

# **An Empirical Analysis of the Relationship between Wages and Working Time**

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## **Abstract**

*This paper presents an empirical analysis of the relationship between wages and working time, based on labor economic theory and latest studies in the field. We performed correlation analysis between relevant economic indicators retrieved from the OECD database, and comparative analysis, in order to showcase the gap that is both at European and international level. The results showed that 62% of the variation in average annual hours actually worked per worker is explained by the invers variation of average hourly wage, and 43% of the variation in average annual wages is explained by the invers variation of average annual hours actually worked per worker. Therefore, usually, employees work fewer hours a year and earn higher annual wages, if the wage rate is comparatively higher, statement supported by the results of the comparative analysis as well. Also, the comparative analysis underlined several countries where, although the wage rate is higher compared to those in other states, employees work more hours a year to earn a higher income. We concluded that the gap between OECD Member States is due, on the one hand, to the wage rate that influences the working hours decision, and on the other hand, to individual' decision to earn a higher income, that allows him to by the goods and services he needs, given the existing economic restrictions.*

**Keywords:** *wage; working time; correlation analysis; comparative analysis; OECD.*

**JEL Classification:** *E24; J22; J31; N30.*

## **Introduction**

An important aspect of the balance between work and daily living is the amount of time a person spends at work, as evidence suggests that long work hours may increase stress and affect personal health. So, in the long run, the capacity to successfully combine work and personal life is important for the well-being of any individual, and household. In this respect, figures show that around 11% of employees in the OECD Member States work 50 hours or more per week. Also, there is a significant gap regarding annual working time per worker both at European and international level. Employees in most Central and Eastern European (CEE) countries generally work more hours a year than those in highly developed European countries. Compared to the European average, workers in other OECD countries work more hours a year, on average, with 55 (Australia) to 538 hours (Mexico). Therefore, it is justified to ask if wage rate influences the working hours decision, and to what extent? To answer this question, this paper presents an

empirical analysis of the relationship between wages and working time, based on labor economic theories as well as most recent studies in the field.

## **Theoretical Background**

Economic theory underlines that wage rate influences individual's labor supply decision, respectively the quantity of labor (working time) a worker is willing to supply (Smith, 2003). As the wage rate rises, an individual is willing to work more hours a week (substitution effect) up to a point when its priority change and leisure time becomes more important, because its higher income allows him to buy the goods and services it needs (income effect). In other words, as a result of the increase in the wage rate, workers can earn higher incomes, working fewer hours, which makes the long work hours less attractive. Regarding the wage rate at which the ratio between working time and leisure time changes in favor of the latter, even though the individual's labor supply curve is bending backward for most people (Parkin, 2012), economists agree that this varies from one individual to another. Thus, economic theory underlines that wage rate has a significant impact on working hours decision. Moreover, the impact is very different from one person to another, being determined by a diversity of factors.

In this respect, theory and studies in the field emphasize that wage rate is significantly determined by occupation, respectively the value of the marginal product of the skills in the various occupations, and the market power (Parkin, 2012). In many countries, most occupations earn a wage rate below the national average, because a higher wage rate usually requires a college degree and postgraduate training. Moreover, in recent years, wage rates have become increasingly unequal, as high wage rates have increased while low wage rates have stagnated or even fallen (Acemoglu and Autor, 2011). Even though the reasons are complex and not fully understood, most economists agree that one reason is that the new technologies made skilled workers more productive and destroyed some low-skilled jobs, and another reason is that globalization has brought increased competition for low-skilled workers and opened global markets for high-skilled workers (Mureşan, Ivan, 2009; Ivan, Iacovoiu, 2009).

Regarding the heterogeneous effect of hours on wages across occupations, the latest empirical studies showed that occupations play "an important role in shaping some dimensions of inequality by gender" (Bertrand et al. 2010; Goldin, 2014; Erosa et al., 2017; Bertrand, 2018; Cortes and Pan, 2019). Also, other researchers found that occupations shape "overall wage and earnings inequality" (Cortes and Pan, 2016).

Also, empirical studies point out that the effects of working hours on wages are both static and dynamic, because "the choice of hours today" affects both "current and future earnings", but to a different extent (Imai and Keane, 2004). Regarding the static effects of working hours on wages, Aaronson and French (2004) showed that there is "a wage penalty for part-time work", while Bick, Blandin and Rogerson (2020) found that "in most occupations wages increase with hours below 40 hours and decrease with hours above 50 hours." This means that "the effect of moving from part-time to full time job" is not the same as moving from 40 hours per week to 50 or more hours per week. As concerned the dynamic effect of working hours on wages, the results of an empirical research conducted by Bick, Blandin and Rogerson (2020) who studied "the dynamic relationship between hours and wages" showed that "long current hours continue to be associated with lower wages, but long past hours are associated with higher wages", suggesting that "future benefits may be an important determinant of the hours decision".

In conclusion, both theory and empirical studies in labor economics underline that the relationship between wages and working hours depends on many factors, such as occupations, market power, the type of the job (part-time or full-time), the present and future benefits (long

current hours and long past hours), and the technology that allows skilled workers to be more productive.

## Methodology

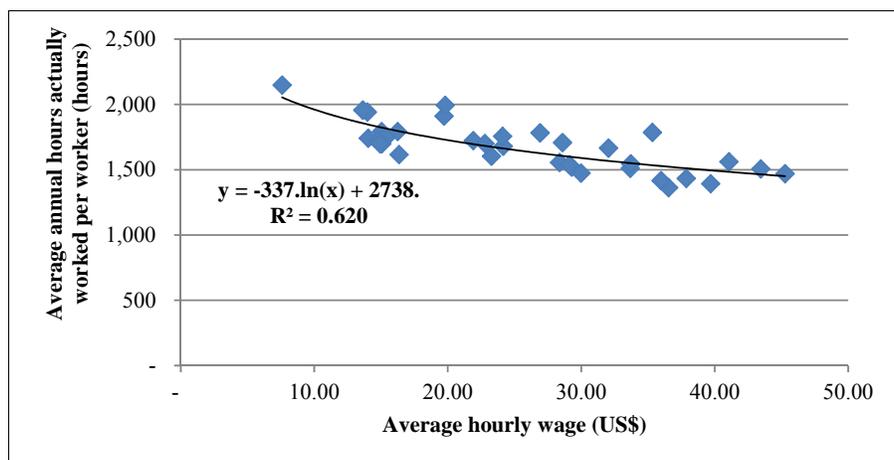
The empirical analysis is based on relevant economic indicators, which reflect in a conclusive manner the quantitative aspects related to working time and wages. Working time per employee is highlighted by the “average usual weekly hours worked on the main job, full-time and part – time” and “average annual hours actually worked per worker”. The wage is expressed by the “average annual wage at Purchasing Power Parities (PPPs) for private consumption of the same year” and respectively, the average hourly wage calculated by the author as the ratio between the average annual wage and the “average annual hours actually worked per worker”.

The need to use these relevant economic indicators imposed the limitation of the study to a relatively small number of states, for which statistical data could be retrieved from the database of the Organization for Economic Co-operation and Development (OECD). Therefore, we selected for analysis 35 OECD Members States. Data regarding the average usual weekly hours for Canada, Japan and South Korea were retrieved from other reliable databases as they were not available in the OECD database (<https://stats.oecd.org/>). The values of the economic indicators for the 35 analyzed countries, related to the year 2018, are presented in Appendix.

In order to underline the relationship between wages and working time, we performed correlation analysis starting from the theoretical hypothesis according with workers can earn the same or higher annual wages, working fewer hours per year, if the wage rate increases. The Excel program was used to calculate the Spearman correlation coefficient (CORREL) and the determination coefficient ( $R^2$ ), as well as to highlight the regression equation that best reflects the relationship between the analyzed variables. Also, we performed comparative analysis between the selected countries in order to showcase the gap that is both at European and international level.

## Results

The correlation between the average hourly wage, as independent variable (X), and the average annual hours actually worked per worker, as dependent variable (Y), was analyzed in order to highlight the impact of the variation of wage rate on working time (Figure 1).

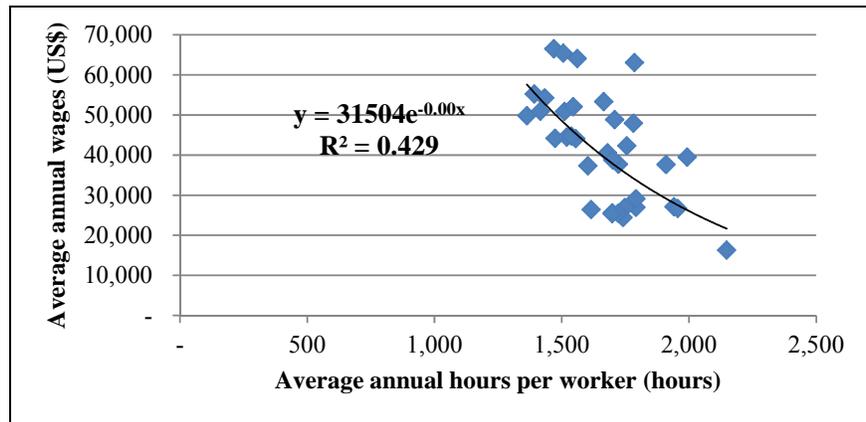


**Fig. 1.** The correlation between average hourly wage and average annual hours per worker

The results underlined a relatively strong invers relationship between the parameters, because the value of correlation coefficient (CORREL) is -0,76826. The regression equation that best reflected the correlation between the variables was logarithmic model for which the value of determination coefficient ( $R^2$ ) is 0,62 (Figure 1).

Therefore, 62% of the variation in average annual hours actually worked per worker is explained by the invers variation of average hourly wage. This means that, usually, when the wage rate is comparatively higher, employees work fewer hours a year, but earn higher annual wages.

In order to highlight the impact of the variation of working time on wages, we analyzed the correlation between the average annual hours actually worked per worker, as independent variable, and the average annual wages, as dependent one (Figure 2).



**Fig. 2.** The correlation between average annual hours per worker and average annual wages

The results showed a moderate invers relationship between the variables, as the value of correlation coefficient (CORREL) is -0,62788. The regression equation that best reflected the correlation between the variables was exponential model for which the value of determination coefficient ( $R^2$ ) is 0,429, as presented in the figure above.

Therefore, 43% of the variation in average annual wages is explained by the invers variation of average annual hours actually worked per worker. In other words, there are some countries where employees work fewer hours per year as compared with other states and earn comparatively higher annual wages, but in most of the cases they work more hours a year in order to earn higher incomes.

## Discussions

The correlation analysis carried out for the 35 selected countries highlighted the fact that, generally, if the wage rate is comparatively higher, employees will earn higher annual wages, working fewer hours per year. In other words, employees work more hours a year mainly in countries with a comparatively lower wage rate.

Regarding this statement, statistical data presented in Appendix show that in highly developed European countries (Austria, Belgium, Denmark, Switzerland, Finland, France, Germany, Luxembourg, the United Kingdom, the Netherlands, Norway and Sweden) employees work fewer hours a year (less than 1,561 hours) compared to those in Chile, Greece, Israel, Italy, Japan, South Korea, Mexico, New Zealand, Portugal, Spain and CEE countries (over 1,701 hours), but earn higher annual wages (over US\$44,111 compared to less than US\$42,325), because the average hourly wage is higher (over US\$28.37 compared to less than US\$24.15).

In Italy, Japan, New Zealand and Spain, employees work fewer hours per year (between 1,680 and 1,756 hours) compared to those in the Czech Republic, Chile, Greece, Israel, Mexico, Portugal and Poland (between 1,792 and 2,148 hours), but earn higher annual wages (over US\$37,752 compared to less than US\$37,655), as the average hourly wage is higher (over US\$21.91 compared to less than US\$19.71). Also, in Slovenia, employees work fewer hours per year (1,603 hours) compared to Chile, Greece, Mexico, Portugal and other CEE countries, but earn higher annual wages (US\$37,322 compared to less than US\$29,109), because the wage rate is higher (US\$23.28 compared to less than US\$16.35).

Table below presents some relevant examples of countries where employees work more hours a year compared to those in other states that have a comparable level of development, but earn lower annual wages, because the wage rate is lower (Table 1).

**Table 1.** Comparative analysis working time–average wage (2018)

OECD Member States	Average annual hours actually worked per worker		Average annual wage		Average hourly wage	
	hours	%	US\$	%	US\$	%
<b>Belgium</b>	<b>1,545</b>	<b>100.00</b>	<b>52,080</b>	<b>100.00</b>	<b>33.71</b>	<b>100.00</b>
Denmark	1,392	90.10	55,253	106.09	39.69	117.74
Netherlands	1,433	92.75	54,262	104.19	37.87	112.34
<b>Czech Rep.</b>	<b>1,792</b>	<b>100.00</b>	<b>26,962</b>	<b>100.00</b>	<b>15.05</b>	<b>100.00</b>
Poland	1,792	100.00	29,109	107.96	16.24	107.96
<b>Finland</b>	<b>1,555</b>	<b>100.00</b>	<b>44,111</b>	<b>100.00</b>	<b>28.37</b>	<b>100.00</b>
United Kingdom	1,538	98.91	44,770	101.49	29.11	102.61
<b>France</b>	<b>1,520</b>	<b>100.00</b>	<b>44,510</b>	<b>100.00</b>	<b>29.28</b>	<b>100.00</b>
Austria	1,511	99.41	50,868	114.28	33.67	114.99
Denmark	1,392	91.58	55,253	124.14	39.69	135.55
Germany	1,363	89.67	49,813	119.91	36.55	124.83
<b>Greece</b>	<b>1,956</b>	<b>100.00</b>	<b>26,671</b>	<b>100.00</b>	<b>13.64</b>	<b>100.00</b>
Chile	1,941	99.23	27,125	101.70	13.97	102.42
Czech Rep.	1,792	91.62	26,962	101.09	15.05	110.34
Estonia	1,748	89.37	26,898	100.85	15.39	112.83
Poland	1,792	91.62	29,109	109.14	16.24	119.06
<b>Ireland</b>	<b>1,782</b>	<b>100.00</b>	<b>47,952</b>	<b>100.00</b>	<b>26.91</b>	<b>100.00</b>
Australia	1,665	93.43	53,349	111.26	32.04	119.07
Austria	1,511	84.79	50,868	106.08	33.67	125.11
Canada	1,708	95.85	48,849	101.87	28.60	106.28
Denmark	1,392	78.11	55,253	115.23	39.69	147.49
Germany	1,363	76.49	49,813	103.88	36.55	135.82
Netherlands	1,433	80.42	54,262	113.16	37.87	140.72
Switzerland	1,561	87.60	64,109	133.69	41.07	152.62
<b>Israel</b>	<b>1,910</b>	<b>100.00</b>	<b>37,655</b>	<b>100.00</b>	<b>19.71</b>	<b>100.00</b>
Canada	1,708	89.42	48,849	129.73	28.60	145.10
Italy	1,723	90.21	37,752	100.26	21.91	111.16
Japan	1,680	87.96	40,573	107.75	24.15	122.53
New Zealand	1,756	91.94	42,325	112.40	24.10	122.52
<b>Italy</b>	<b>1,723</b>	<b>100.00</b>	<b>37,752</b>	<b>100.00</b>	<b>21.91</b>	<b>100.00</b>
Japan	1,680	97.50	40,573	107.47	24.15	110.22
<b>Lithuania</b>	<b>1,616</b>	<b>100.00</b>	<b>26,429</b>	<b>100.00</b>	<b>16.35</b>	<b>100.00</b>
Slovenia	1,603	99.19	37,322	141.22	23.28	142.38
<b>Norway</b>	<b>1,415</b>	<b>100.00</b>	<b>50,956</b>	<b>100.00</b>	<b>35.99</b>	<b>100.00</b>
Denmark	1,392	98.37	55,253	108.43	39.69	110.28
<b>Netherlands</b>	<b>1,433</b>	<b>100.00</b>	<b>54,262</b>	<b>100.00</b>	<b>37.87</b>	<b>140.72</b>
Denmark	1,392	97.14	55,253	101.83	39.69	104.81
<b>Spain</b>	<b>1,701</b>	<b>100.00</b>	<b>38,761</b>	<b>100.00</b>	<b>22.79</b>	<b>100.00</b>

Table 1 (cont.)

Finland	1,555	91.42	44,111	113.80	28.37	124.48
Japan	1,680	97.76	40,573	104.67	24.15	105.97
United Kingdom	1,538	90.42	44,770	115.50	29.11	127.73
<b>United States</b>	<b>1,786</b>	<b>100.00</b>	<b>63,093</b>	<b>100.00</b>	<b>35.33</b>	<b>100.00</b>
Switzerland	1,561	87.40	64,109	101.61	41.07	116.26

Source: Own calculations based on data in Appendix

However, there are also countries where, although the average hourly wage is higher, employees work more hours a year to earn a higher income, such as: the United States compared to Australia, Austria, Belgium, Canada, Switzerland, Finland, France, Ireland, Italy, Japan, Latvia, Lithuania, the United Kingdom, New Zealand, Slovenia, Spain and Sweden; Canada compared to Japan, Lithuania and Spain; South Korea compared to Chile, Greece, Portugal and CEE countries; Israel compared to Portugal, Latvia, Lithuania, Slovenia and Slovakia; New Zealand compared to Italy, Portugal, Latvia, Lithuania, Slovenia and Slovakia; Ireland compared to Italy, Japan, Latvia, Lithuania, New Zealand, Portugal, Slovenia and Spain.

In other words, the annual wage of a US worker (US\$63,093), who works 1,786 hours per year, would be reduced by US\$2,749, if he would work 1,708 hours like in Canada, respectively by US\$8,508, if he would work 1,545 hours (Belgium). If a Canadian employee would work 1,616 hours per year like in Lithuania, instead of 1,708 hours, he would earn an annual wage of US\$46,218 compared to US\$48,849. A South Korean worker who would work 1,741 hours a year like in Hungary, instead of 1,993 hours, would earn a lower annual wage (with US\$4,983). If an Israeli worker would work 1,616 hours a year (Lithuania), instead of 1,910 hours, he would earn an annual wage of US\$ 31,851 compared to 37,655 US\$. The annual wage of a New Zealand worker (US\$42,325), who works 1,756 hours per year, would be reduced by US\$1,379 if he would work 1,699 hours like in Canada. An Irish employee who would work 1,723 hours per year like in Hungary, instead of 1,782 hours, would earn a annual wage lower with US\$1,586.

## Conclusion

Economic theory shows that wage rate influences the working hours decision, because as the hourly wage rises, an employee is willing to work more hours a week up to a point when its priority change and leisure time becomes more important. Moreover, empirical studies in labor economics underline that the relationship between wages and working hours depends on many factors, as for example occupations, the present and future benefits, if the job is part-time or full-time, market power, and the technology that allows skilled workers to be more productive.

Starting from the theoretical hypothesis according to which employees can work fewer hours a year and earn the same or higher annual wages, if the wage rate increases, we performed correlation analysis to underline the relationship between wages and working time. The results showed that: (1) 62% of the variation in average annual hours actually worked per worker is explained by the invers variation of average hourly wage; (2) 43% of the variation in average annual wages is explained by the invers variation of average annual hours actually worked per worker.

These results underline that, usually, employees work fewer hours a year and earn higher annual wages, if the average hourly wage is comparatively higher, statement supported by the results of the comparative analysis as well. Thus, in highly developed European countries employees work fewer hours a year compared to those in less developed states, as for example CEE countries, Chile, Greece, Israel, South Korea, Mexico etc., but earn higher annual wages, because the average hourly wage is higher. Also, there are significant differences between CEE countries, respectively the average annual hours actually worked per worker is much lower in

those states that have a higher average hourly wage, as for example Slovenia and Lithuania compared to the Czech Republic, Hungary, Estonia and Poland, where workers earn comparatively lower annual wages.

In addition, the analysis carried out for the 35 OECD Member States highlighted the fact that in some countries, although the average hourly wage is higher compared to those in other states, employees work more hours a year to earn higher annual wages, as for example the United States, Israel, South Korea, New Zealand, Ireland and Canada.

Therefore, the gap between the analyzed countries in what concern the working time, both at European and international level, is due, on the one hand, to the wage rate that influences the working hours decision, and on the other hand, to the individual' decision to earn a higher income that allows him to buy the goods and services he needs, given the existing economic restrictions, such as purchase power, labor demand, technology etc. Consequently, in our opinion, earning a "decent wage achievable within normal work week" may be the first step to balance working and leisure time. Earning a "living wage" could determine a decrease of excessive overtime that workers spend on multiple jobs that, usually, do not bring future benefits and could affect the individual' well-being on the long run, as studies in the field underline.

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## APPENDIX

Table 2. The values of the analyzed indicators (2018)

Crt. No.	Countries	Weekly hours of work (hours)	Average annual hours per worker (hours)	Average annual wages (US\$)	Average hourly wages* (US\$)
1	Australia	35.7	1,665	53,349	32.04
2	Austria	35.6	1,511	50,868	33.67
3	Belgium	35.6	1,545	52,080	33.71
4	Canada	37.7 <sup>1</sup>	1,708	48,849	28.60
5	Chile	42.8	1,941	27,125	13.97
6	Czech Republic	39.4	1,792	26,962	15.05
7	Denmark	32.4	1,392	55,253	39.69
8	Estonia	38.2	1,748	26,898	15.39
9	Finland	36.3	1,555	44,111	28.37
10	France	36.2	1,520	44,510	29.28
11	Germany	34.3	1,363	49,813	36.55
12	Greece	38.8	1,956	26,671	13.64
13	Hungary	39.6	1,741	24,455	14.05
14	Iceland	38.8	1,469	66,504	45.27
15	Ireland	35.2	1,782	47,952	26.91
16	Israel	40.6	1,910	37,655	19.71
17	Italy	35.7	1,723	37,752	21.91
18	Japan	38.9 <sup>2</sup>	1,680	40,573	24.15
19	South Korea	41.5 <sup>3</sup>	1,993	39,472	19.81
20	Latvia	39.1	1,699	25,586	15.06
21	Lithuania	38.7	1,616	26,429	16.35
22	Luxembourg	37.4	1,506	65,449	43.46
23	Mexico	45.1	2,148	16,298	7.59
24	Netherlands	29.3	1,433	54,262	37.87
25	New Zealand	37.7	1,756	42,325	24.10
26	Norway	33.8	1,416	50,956	35.99
27	Poland	39.8	1,792	29,109	16.24
28	Portugal	39.5	1,722	25,487	14.80
29	Slovak Republic	39.1	1,698	25,357	14.93
30	Slovenia	39.0	1,603	37,322	23.28
31	Spain	36.5	1,701	38,761	22.79
32	Sweden	36.0	1,474	44,196	29.98
33	Switzerland	34.4	1,561	64,109	41.07
34	United Kingdom	36.6	1,538	44,770	29.11
35	United States	38.6	1,786	63,093	35.33

Source: OECD, Statistics, 2020; \* - Own calculations; <sup>1)</sup> - Statistics Canada, <sup>2)</sup> - [www.ceicdata.com](http://www.ceicdata.com), 2020; <sup>3)</sup> - [www.koreabizwire.com](http://www.koreabizwire.com), 2020.