

The decline in wages between 2008 and 2010 affected most the category of women under 30 years and men in the category 30–50 years. It did not practically affect the

**Table 11.** Linear regression of estimated ICT wage trends by age.

| Sphere of activity | Linear regression $y = ax + b$ |
|---|---|
| Under 30 years women | $y = 44.241x + 473.99$; $R^2 = 0.8730$ |
| Under 30 years men | $y = 53.185x + 522.96$; $R^2 = 0.8539$ |
| 30–50 years women | $y = 67.987x + 482.98$; $R^2 = 0.8853$ |
| 30–50 years men | $y = 83.485x + 641.51$; $R^2 = 0.8616$ |
| Over 50 years women | $y = 60.563x + 510.83$; $R^2 = 0.8940$ |
| Over 50 years men | $y = 68.638x + 643.09$; $R^2 = 0.8505$ |

Source: authors.

**Table 12.** Linear regression of estimated ICT wage trends by age.

| Period | 2000–2008 Linear regression $y = ax + b$; $R^2$ | 2009–2014 Linear regression $y = ax + b$; $R^2$ |
|---|---|---|
| Under 30 years women | $y = 65.671x + 377.04$; $R^2 = 0.9079$ | $y = 10.109x + 976.33$; $R^2 = 0.3586$ |
| Under 30 years men | $y = 77.581x + 408.06$; $R^2 = 0.8981$ | $y = -3.176x + 1188.30$; $R^2 = 0.0783$ |
| 30–50 years women | $y = 94.157x + 358.11$; $R^2 = 0.9218$ | $y = 1.328x + 1319.20$; $R^2 = 0.0108$ |
| 30–50 years men | $y = 122.310x + 457.57$; $R^2 = 0.9345$ | $y = -10.376x + 1706.10$; $R^2 = 0.343$ |
| Over 50 years women | $y = 84.900x + 396.05$; $R^2 = 0.9442$ | $y = 3.752x + 1244.40$; $R^2 = 0.0956$ |
| Over 50 years men | $y = 100.920x + 488.83$; $R^2 = 0.9308$ | $y = -14.400x + 1540.70$; $R^2 = 0.6443$ |

Source: authors.

wages in the category of women over 50 years and only slightly the category of men over 50 years. The category of women 30–50 years was affected very little.

On the basis of the analysis of the coefficients of regression functions shown in Table 11, we reached the conclusion that in time the differences between the wages in all the age categories are increasing between men and women in the period under review.

A somewhat different view of the evolution of wages by age is provided by analysis of data from two periods. The first is before the crisis, between 2000 and 2008, the second period is post-crisis – 2009–2014. The results of regression analysis are shown in Table 12.

In the first analyzed period, coefficient '*a*' points to increasing differences between wages of men and women in all the age categories. In each category $a_w < a_m$, it is not possible for the wages to equalize in time.

A completely opposite trend is detected in the second period between 2009 and 2014. Here coefficients '*a*' are in all the all age categories of women higher than in the categories of men ($a_w > a_m$), and, therefore, gradual equalization takes place. In the category under-30 years, the trends lead to equalization in approximately 16 years, in the category 30–50 years in 33 years, and the category over 50 years in approximately 16 years, if the trends observed in the second part of the period under review are preserved.

We performed the correlation analysis and the *T*-test for all educational groups: the result of the correlation analysis also leads to the conclusion that in the entire period under review the differences between the wages do not change in time. The results are shown in Table 13. The critical value for *T*-test – one-tail is 1.7613 and for *T*-test – two-tail it is 2.1448.

Having performed the correlation analysis and *T*-test, we rejected Hypothesis H4 formulated in the second chapter, and at the same time, we can state that the Hypothesis is rejected in the division into individual age categories, as we identified a

**Table 13.** Results of the correlation analysis and *T*-test for Hypothesis H4 structured by age.

| Type of dependency | Correlation coefficient | Calculated value of *T*-test one-tail | Calculated value of *T*-test two-tail | Conclusion for hypothesis |
|---|---|---|---|---|
| Under 30 years men versus women | 0.9980 | $1.23 \times 10^{-7}$ | $2.5 \times 10^{-7}$ | Rejected |
| 30–50 years men versus women | 0.9983 | $1.2 \times 10^{-9}$ | $2.3 \times 10^{-9}$ | Rejected |
| Over 50 years men versus women | 0.9959 | $6 \times 10^{-10}$ | $1.2 \times 10^{-9}$ | Rejected |

Source: authors.

**Table 14.** Ratios between women's wages and men's wages men by category and always at the beginning and end of the periods under review.

| Category/year | 2000 | 2008 | 2009 | 2014 |
|---|---|---|---|---|
| ICT specialists | 83.88 | 82.77 | 83.10 | 83.56 |
| ICT technicians | 82.92 | 78.25 | 78.12 | 82.21 |
| Secondary education | 86.14 | 84.21 | 81.07 | 83.61 |
| Bachelor's education | 85.60 | 94.84 | 92.15 | 84.49 |
| Master's education | 84.24 | 80.78 | 80.41 | 80.45 |
| Doctoral education – PhD | 122.36 | 88.22 | 80.09 | 85.28 |
| Wage sphere | 84.49 | 82.01 | 81.51 | 83.12 |
| Salary sphere | 92.72 | 94.64 | 95.75 | 95.78 |
| Under 30 years | 88.64 | 87.14 | 85.17 | 89.45 |
| 30–50 years | 79.33 | 77.71 | 78.78 | 81.29 |
| Over 50 years | 84.04 | 82.09 | 81.51 | 86.26 |

Source: Authors, data Trexima (2015).

very strong dependency between the wages of men and women, and hence continuation of the existing inequality.

## Conclusions and discussion

During the analysis of the wage, we monitored inequalities between men and women for the entire period of 2000–2014, then a period before the economic crisis 2000–2008, and the crisis and post-crisis period 2009–2014. The results are shown in Table 14. This table shows the basis for calculation of the percentage ratio of women's wages in comparison with men's wages is men's 100% wage in the relevant category.

The findings indicate that:

- Broken down by professions, the differences in wages for the entire period under review decreased very little, while economic growth helped narrow the gap slightly, and the crisis led to a minimum increase. Hardly anything changed in the entire period under review (for ICT specialists the gap narrowed by 0.32 percentage points; for ICT technicians, the gap narrowed by 0.71 percentage points).
- Concerning education, we identified the largest wage gap in education in master's education, while the least difference is in bachelor's education. An anomaly in doctoral education at the beginning of the period under review (122.36%) is caused by a small sample of the women, which included only 33 persons. In subsequent years, there were more than 100 persons. Doctoral education in ICT manifests itself only in large conurbations with around 500,000 inhabitants.

Concerning the sphere of activity, the narrowest wage gap between men and women is in the salary sphere, which does not permit any great differences because of

the wage scales. It is also evident that this difference decreased even more during the period under review to 95.78% of the wages of men. According to further research, the difference is caused by personal bonuses awarded to men. Basic wages of women and men are equal by dint of the wage scales.

In the age categories, the biggest difference is in the category 30–50 years – 81.29%, the smallest difference is in young workers under 30 years – women's wages equal 89.45% of men's wages. In categories over 50 years, this share accounted for only 86.26% in 2014.

Overall, it can be said that practically in all the categories the differences in wages between men and women reduced during the entire period under review.

Further findings:

- Period of economic growth in 2000–2008 helped wages rise in absolute terms (Figures 3–6) but also increased the difference between men's and women's wages.
- Between 2008 and 2010, a decline in wages occurred, amounting to approximately 7%. This phenomenon reduced moderately the difference in the wages for the category of salary sphere by 1.09 percentage points, and age 30–50 years – by 1.07 percentage points. In the other categories, the difference increased by 1–2 percentage points. An exception is doctoral education where the difference increased by 8.13 percentage points.
- In 2009–2014, we witnessed a gradual equalization of wages between men and women. In all the monitored categories, this difference in the period 2009–2014 decreased, ranging from 0.03 percentage points in the salary sphere category to 5.19 percentage points in doctoral education. An exception is the category of bachelor's education where the difference increased by 7.66 percentage points. The reason is that due to the reorganization of the Czech higher education institutions, bachelor's find employment relatively quickly, in greater numbers since 2000. Therefore, the wages in 2000 were higher than the wages of master's because the economy did not have any set roles for this category.

Overall, we rate the trends in the equalization of wages between men and women as positive – a gradual equalization is taking place. What, however, we cannot regard as positive is the pace of the equalization. As the results of the regression analysis show, the process is very slow and protracted. Another positive finding in terms of ICT professionals is the fact that the average wage difference between men and women is approximately 17%, which is lower than in the entire Czech economy (in 2014, it was 23.3% – Table 1).

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